3.3.1 PHYSICAL SETTING

This section describes physiography, geology, and soils along the Mina rail alignment. Characterization of the physical setting also identifies relationships to other resource areas described in this Rail Alignment EIS, such as aesthetics, land use, biological (vegetation) resources, and surface-water resources.

Section 3.3.1.1 describes the region of influence for physical setting along the Mina rail alignment; Section 3.3.1.2 describes the general physical setting and characteristics in the region of influence; and Section 3.3.1.3 describes the physical setting in more detail for the Mina rail alignment alternative segments and common segments.

3.3.1.1 Region of Influence

The region of influence for physical setting along the Mina rail alignment includes all areas that would be directly or indirectly affected by construction and operation of the proposed railroad. These areas include the nominal width of the rail line construction right-of-way, and the footprints of facilities outside the nominal width of the construction right-of-way.

3.3.1.2 General Setting and Characteristics

3.3.1.2.1 Physiography

The Mina rail alignment would cross the western Great Basin of the Basin and Range Physiographic Province. The terrain consists of relatively narrow mountain ranges separated by broad sediment-filled basins approximately 16 to 24 kilometers (10 to 15 miles) wide. The mountain ranges are mostly tilted, fault-bounded crustal blocks that are as much as 120 kilometers (75 miles) long. Mountain ranges typically rise from 910 to 1,520 meters (3,000 to 5,000 feet) above the adjacent valley floors. As shown in Figure 3-124, from north to south, a rail line along the Mina rail alignment would use gaps, passes, and valleys to cross or travel near the following mountain ranges: Terrill Mountains, Calico Hills, Monte Cristo Range, Clayton Ridge, Montezuma Range, and Goldfield Hills.

From north to south, the rail line would cross Campbell Valley, Sunshine Flat, Long Valley, Soda Spring Valley, Rhodes Salt Marsh, Columbus Salt Marsh, Big Smoky Valley, Montezuma Valley, Clayton Valley, Stonewall Flat, Lida Valley, Sarcobatus Flat, Oasis Valley, Crater Flat, and Jackass Flats (see Figure 3-124). All lowlands, except for Campbell Valley, Oasis Valley, Crater Flat, and Jackass Flats have interior drainage to ***playas*** or dry washes and are therefore closed basins. The design of the rail alignment accounts for the locations of the playas in these basins to avoid them. Section 3.3.5 describes surface-water resources in the Mina rail alignment region of influence.

> **Alluvial fan**: A low, outspread, relatively flat-to-gently sloping mass of loose rock material, shaped like an open fan or a segment of a cone, deposited by a stream where it issues from a narrow mountain valley on a plain or break valley.
>
> **Playa**: A nearly level area at the bottom of a desert basin that does not drain to a river and is temporarily covered with water from heavy rains or snowmelts. Normally a dry lakebed that may contain water in response to seasonally high runoff.

Sediment in the valleys are composed of coarse to fine alluvial debris (boulders, cobbles, sand, silt, and clay) eroded from the adjacent mountains. Large alluvial fans, a common landform in the region, originate at the base of the mountains, and occasionally extend far into the valleys.

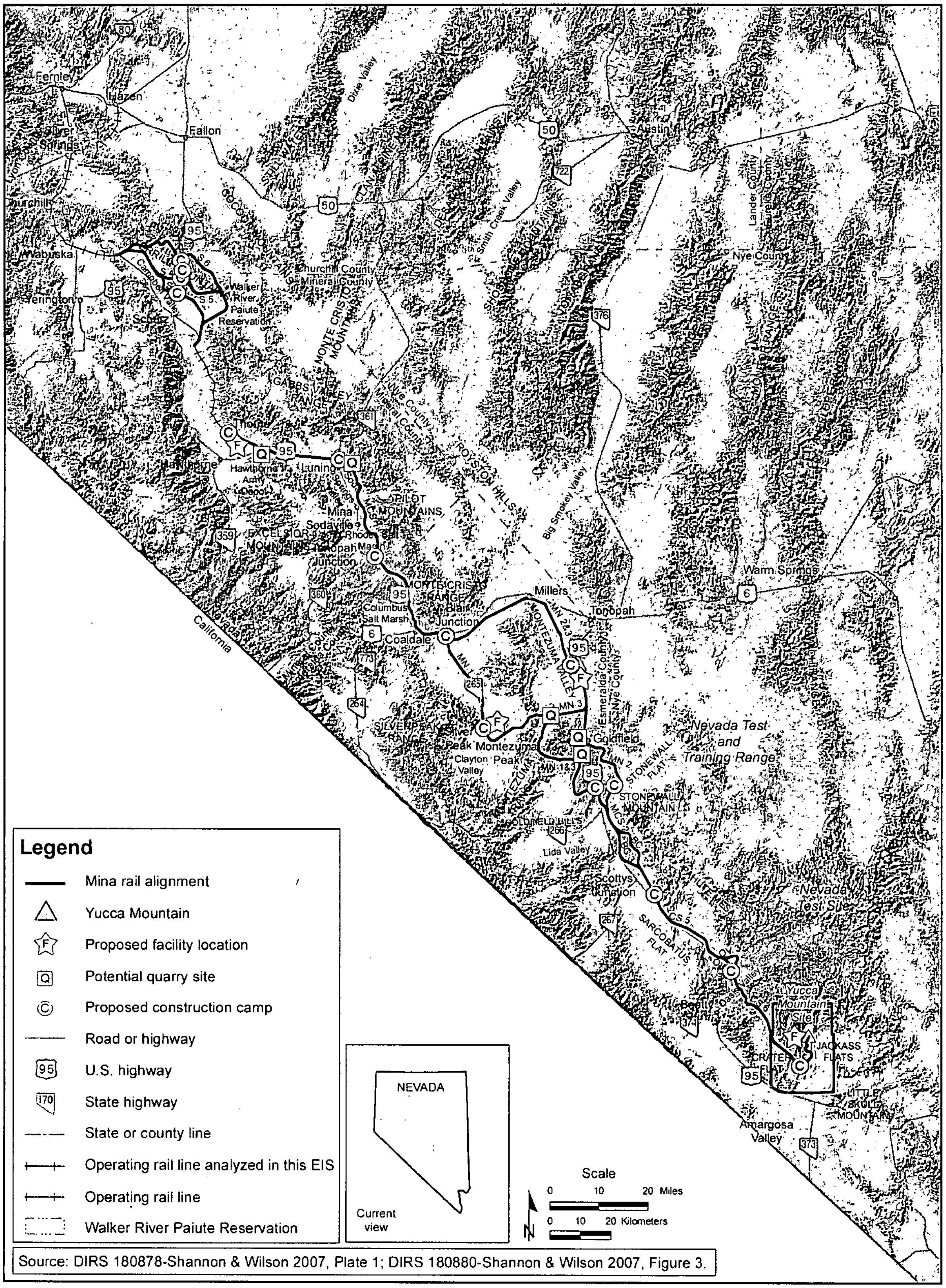


Figure 3-124. Physiographic setting along the Mina rail alignment.

Playas occur in the lowest parts of some valleys. After heavy rains or snowmelt, the lowlands can fill with water. Evaporation of this water over days or weeks leaves a variety of salts near the surface that limit the growth of vegetation. In some locations, where the surface water percolates at a sufficient depth, the water can enter deep saline aquifers. Valleys with playas are sometimes referred to as closed basins, because no surface water flows out of them.

Elevations along the Mina rail alignment range from approximately 980 meters (3,200 feet) above mean sea level at the base of Busted Butte on the west side of Jackass Flats to approximately 2,000 meters (6,500 feet) above mean sea level at an unnamed pass in the Montezuma Range (DIRS 176184-Shannon & Wilson 2006, Figure 3; DIRS 180880-Shannon & Wilson 2007, Figure 3).

3.3.1.2.2 Geology

This section summarizes regional geology along the Mina rail alignment. The geotechnical reports to support the preliminary design effort (DIRS 180878-Shannon & Wilson 2007, all; DIRS 180880-Shannon & Wilson 2007, all) provide a more detailed discussion of regional geology.

The Mina rail alignment would cross a region of complex stratigraphic and structural elements that includes major north-south trending basins and ranges and broad volcanic uplands. Table 3-79 provides a generalized stratigraphic description and lists rock sequences according to the geologic age during which they were deposited, and their locations from north to south along the Mina rail alignment. Table 3-79 also defines the geologic periods discussed in the geology sections of this Rail Alignment EIS.

North of the Montezuma Range, exposures consist of ***sedimentary rocks*** (such as carbonate) and ***volcanic rocks*** of Paleozoic age, as well as Tertiary volcanic flows and ash fall deposits. South of the Montezuma Range, only the Tertiary volcanic rocks are visible at the surface.

Soils in the valleys were primarily formed from late Tertiary and Quaternary and some Paleozoic debris eroded from neighboring mountains, wind-blown sand and silt, fine-grained lake deposits, evaporite deposits, and marsh and playa sediments. In some areas, alluvial fans are thin and overlie bedrock surfaces. Elsewhere, basin-fill sediments are more than 1,200 meters (4,000 feet) thick (DIRS 180878-Shannon & Wilson 2007, p. 14).

The oldest ***outcrops*** in the region are Precambrian Era ***metamorphic rocks***, which are exposed in hills west of Montezuma alternative segment 1 and west of Mina common segment 6. Other than these exposures, Precambrian bedrock is covered by younger rocks.

Metamorphic rocks are rocks in which the original mineralogy, texture, or composition has changed due to the effects of pressure, temperature, or the gain or loss of chemical components.

Sedimentary rocks are rocks formed by the accumulation of sediment in water or land. Sandstone, chert, limestone, dolomite, shale, siltstone, and mudstone are types of sedimentary rocks that are found in the Great Basin. They are differentiated by chemistry, deposition, and grain size.

Volcanic rocks are rocks that have been ejected at or near the earth's surface. Tuffs, lava flows, volcanic breccias, basalt, andesite, and rhyolite are types of volcanic rocks that are found in the Great Basin. They are differentiated by chemistry and texture.

During the late Paleozoic Era, the area was periodically covered by shallow seas to the east that generally deepened westward. Thick layers of limestone, shale, sandstone and some volcanic rocks, now exposed widely in the mountains along Mina common segment 1, are the remains of these Paleozoic seas (DIRS 180878-Shannon & Wilson 2007, p. 11).

Table 3-79. General stratigraphy – Mina rail alignment (page 1 of 2).

Geologic age[a]	Northern portion of the Mina rail alignment[b, c]	Northern portion of Mina common segment 1[b, d]	Southern portion of Mina common segment 1[b, e]	Montezuma alternative segments 1, 2, and 3 [b, f]	Southern portion of the Mina rail alignment (southwest Nevada volcanic field)[g]
Cenozoic Era[h] (less than 65 Ma) -Quaternary Period (less than 1.6 Ma)	Stream channel and lake alluvium; wind-blown, playa, and basin-fill deposits.	Stream channel, lake, floodplain and fan alluvium; wind-blown, playa and basin-fill deposits.	Stream channel, lake, floodplain and fan alluvium; wind-blown and basin-fill deposits.	Stream channel and fan alluvium; dune, playa and landslide deposits; basalt flows and cinder cones.	Stream channel and floodplain alluvium; wind-blown, playa, and landslide deposits; fan alluvium; basin-fill deposits. Basalt flows.
Cenozoic Era (less than 65 Ma) -Tertiary Period (65 to 1.6 Ma)	Late Tertiary rocks include alluvial fan and landslide deposits; gravel; basalt and andesite lava flows; sedimentary and volcanic rocks; sedimentary breccia; conglomerate; and sandstone. No mid-Tertiary rocks. Early Tertiary rocks include dacite, rhyodacite, tuffs, and rhyolite dikes.	Late Tertiary rocks include alluvial, fan, landslide and gravel deposits, conglomerate, lava flows, dikes, fine grained lake deposits, stream alluvium, sandstone, lava flows, dikes, cinder cones, claystone. Mid-Tertiary rocks include lava flows, interbedded with tuffs, and other volcanic rocks. Early Tertiary rocks include tuff, sandstone, conglomerate, siltstone, shale and conglomerate and volcanic rocks.	Late Tertiary rocks include basalt lava flows, cinder cones, sandstone and conglomerate, tuff, basalt lava flows, andesite, breccia. Mid-Tertiary rocks include dacite and andesite to rhyodacite, tuff, tuff breccia, lava flows, and intrusive volcanic rocks. No early Tertiary rocks area exposed along this portion of the alignment.	Late Tertiary rocks include conglomerate and sandstone, basalt siltstone, claystone, tuff, volcanic and lava flows. Mid-Tertiary rocks include lava flows, and dykes, andesite breccia, silicic dykes, tuff, volcaniclastic, sandstone and shale. Early Tertiary rocks include sandstone and siltstone, conglomerate, sandstone and basalt flows, rhyolite, and ash fall tuff.	Silicic ash-flow tuffs; minor basalts. Predominantly volcanic rocks of the southwestern Nevada volcanic field.
Mesozoic Era (240 to 65 Ma)	Late Mesozoic rocks include granite, granodiorite and quartz monzonite, diorite, tonalite gabbro, hornfels, schist and marble. Early Mesozoic rocks include andesite lava flows, tuff, metamorphosed volcanoclastic rocks.	Granite, quartz monzonite, granodiorite, diorite, tonalite and serpentine, volcanic rocks, ***clastic***, volcaniclastic and carbonate sedimentary rocks. Metamorphosed marine and submarine sedimentary rocks, lava flows and flow breccia, tuff, hornfels, greywacke, argillite and limestone (such as marine volcanic and sedimentary rocks).	Late Mesozoic (Cretaceous) age rocks include quartz monzonite, granodiorite, and granite. No early or mid-Mesozoic rocks are exposed along this portion of the alignment.	Late Mesozoic (Cretaceous) age rocks include granite, quartz monzonite, granodiorite, mafic and felsic dikes. No early or mid-Mesozoic rocks are exposed along this portion of the alignment.	Granitic rocks of Late Mesozoic (Cretaceous) age occur. No early or mid-Mesozoic rocks are exposed along this portion of the alignment.

Table 3-79. General stratigraphy – Mina rail alignment (page 2 of 2).

Geologic age[a]	Northern portion of the Mina rail alignment[b, c]	Northern portion of Mina common segment 1[b, d]	Southern portion of Mina common segment 1[b, e]	Montezuma alternative segments 1, 2, and 3[b, f]	Southern portion of the Mina rail alignment (southwest Nevada volcanic field)[g]
Paleozoic Era (570 to 240 Ma)	Rocks of this age are not exposed in the region.	Submarine lava flows, volcanic clast sedimentary rock, and conglomerate. Limestone, dolomite chert, chert-clast sandstone, and chert pebble conglomerate. Sandstone, fine-grained clastic rocks, quartzite, hornfels, siltstone, and shale. Early Paleozoic (Ordovician and Cambrian) rocks are shale, siltstone, claystone, limestone, marble, and metamorphosed sedimentary rocks.	Dolomite chert, chert-clast sandstone and chert pebble conglomerate. Fine-grained clastic rocks, conglomerate, limestone, quartzite, and partially altered mafic volcanic rocks.	Rocks of Middle and Late Paleozoic age are not exposed along this portion of the alignment. Early Paleozoic (Ordovician and Cambrian) rocks are shale, siltstone, claystone, limestone, marble, and metamorphosed sedimentary rocks.	Alternating marine and terrestrial sediments comprised mostly of shale, quartzite, limestone, and dolomite.
Precambrian Era (greater than 570 Ma)	Rocks of this age are not exposed along this portion of the alignment.	Rocks of this age are not exposed along this portion of the alignment.	Rocks of this age are not exposed along this portion of the alignment.	Claystone, siltstone, fine-grained sandstone, sandy limestone, dolomite, and slightly metamorphosed sedimentary rocks.	Conglomerate, quartzite, sandstone, shale, dolomite, limestone, chert, and diabase overlie old ***igneous*** and metamorphic rocks that form the crystalline "basement."

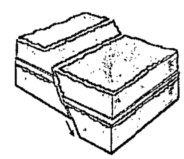
a. Ma = approximate years ago in millions.
b. Source: DIRS 180880-Shannon & Wilson 2007, Table 2 and Table 3.
c. Includes Wassuk Range, Walker River Basin, and Whiskey Flat.
d. Includes Candelaria and Goldfield Hills, Excelsior Mountains, Columbus and Rhodes Salt Marshes, Soda Spring Valley, Pilot Mountain, Gabbs Valley, and Gibbs Range.
e. Includes Monte Cristo Range.
f. Includes Montezuma Range, Clayton Ridge, Paymaster Ridge, Palmetto Mountains, Silver Peak Mountains, Mineral Ridge, Weepah Hills, Big Smoky Valley, Goldfield Hills, Malpais Mesa, Mt. Jackson Ridge, Montezuma and Lida Valleys, and Lone Mountain.
g. Includes Sarcobatus Flat, Pahute Mesa, Oasis Valley, Crater Flat, Yucca Mountain, Jackass Flats, Rock Valley, and Yucca Flat. Source: DIRS 176184-Shannon & Wilson 2006, Tables 2 and 3.
h. The Cenozoic Era consists of both the Quarternary and the Tertiary periods.

In Mineral County, off-shore sedimentation continued throughout the Mesozoic era, before ending with new tectonic movement (DIRS 180878-Shannon & Wilson 2007, pp. 11 to 12).

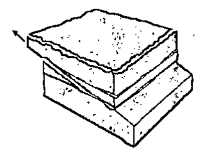
Major east-west compression occurred periodically in the Great Basin between about 350 million and 65 million years ago (DIRS 169734-BSC 2004, p. 2-16). This compression moved large sheets of old rock great distances upward and eastward over young rocks along ***thrust faults*** to produce mountains. Most of the thrust ***fault*** traces have eroded away; however, there is evidence of thrust motion in the Garfield Hills area, where Triassic rocks overlie Jurassic rocks (DIRS 180878-Shannon & Wilson 2007, p. 14). Range-bounding ***normal faults***, which have developed in response to ***crustal extension*** over approximately the last 20 million years, are conspicuous features in this part of Nevada and are especially visible in parts of Nye County. These faults have surface traces that form distinctive segments 5 to 30 kilometers (3.1 to 19 miles) long (DIRS 174214-Kleinhampl and Ziony 1985, p. 144). Although generally coincident with the range fronts, in places these normal faults, and shorter ***splay faults*** radiating outward from these normal faults, extend into adjacent valleys where they are buried by recent alluvial deposits. Both the exposed and buried parts of active faults could be capable of rupturing the surface.

Faulting is movement of the earth's crust that produces relative displacement of adjacent rock masses along a fracture. Generally, the fracture is referred to as a fault.

Splay faults are minor faults that branch off of a primary fault, or interconnect to form a fault zone.



A **normal fault** is a fault where the block above an inclined fault has moved down relative to the other block.



A **thrust fault** is a fault that occurs when squeezing forces push the block above an inclined fault up in relation to the other block.

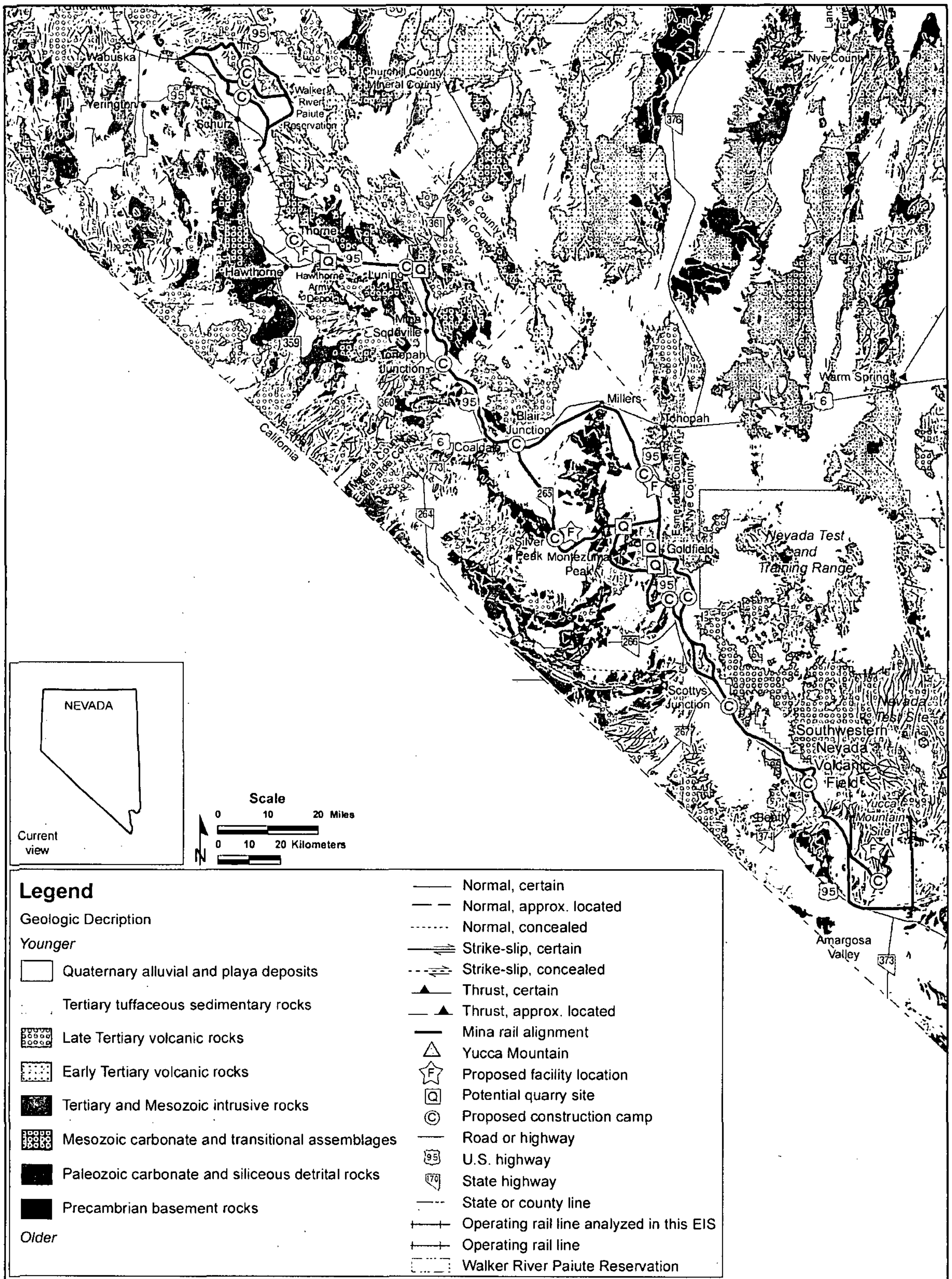
Source: DIRS 155970-DOE 2002, Figure 3-9.

Crustal extension in the region, which began about 20 million years ago, is still occurring (DIRS 176184-Shannon & Wilson 2006, p. 12). By about 11.5 million years ago, present-day mountains and valleys were well developed. Evidence for recent, continuing crustal extension is based on Holocene-age (approximately the last 10,000 years) faults, recurring ***earthquakes***, and geothermal features. The Holocene-age faults are visible in many valleys in Mineral, Esmeralda, and Nye Counties that the proposed rail line would cross (Figure 3-125).

Evidence of crustal extension is seen in the Walker-Lane Structural Belt, a 96-kilometer (60-mile)-wide deformation zone that parallels the Nevada-California border from Las Vegas to northern California. The belt includes generally northwest-trending faults that were active within the last 20 million years (DIRS 180878-Shannon & Wilson 2007, p. 16). The earthquakes along the western section of the Great Basin are primarily connected to ruptures along surface or buried faults in the Walker-Lane Belt (DIRS 180878-Shannon & Wilson 2007, p. 17). Section 3.3.1.2.2.1 provides more information on ***seismic*** activity along the Mina alignment.

The southwestern Nevada volcanic field is a volcanic plateau that developed between 16 and 7 million years ago, with the greatest eruptions occurring between 14 and 11 million years ago (DIRS 176184-Shannon & Wilson 2006, p. 11). The volcanic field encompasses common segment 5, the Oasis Valley alternative segments, and common segment 6 (Sarcobatus Flat, Pahute Mesa, Oasis Valley, Crater Flat, Yucca Mountain, Jackass Flats, Rock Valley, and Yucca Flat).

The field has a complex history of volcanism and deformation (DIRS 169734-BSC 2004, pp. 2-4 through 2-15). Eruption of 17 ash-flow ***tuff*** sequences and lava flows occurred from at least seven large, overlapping ***caldera*** complexes to form the southwestern Nevada volcanic field.



Source: DIRS 176782-MO0604GSCGMN03.000 2006, all; DIRS 176899-MO0604GISNVFL3.000 2006, all.

Figure 3-125. Geologic setting along the Mina rail alignment.

The youngest caldera-forming events associated with this feature occurred between 7.5 and 7.6 million years ago with eruptions southeast of Mina common segment 2 (DIRS 180878-Shannon & Wilson 2007, p. 13). The mid-Tertiary eruptions deposited ash-fall and volcanic-ash flows with minor lava flows and reworked materials. Only Tertiary and younger rocks are exposed in the southwestern Nevada volcanic field area.

There are cinder cones (a type of volcano formed by ejected cinders) south of Blair Junction in Big Smoky Valley, the northwest corner of Clayton Valley, and Oasis Valley. The ***basalt*** flows and associated material ejected from volcanoes are dated approximately between 1.6 million years and 10,000 years old (DIRS 180878-Shannon & Wilson 2007, p. 29; DIRS 176184-Shannon & Wilson 2006, pp. 25 and 26).

3.3.1.2.2.1 Faulting and Seismic Activity. Historically, there have been numerous earthquakes in the Great Basin region as a result of the ongoing crustal extension (see Figure 3-126). Consistent with geologic evidence, the historical record of Holocene-age ***seismicity*** (occurring within the last 10,000 years) suggests that seismic activity was concentrated in the western part of the Great Basin (DIRS 180878-Shannon & Wilson 2007, p. 16 and Plate 4). Modern earthquakes in the area predominantly occur at depths of 2 to 12 kilometers (1.2 to 7.4 miles) below Earth's surface (DIRS 169734-BSC 2004, p. 4-35).

The western Great Basin contains many Quaternary fault traces; however, there are few instances of surface rupture within the last 10,000 years (DIRS 180878-Shannon & Wilson 2007, p. 16). These faults are characterized by discontinuous scarps (vertical displacement along a fault), from surface displacement. Studies of Holocene faults have calculated slip rates of 0.01 to 0.1 millimeter (0.000039 to 0.0039 inch) per year, with a surface-rupturing recurrence of approximately 100 years (DIRS 176905-Workman et al. 2002, p. 18). Studies of fractures other than ***block-bounding faults*** around Yucca Mountain determined that fault displacements of about 0.1 centimeter (0.039 inch) would have an exceedance ***probability*** of once every 100,000 years (DIRS 169734-BSC 2007, p. 4-64).

Figure 3-126 shows the number and locations of earthquakes of magnitude 3.0 and greater on the Richter scale based on available historical and recorded data from 1852 to 2004. Most of the earthquakes around the Mina rail alignment fall within a magnitude range of 3.0 to 3.9, the range that most people start to feel ground shaking (DIRS 180969-USGS 2006, all). As magnitude increases, the potential for damage from ground shaking also increases. The highest concentration of earthquakes, large and small, along the Mina rail alignment occur in the northern portion of Mina common segment 1, centered around Garfield Hills and Soda Spring Valley.

There have been many seismic events with a magnitude 5.0 or larger on the Richter scale within 30 kilometers (19 miles) of the proposed rail alignment, several occurring on the Nevada Test Site north of Yucca Mountain. Most seismic events on the Nevada Test Site are associated with historical underground testing, not natural ***faulting***. Seismic activity from man-made tests has not activated local faults (DIRS 169734-BSC 2004, pp. 4-33 and 4-35). There is another cluster of earthquakes around the northern portion of the Mina rail alignment, in the mountains around Soda Spring Valley. This seismic activity is believed to be connected to stretching along the Walker Lane Structural Belt (DIRS 180878-Shannon & Wilson 2007, pp. 16 and 17). The closest major earthquake to the rail alignment was a magnitude 6.3 magnitude event in 1959 near Schurz. In 1932, there was a magnitude 7.2 earthquake near Cedar Mountain that caused cracking in some structures. A 1992 earthquake near Little Skull Mountain is the largest recorded earthquake in the vicinity of Yucca Mountain. The magnitude 5.6 event was apparently triggered by a magnitude 7.3 earthquake which occurred 20 hours earlier at Landers, California, 300 kilometers (190 miles) southwest of Yucca Mountain (DIRS 169734-BSC 2004, pp. 4-38 and 4-39). Since 1978, DOE has monitored seismic activity in the area around Yucca Mountain to pinpoint seismic events (DIRS 155970-DOE 2002, p. 3-32). In the area around the Mina rail alignment, earthquakes with a magnitude of 6.1 to 6.4 are predicted to have a return period of 2,500 years (DIRS 174296-Shannon & Wilson 2005, p. 14).

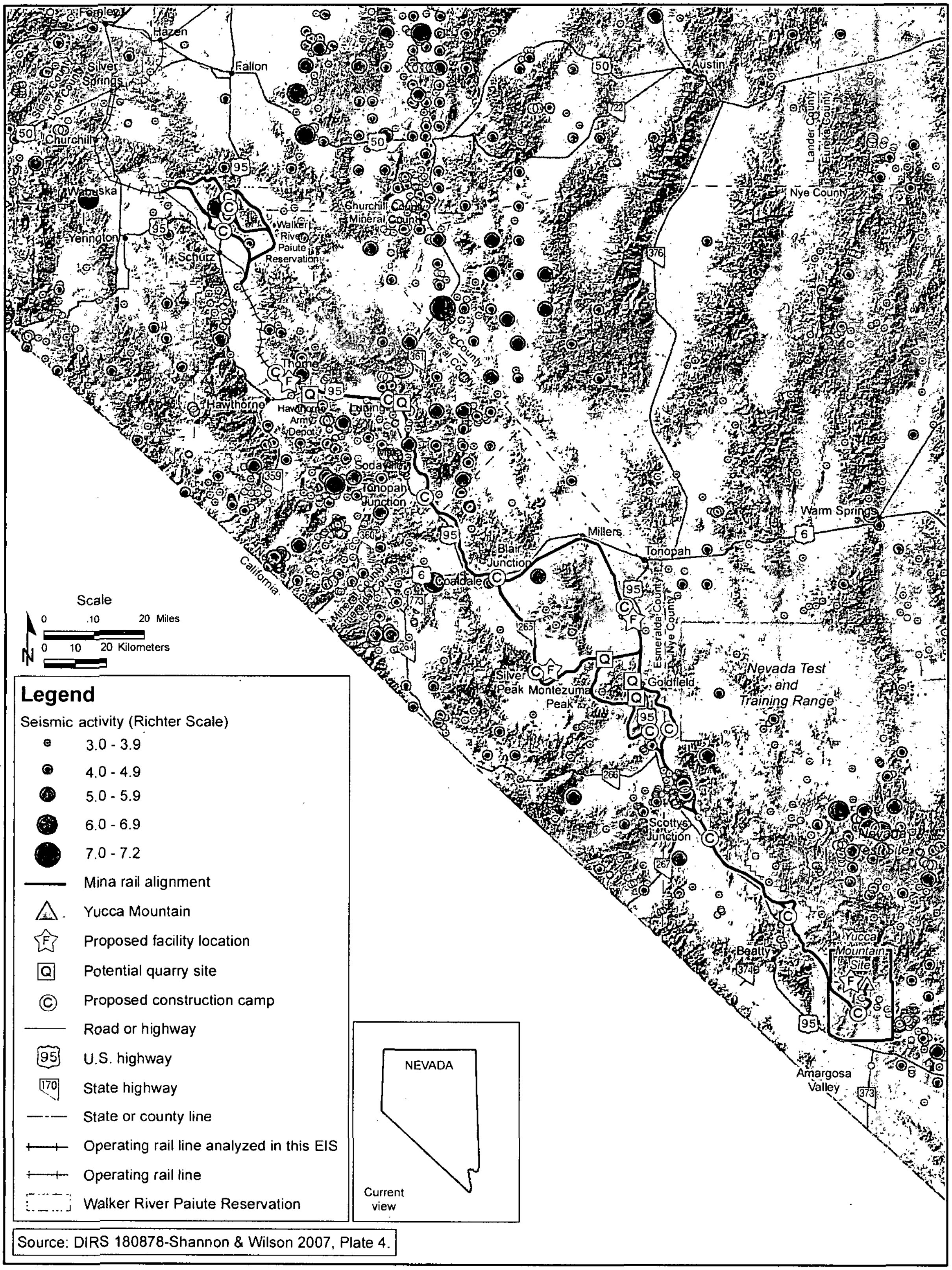


Figure 3-126. Seismic activity in Nevada along the Mina rail alignment from 1852 to 2004.

Through the National Earthquake Hazard Reduction Program, national and regional shaking-hazard maps are used to determine the probability of seismic-related damage based on regional earthquake occurrence rates and how far the shaking travels horizontally (DIRS 174194-USGS 2005, all). These maps are used to meet modern seismic design provisions for the construction of buildings, bridges, highways, and utilities. Shaking-hazard maps, also known as peak acceleration maps, show the levels of horizontal shaking that have a certain probability of being exceeded in a 50-year period (see Figure 3-127). When an earthquake occurs, the forces caused by the shaking can be measured as a percentage of the constant known as *g*, which is the acceleration of a falling object due to gravity. The resulting map uses contour lines to show the amount of shaking a location would experience during any area earthquake, regardless of its distance to the epicenter.

The predicted peak horizontal accelerations tend to decrease from northwest to southeast along the Mina rail alignment. The northern portion of the Mina rail alignment shows a 2-percent probability of exceeding a peak horizontal acceleration of 50-percent *g* within a 50-year period (Figure 3-127) and a 10-percent probability of exceeding a peak horizontal acceleration of 25-percent *g* within a 50-year period (DIRS 174296-Shannon & Wilson 2005, Figure 3). In other words, the Mina rail alignment would experience shaking of 50-percent *g* or more from a seismic event with a return period of approximately 2,500 years (DIRS 174296-Shannon & Wilson 2005, p. 14). Peak horizontal acceleration of 10-percent *g* is considered to be capable of minor structural damage in normal buildings, while 50-percent *g* could cause damage to most structures.

3.3.1.2.2.2 Mineral and Energy Resources. For more than 100 years, parts of the western Great Basin have produced substantial amounts of base and precious metals, particularly gold and silver (DIRS 180882-Shannon & Wilson 2007, pp. 5 and 6). Parts of the Mina rail alignment, especially in the vicinity of the Goldfield Mining District, have been intensely mined and have extensive surface and underground mine workings. Energy resources reported along and near the rail alignment include low-temperature geothermal water. Section 3.3.2, Land Use and Ownership, describes ***mining districts*** and associated land claims along the Mina rail alignment in more detail.

3.3.1.2.2.3 Potential Sources of Construction Materials. As described in Chapter 2, there would be local sources for some construction materials. The estimated quantity of ***ballast*** required for construction of a rail line along the Mina rail alignment would range from 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) (DIRS 180875-Nevada Rail Partners 2007, p. 3-1). DOE has identified five potential ballast quarry locations along the Mina rail alignment with sufficient topographic and geologic characteristics to accommodate excavation and preparation facilities. Figures 2-29 through 2-33 show the potential quarry sites along Mina common segment 1 and Montezuma alternative segments 1, 2, and 3. The topography and geology of potential ballast quarry sites are described in more detail in the discussion of the alternative segment or common segment with which they are associated.

The amount of material excavated from cuts would not equal the fill requirements to construct the rail alignment. Therefore, borrow pits would need to be excavated to supplement the difference in subballast. There is also a high likelihood the Department would find suitable sands and gravels on the alluvial fans along the rail alignment for this use. Section 3.3.11, Utilities, Energy, and Materials, discusses the regional supply chains for other construction materials.

3.3.1.2.3 Soils

DOE used soil survey databases from the U.S. Department of Agriculture, Natural Resources Conservation Service (DIRS 176781-MO0603GSCSSGEO.000), to identify soil types and characteristics along the Mina rail alignment. Approximately 95 percent of the project area has been surveyed. However, soil surveys around the Nevada Test and Training Range have not been completed.

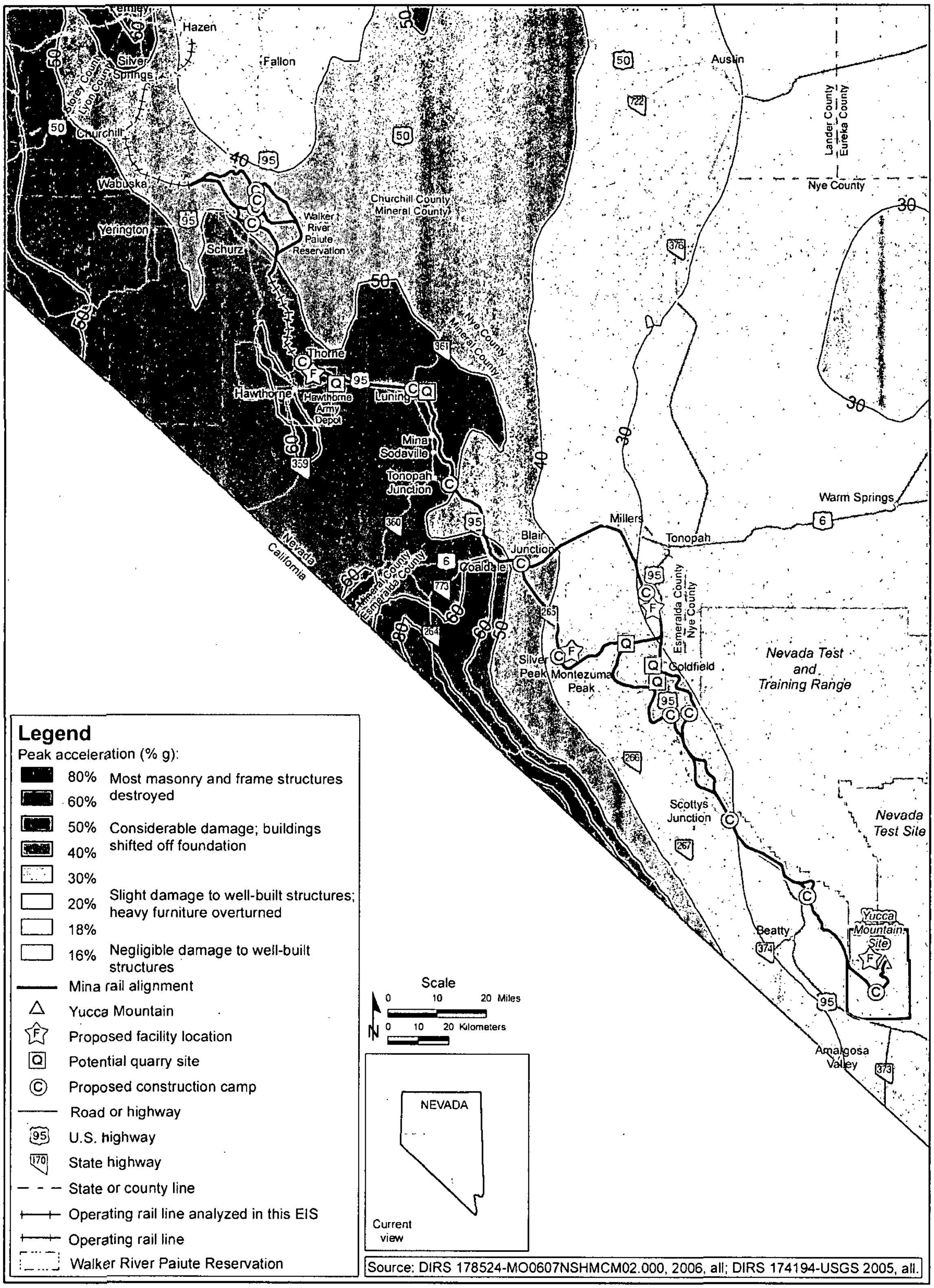


Figure 3-127. Seismic hazards along the Mina rail alignment: peak acceleration (percent *g*) with 2-percent probability of exceedance in 50 years.

In areas where soils data are not available, DOE does not consider the unavailable data critical to the design and construction of a railroad along the Mina rail alignment, because soils are expected to be similar to those already surveyed. In addition, as part of the design, DOE would place geotechnical borings along the entire rail alignment to obtain site-specific soils data.

This Rail Alignment EIS identifies the specific soil characteristics relevant to proposed railroad construction and operations. From a potential impact perspective, soil designated as supporting ***prime farmland*** is considered one of the relevant characteristics. The Natural Resources Conservation Service (DIRS 181427-NRCS 2007, Part 622.04(a)) defines prime farmland as:

> Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or ***alkalinity***, an acceptable content of salt and sodium, and few or no rocks. Its soils are ***permeable*** to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding.

The prime farmland soil label is applied to the soil types and associations that the National Resources Conservation Service identifies as satisfying this definition. Less than 0.1 percent, or about 0.14 square kilometer (35 acres), of the Mina rail-alignment construction right-of-way would contain soils classified as prime farmland (see Figure 3-128). All of the prime farmland soils that the Mina rail alignment would cross are found on the Walker River Paiute Reservation, which contains 5.5 square kilometers (1,400 acres) of prime farmland soils. Lyon, Churchill, Mineral, and Nye Counties contain 299 square kilometers (74,000 acres), 407 square kilometers (100,000 acres), 44 square kilometers (11,000 acres), 610 square kilometers (150,000 acres), respectively, soils classified as prime farmland (DIRS 176781-MO0603GSCSSGEO.000). Esmeralda County has none. The amount of prime farmland soils within the Mina rail alignment construction right-of-way would consist of 2.6 percent of the total prime farmland soils on the Walker River Paiute Reservation but less than 0.01 percent of the total prime farmland soils on the Walker River Paiute Reservation, and in Lyon, Churchill, Mineral, and Nye Counties. DOE has also contacted the Nevada Natural Resource Conservation Service office to collaborate on the identification of prime, unique statewide, or locally important farmland along the alignment. This correspondence is further described in Section 4.3.1.2.1.3, and in the individual segment discussions in Section 4.3.1.2.2.

Table 3-80 lists the prime farmland and quantity of soils with other characteristics along the Mina rail alignment. The table lists the percentage of the area within the nominal width of the construction right-of-way that contains soils with a particular characteristic. In some locations along the rail alignment, DOE would occupy and disturb less of the construction right-of-way to avoid sensitive environmental resources and private property. Because different combinations of alternative segments and common segments would be different lengths and have different disturbed areas, DOE judged the impacts from soil erosion based on the acreage of specific soil types that would be affected by construction-related disturbance. Section 4.3.1.2.1.3 provides a more detailed discussion of how railroad construction and operations could affect topsoil.

Other soil characteristics that are particularly relevant to proposed railroad construction and operations are classified on Table 3-80 as ***erodes easily*** and ***blowing soil***. Soil with either of these characteristics can be quite susceptible to erosion. As seen in Table 3-80, these soil types are found in similar amounts within each group of alternative segments.

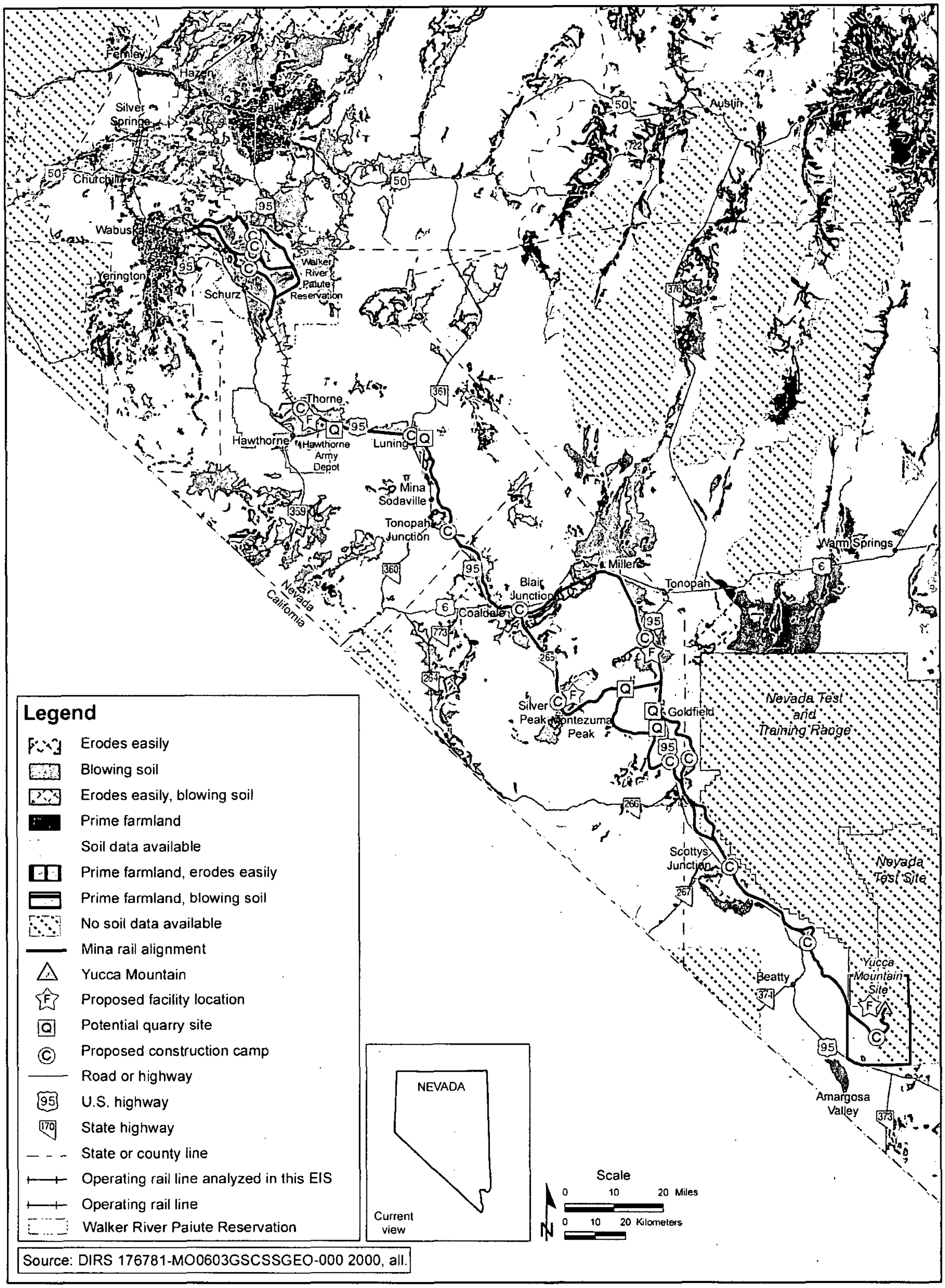


Figure 3-128. Soils with prime farmland, erodes easily, and blowing soil characteristics along the Mina rail alignment.

Table 3-80. Percent of soil characteristics within the Mina rail alignment construction right-of-way.[a]

Rail line segment	Percent prime farmland	Percent blowing soil	Percent erodes easily	Percent soil survey coverage[b]
Union Pacific Railroad Hazen Branchline[c]	NA	NA	NA	NA
Department of Defense Branchline North[c]	NA	NA	NA	NA
Schurz alternative segment 1	d	83	4.7	100
Schurz alternative segment 4	d	69	4.8	100
Schurz alternative segment 5	d	63	2.9	100
Schurz alternative segment 6	d	51	2.9	100
Department of Defense Branchline South[f]	e	39	e	100
Mina common segment 1	e	39	7.9	100
Montezuma alternative segment 1	e	5.2	15	100
Montezuma alternative segment 2	e	33	13	100
Montezuma alternative segment 3	e	26	10	100
Mina common segment 2	e	e	100	100
Bonnie Claire alternative segment 2	e	e	27	18
Bonnie Claire alternative segment 3	e	e	25	77
Mina common segment 5	e	2.6	e	74
Oasis Valley alternative segment 1	e	13	e	100
Oasis Valley alternative segment 3		4.8	e	100
Mina common segment 6	e	e	e	74

a. Source: DIRS 176781-MO0603GSCSSGEO.000.
b. There are data gaps for Nye County around the Nevada Test and Training Range because those soil surveys have not been completed.
c. Soil survey is not described because there would be no surface disturbance along this portion of the rail alignment. NA = not applicable.
d. Amount is less than 1 percent.
e. Characteristic not present. Soil percentages do not add up to 100 percent.
f. Soil characteristics are identified because DOE would establish a construction camp and build a siding along this branchline.

The erodes easily characteristic is a measure of the susceptibility of bare soil to be detached and moved by water. These soils, which tend to contain relatively high amounts of silts and ***loams***, tend to erode easily when disturbed. Approximately 19 percent of the entire Mina rail alignment has soils with this characteristic (DIRS 176781-MO0603GSCSSGEO.000).

The blowing soil characteristic is based on the soil survey classification of susceptibility of a given soil to wind erosion. This classification method uses eight groupings. Soils assigned to Group 1 are the most susceptible to wind erosion and those assigned to Group 8 are the least susceptible. Soils listed in Table 3-80 with the blowing soil characteristic are those assigned to erodibility Group 1 or 2 (DIRS 181427-NRCS 2007, Exhibit 618-16). The blowing soil characteristic identifies areas where fine-textured, sandy materials predominate and where uncontrolled soil disturbance could result in increased wind erosion. Depending on the combination of alternative segments and common segments, between 23 and 26 percent of the entire Mina rail alignment would have soils with the blowing soil characteristic (DIRS 176781-MO0603GSCSSGEO.000). Figure 3-128 identifies the locations of prime farmland, erodes easily, and blowing soils.

3.3.1.3 Setting and Characteristics along Alternative Segments and Common Segments

3.3.1.3.1 Union Pacific Railroad Hazen Branchline (Hazen to Wabuska)

There would be no new construction along the Union Pacific Railroad Hazen Branchline. Therefore, DOE has not characterized the physical setting in this area.

3.3.1.3.2 Department of Defense Branchline North (Wabuska to the Boundary of the Walker River Paiute Reservation)

Figure 3-129 shows this existing rail line. DOE would build a passing ***siding*** adjacent to the existing rail line on previously disturbed land within the existing right-of-way. Therefore, the Department has not characterized the physical setting in this area.

3.3.1.3.3 Schurz Alternative Segments

3.3.1.3.3.1 Physiography. The Schurz alternative segments would be in the Walker River Basin, northeast of the Wassuk Range.

There is an existing rail line (in this Rail Alignment EIS, called the Department of Defense Branchline through Schurz), which connects Department of Defense Branchlines North and South (see Figure 3-130). The branchline travels along the southern edge of Campbell Valley, along the eastern side of the Wassuk Range, through the town of Schurz on the Walker River Paiute Reservation, and terminates at Hawthorne.

Each of the Schurz alternative segments would start at the north end of Campbell Valley and end near Gillis Canyon (see Figure 3-130). In flat locations, the alternative segments would travel along a similar path, and divert around hilly terrain.

Schurz alternative segment 1 would run through Sunshine Flat and travel east of the Weber Reservoir through the Walker River Paiute Reservation. Schurz alternative segment 4 would also cross Sunshine Flat, traveling north of the Calico Hills. Schurz alternative segment 4 would then curve along the southern edge of the Terrill Mountains and travel along an unnamed valley. Schurz alternative segment 5 would travel along the southern edge of the Desert Mountains (elevation 2,040 meters [6,700 feet] above mean sea level), then southeast through Long Valley (elevation 1,300 meters [4,300 feet] above mean sea level), between the Calico Hills and Terrill Mountains, and through the unnamed valley at the southern edge of the Walker River Paiute Reservation. Schurz alternative segment 6 would also travel along the southern edge of the Desert Mountains, and southeast through Long Valley, then curve northeast around the Terrill Mountains, west of the Rawhide Flats, and then down through the unnamed valley before terminating at Gillis Canyon.

3.3.1.3.3.2 Geology. All of the Schurz alternative segments would cross a variety of recent alluvial fans, wind-blown and river deposits, playas, Tertiary sedimentary rocks, basalt, ash-fall deposits, and Mesozoic granite bedrock. Sections of the bedrock in this area have been altered with intrusive volcanic veins, resulting in variable concentrations of commercial minerals. Metallic and nonmetallic minerals of variable quantity and quality have been identified in the surrounding mountains. Surveys and drill cores have identified an iron-rich ore called the Hottentot prospect within Calico Hills (DIRS 180882-Shannon & Wilson 2007, pp. 29 and 30). To construct any of the Schurz alternative segments, DOE would use ***alluvium*** within the nominal construction right-of-way as fill materials, but otherwise would not excavate construction materials.

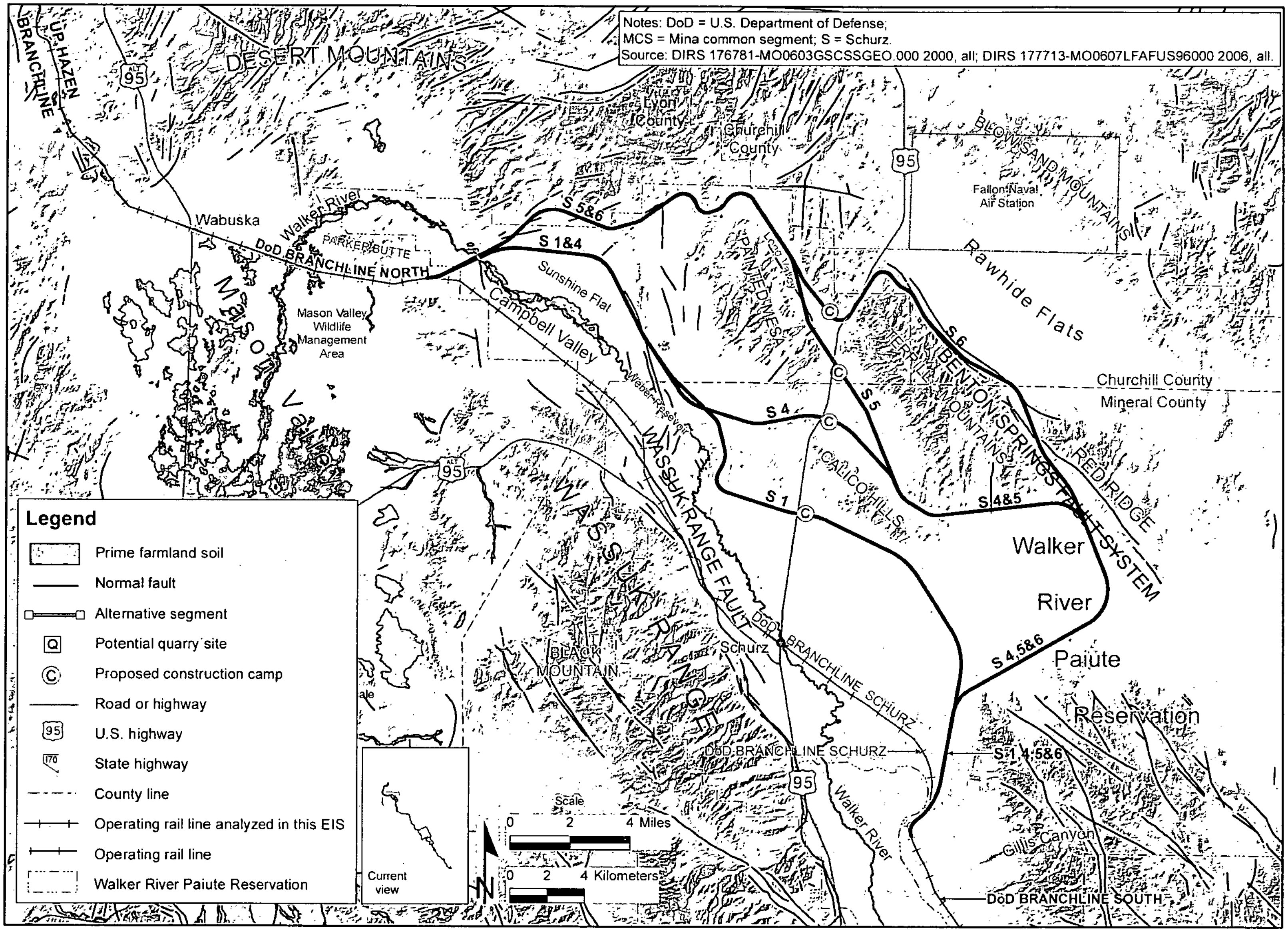


Figure 3-129. Physiographic features of common segments and alternative segments in map area 1.

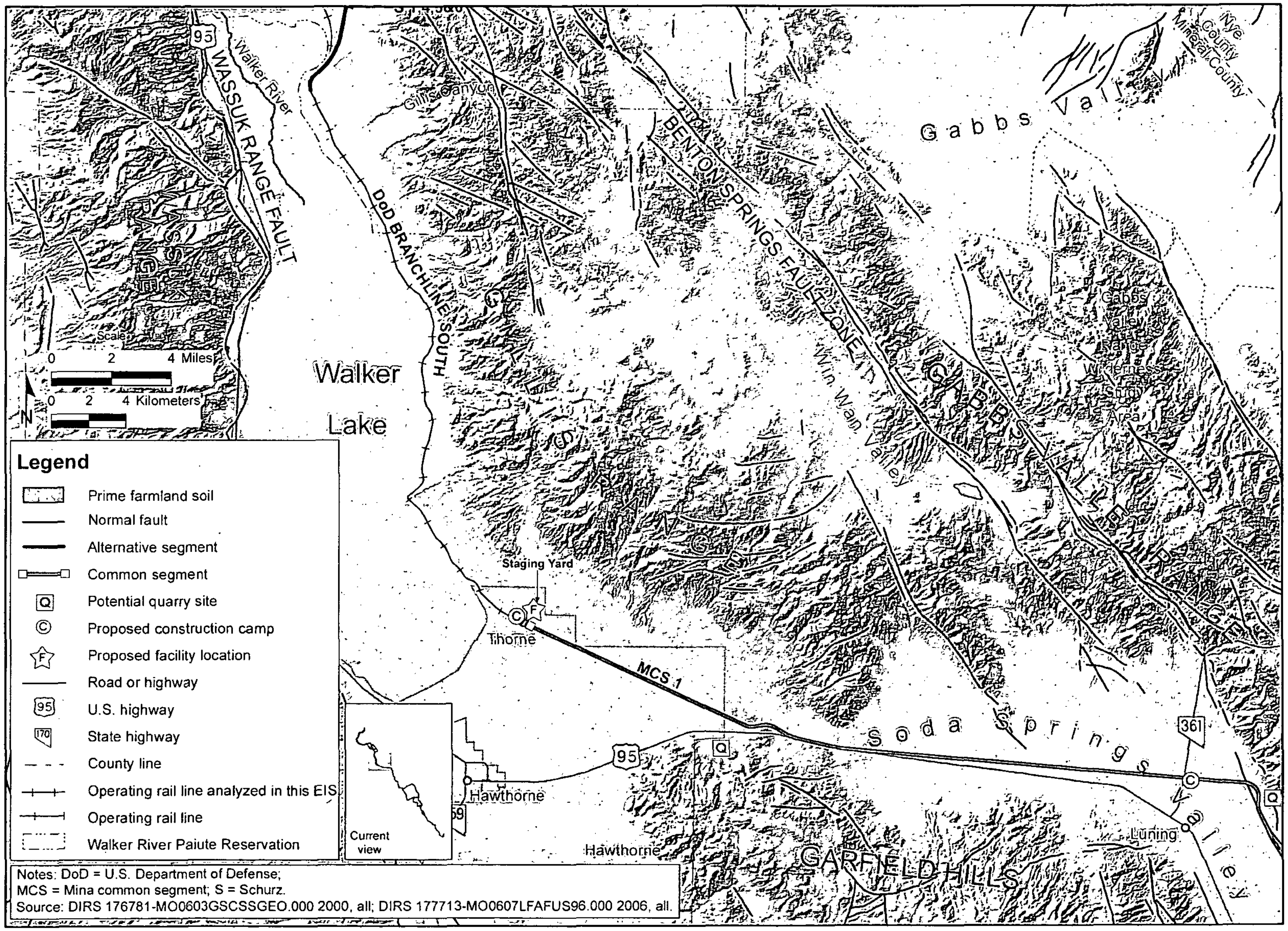


Figure 3-130 Physiographic features of common segments and alternative segments in map area 2.

There are both metallic minerals and nonmetallic minerals of variable quality and quantity in the surrounding mountains (DIRS 180882-Shannon & Wilson 2007, pp. 22, 31, and 32). Geothermal resources include warm springs and steam wells that are found approximately 14 kilometers (8.5 miles) west of the beginning of the Schurz alternative segments. A geothermal power plant and biodiesel plant use energy heat from the steam wells in Wabuska. Section 3.3.2, Land Use and Ownership, provides additional information about the mining districts around the Schurz alternative segments.

All four Schurz alternative segments would cross a small normal fault, and Schurz alternative segments 1 and 4 would cross another linear fault, both of which are part of the Wassuk Range Fault System. This fault system is a series of north-trending faults along the eastern edge of the Wassuk Range. The Walker River Basin was formed during the Quaternary as the western edge of the valley downslipped along the fault system. Schurz alternative segment 6 would cross northern-tracing faults along the eastern edge of the Terrill Mountains. These faults could be correlated with the Benton Springs Fault system to the southeast (DIRS 181849-Sawyer 1999, all). There has been one magnitude 6.3 earthquake, one magnitude 5.0 earthquake, and three of magnitude 4.0 earthquakes in the vicinity of the Schurz alternative segments (see Figure 3-127). The magnitude 6.3 earthquake occurred in 1959, approximately 2.3 miles to the east of Schurz alternative segment 1 (DIRS 180878-Shannon & Wilson 2007, p. 17).

3.3.1.3.3.3 Soils. Soils along the Schurz alternative segments occur on ***fan piedmonts***, ***fan remnants***, ***fan skirts***, ***sand sheets***, wind-blown sand, dunes, river valleys, lake plains, and closed valley sediments. They are derived from mixed alluvium, sand sheets, wind-blown and lake deposits, and reworked sedimentary deposits.

The Schurz alternative segments each contain more than 50 percent blowing soils. Schurz alternative segment 1 contains the most blowing soils (83 percent of the alternative segment). Schurz alternative segment 6 contains the least blowing soils (51 percent of the alternative segment). All of the Schurz alternative segments have lower quantities of erodes easily soils, ranging from Schurz alternative segments 5 and 6 at 2.9 percent each, to Schurz alternative segment 4 at 26 percent. Each of the Schurz alternative segments contains less than 1 percent prime farmland soils (see Table 3-80).

> **Fan piedmonts, fan remnants,** and **fan skirts** refer to locations within a large alluvial fan. Fan piedmonts refer to the area along the base of a mountain slope. Fan remnants refer to parts of an older alluvial fan that remain after erosion has removed most of the fan. Fan skirts refer to the area along the base of the alluvial fan in a valley.
>
> **Sand sheets** are large, irregularly shaped, commonly thin, surficial mantles of windblown sand that lack the discernible slip faces that are common on dunes.

3.3.1.3.4 Department of Defense Branchline South (Boundary of the Walker River Paiute Reservation to Thorne)

One construction camp (number 17) would be located at the south end of Department of Defense Branchline South where it would connect with Mina common segment 1. The construction camp would be on the Hawthorne Army Depot and would not require additional road construction. Approximately 39 percent of the soils in the proposed construction camp footprint are considered blowing soils. DOE would also build a siding within the construction right-of-way. Aside from the camp and the siding, there would be no surface disturbance along this portion of the Mina rail alignment. Therefore, DOE has not characterized the physical setting in this area.

3.3.1.3.5 Mina Common Segment 1 (Gillis Canyon Area to Blair Junction)

3.3.1.3.5.1 Physiography. Mina common segment 1 would travel south of the Gillis Range through Soda Spring Valley, with the Gabbs Valley Range to the north and east and Garfield Hills to the west (see Figure 3-131). The common segment would pass to the east of Rhodes Salt Marsh between the

Excelsior Mountains and Pilot Mountains, and then to the east of Columbus Salt Marsh between Candelaria Hills and the Monte Cristo Range (see Figure 3-131). Elevations along this common segment generally range from 1,300 meters (4,300 feet) above mean sea level at Rhodes Salt Marsh to 1,500 meters (4,900 feet) above mean sea level at the lower valley floors of the Monte Cristo Range. The location of the common segment would avoid existing sand dunes in the Soda Spring Valley and playa deposits in the Rhodes and Columbus Salt Marshes.

3.3.1.3.5.2 Geology. Mina common segment 1 would primarily cross sedimentary material including alluvial fan, wind-blown, basin-fill, lake deposits, and playas in addition to old basalt flows, sedimentary rocks, and locally altered sedimentary and volcanic bedrock.

Most of the hills surrounding Mina common segment 1 are part of local mining districts, due to the many types of minerals found in the bedrock within the mountain ranges. Historically, gold, silver, lead, copper, iron, uranium, thorium, manganese, turquoise, calcium carbonate, and halite have been mined or documented in the surrounding mountains (DIRS 180882-Shannon & Wilson 2007, pp. 38, 40 and 41, 44, 60, 64, and 79). The rail line would travel along the valleys, avoiding the calcium carbonate and salt deposits around the playas. It would not cross or approach energy or geothermal resources.

DOE has identified two potential quarry sites along Mina common segment 1. The Garfield Hills quarry would mine basalt at the beginning of Mina common segment 1 in the northern edge of the Garfield Hills. The Gabbs Range quarry would be on the northeastern edge of the Soda Spring Valley where the rail line would turn south. The quarry would mine granite from a foothill at the base of the Gabbs Valley Range.

There are several northwest-trending Quaternary faults in the mountains north of Mina common segment 1. The Gabbs Valley Range, Pilot Mountains, and Soda Spring Valley are all bounded by the Benton Spring Fault. In 1932, there was a magnitude 7.2 earthquake to the northeast of Mina common segment 1 at Cedar Mountain. There have been numerous other earthquakes greater than magnitude 3.0 in the northeastern corner of Soda Spring Valley; however, the number and magnitude of earthquakes decreases farther south around the Monte Cristo Range.

3.3.1.3.5.3 Soils. Soils along Mina common segment 1 consist primarily of alluvial fan deposits comprising sorted sand and gravels, and occasionally overlie shallow bedrock made up of recent volcanic material. Deposits of calcium carbonate in the form of calcrete are also occasionally found within the soils. The common segment would avoid playa deposits in the area of Rhodes Salt Marsh and Columbus Salt Marsh. Approximately 39 percent of Mina common segment 1 is made up of blowing soils and 7.9 percent of the soils have the erodes easily characteristic. There are no prime farmland soils along Mina common segment 1.

3.3.1.3.6 Montezuma Alternative Segments

3.3.1.3.6.1 Physiography. Montezuma alternative segment 1 would travel southeast from Blair Junction, through Clayton Valley, and within a pass between Paymaster Ridge and Clayton Ridge (Figures 3-132 and 3-133). The alternative segment would then turn south through an unnamed valley, then cross the Montezuma Range in an unnamed pass and switchback between the Goldfield and Cuprite Hills. Elevations along Montezuma alternative segment 1 would range from 1,300 meters (4,300 feet) at Clayton Valley to 1,980 meters (6,500 feet) above mean sea level at the south end of the Montezuma Range.

Montezuma alternative segment 2 would travel from Blair Junction northeast through Big Smoky Valley, around Lone Mountain, southeast through Montezuma Valley, and would weave through the Goldfield Hills, with elevations ranging from 1,500 meters (4,900 feet) at Montezuma Valley to 1,950 meters (6,400 feet) above mean sea level at Goldfield Hills.

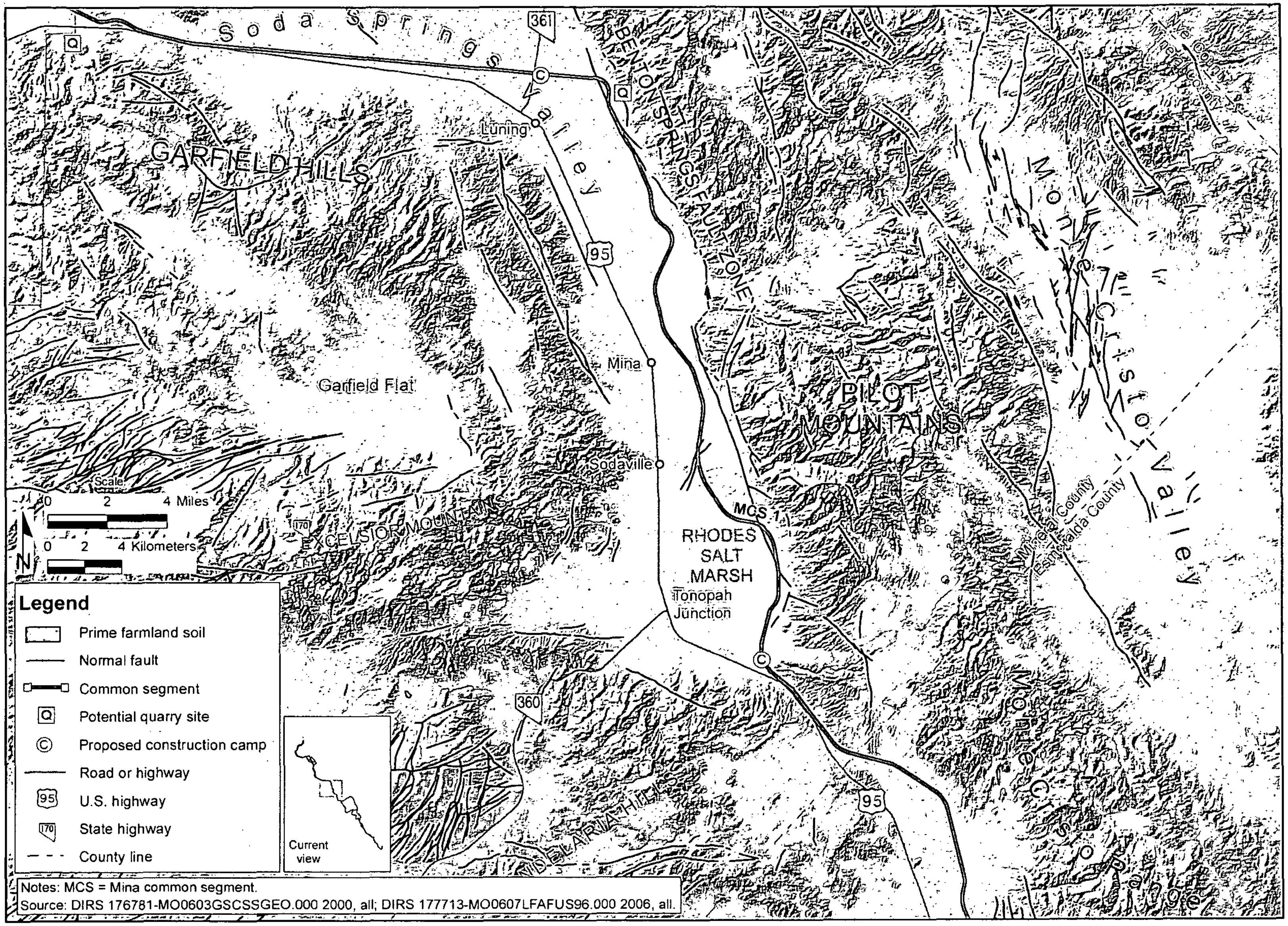


Figure 3-131. Physiographic features of common segments and alternative segments in map area 3.

Montezuma alternative segment 3 would travel from Blair Junction northeast through Big Smoky Valley, around Lone Mountain, southeast through Montezuma Valley, and then cross west near the north end of Montezuma Range. Montezuma alternative segment 3 would continue south through an unnamed valley and cross the Montezuma Range in an unnamed pass and switchback between the Goldfield and Cuprite Hills. The elevations ranges along Montezuma alternative segment 3 would be the same as Montezuma alternative segment 2, with the low point in Montezuma Valley and the high point at Goldfield Hills.

3.3.1.3.6.2 Geology. All of the Montezuma alternative segments would cross a combination of recent alluvial and playa deposits overlying Quaternary volcanic rocks, Mesozoic granite, and Cambrian limestone bedrock. A variety of metallic minerals (silver, gold, and copper; iron and hematite) have been mined in Lone Mountain, Silver Peak, Montezuma Range, and the Cuprite and Goldfield Hills. All of the Montezuma alternative segments would travel through valleys near a range that contains either active or historic mining operations. Montezuma alternative segments 1 and 3 would also cross the Montezuma Range, and Montezuma alternative segment 2 would cross through the Goldfield Hills, where gold, silver, and zeolilte have been mined since 1900.

In addition to the metallic minerals identified within the mountains surrounding the Montezuma alternative segments, there are nonmetallic minerals in the valleys. Montezuma alternative segment 1 would cross Clayton Valley and approach the town of Silver Peak. Minerals such as alum, native sulfur, and kaolinite have been found in Clayton Valley, and a large-scale brine facility in Silver Peak extracts lithium from salt-rich aquifer water. There are warm springs in the Silver Peak area; however, at present, they are not used as an energy resource. In the Cuprite Hills, at the end of the Montezuma alternative segments, there is a large geothermal system with multiple warm heat-flow wells, also not currently used as geothermal resources (DIRS 180882-Shannon & Wilson 2007, Plate 3). Section 3.3.2, Land Use and Ownership, describes the history and extent of the regional mining districts in more detail.

DOE has identified several potential quarry sites along the Montezuma alternative segments. The North Clayton Quarry would be along the northern tip of the Montezuma Range, and would serve either Montezuma alternative segment 1 or 3. The quarry would mine granite from the bottom of the ridge, moving up as additional rock is quarried. The Malpais Mesa Quarry would be on the northwestern edge of the Goldfield Hills and would be accessed by Montezuma alternative segment 1 or 3. This quarry would mine basalt from the bowl-shaped cliff. Potential quarry ES-7, on the northern edge of Malpais Mesa, would serve Montezuma alternative segment 2.

The mountain ranges in this area are typically bounded on one side by linear, north-trending faults. Montezuma alternative segment 1 would cross the Clayton Valley Fault Zone, Paymaster Ridge Fault Zone, Montezuma Range Fault Zone, and Cuprite Hills Fault Zone. These faults are primarily late Quaternary in age. Montezuma alternative segment 2 would cross the Cuprite Hills Fault Zone along the northern edge of the Goldfield Hills. Montezuma alternative segments 2 and 3 would cross the Lone Mountain Fault Zone along the northern edge of the Lone Mountain foothills. Some of the faults associated with this fault zone were active within the last 15,000 years (DIRS 181852-Sawyer and Anderson 1999, all). Seismic activity in the area around the Montezuma alternative segments is limited to a magnitude 5.0 earthquake west of Lone Mountain, and several magnitude 3.0 earthquakes in the immediate vicinity of Lone Mountain and along the Cuprite Hills (see Figure 3-126).

3.3.1.3.6.3 Soils. Soils along the Montezuma alternative segments vary based on their location and the source bedrock. The alternative segments would cross soils consisting of alluvial deposits on fan skirts, fan remnants, and fan piedmonts; sand sheets and basins; and alluvial flats. The soils are derived from mixed alluvium, wind-blown sand, and volcanic sedimentary (limestone) rocks.

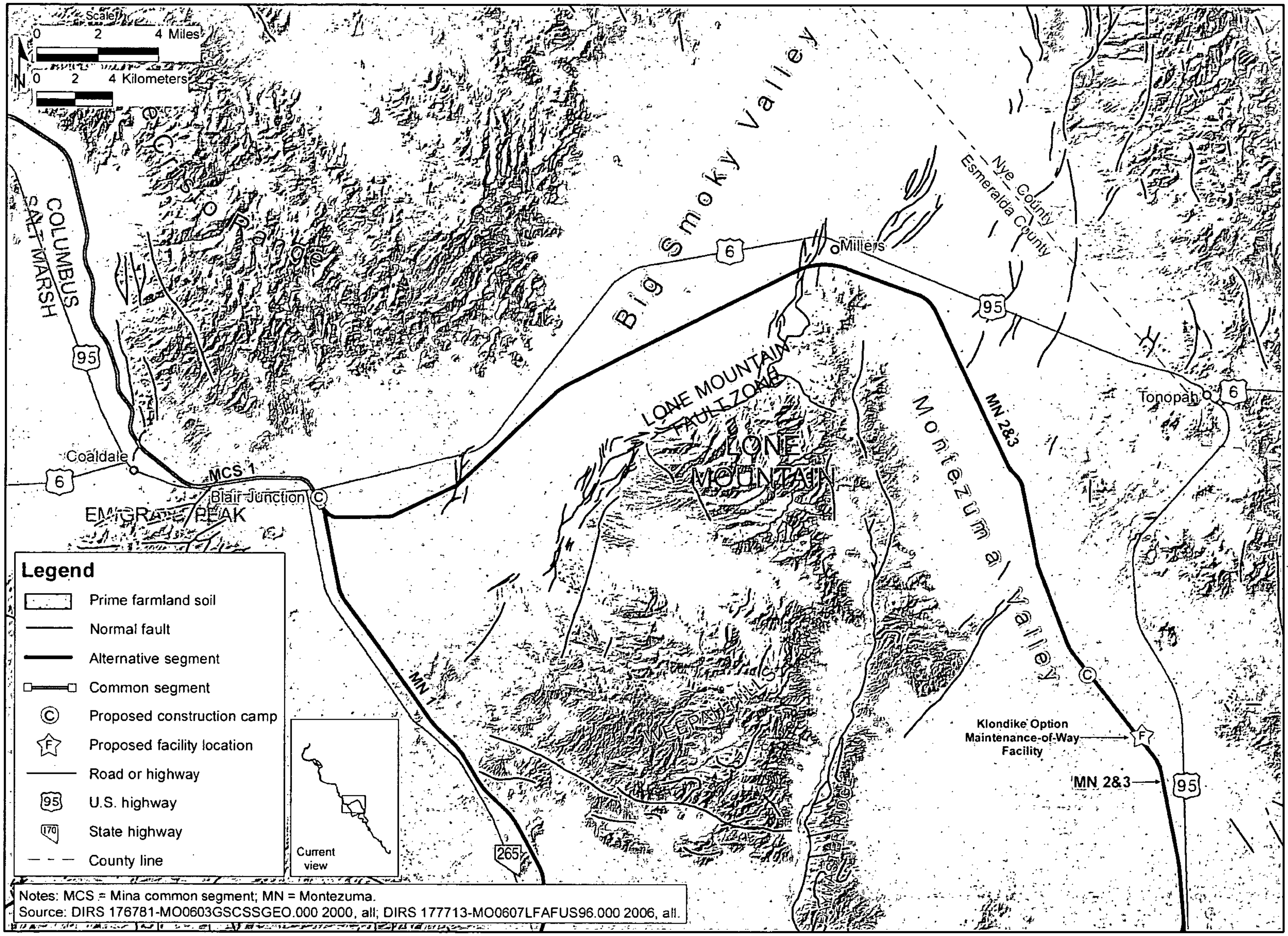


Figure 3-132. Physiographic features of common segments and alternative segments in map area 4.

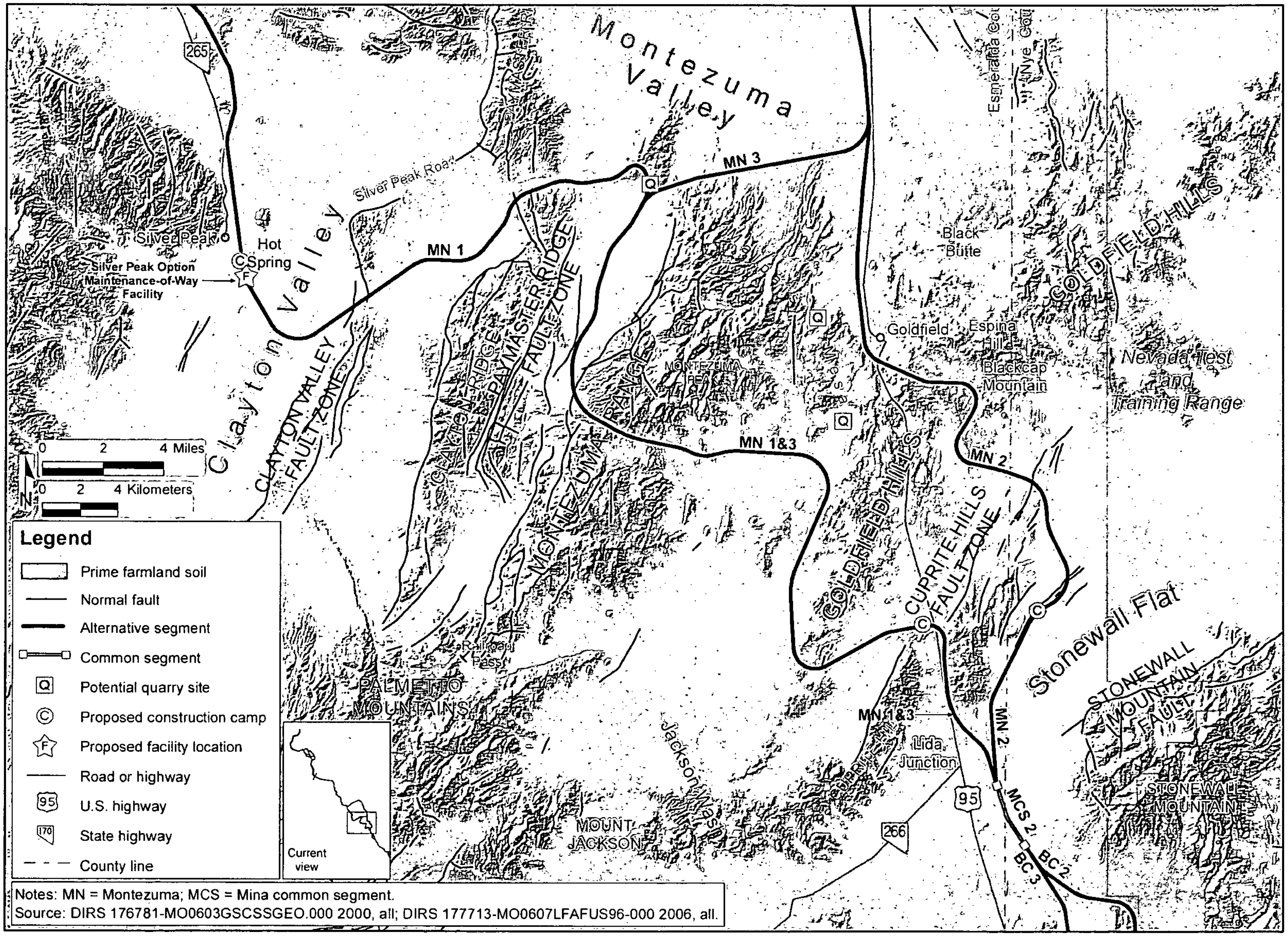


Figure 3-133. Physiographic features of common segments and alternative segments in map area 5.

In some locations along Montezuma alternative segments 1 and 3, thin soils derived from volcanic, sedimentary, or limestone material overlie the mountain bedrock. Along all of the alternative segments, the soils are considered well drained to excessively drained.

There are no prime farmland soils in Esmeralda County, the location of most of the length of the Montezuma alternative segments. Other soil characteristics are variable, depending on their position in the valley (see Table 3-80). Montezuma alternative segment 2 would contain the most blowing soils (33 percent), while Montezuma alternative segment 1 would contain only 5.2 percent. However, Montezuma alternative segment 1 would contain the most erodes easily soils (15 percent), and Montezuma alternative segment 3 would contain the least (10 percent).

3.3.1.3.7 Mina Common Segment 2 (Stonewall Flat Area)

3.3.1.3.7.1 Physiography. Mina common segment 2 would cross Lida Valley, a depression with numerous alkali flats (see Figure 3-133), at an elevation of approximately 1,430 meters (4,700 feet) above mean sea level. Stonewall Mountain is a prominent feature that would border the common segment on the east.

3.3.1.3.7.2 Geology. Through the Stonewall Flat area, Mina common segment 2 would mostly cross fan and stream-channel alluvium filling a ***graben*** (a depression between normal faults) formed by the northerly-trending Stonewall Mountain Fault.

There has been some seismic activity around the Cuprite Hills and at Stonewall Mountain within the past 150 years (see Figure 3-126).

There are metallic minerals, including copper, silver, and gold along this common segment. The deposits occur in sedimentary and volcanic rocks that have been altered by hot fluids. Quartz veins are also mined for silica. Drilling in the Cuprite Hills suggests the existence of a large geothermal system in the area, with multiple warm heat-flow wells drilled in the Cuprite Hills; however, at present, these are not used as geothermal resources (DIRS 180882-Shannon & Wilson 2007, Plate 3). Except for alluvium, the common segment would not cross rocks suitable for construction.

3.3.1.3.7.3 Soils. Soils along Mina common segment 2 are derived from alluvium and occur on fan piedmonts and fan skirts (DIRS 176781-MO0603GSCSSGEO.000). All of the soils are considered to be easily erodible. There are no blowing soils or prime farmland soils along the segment.

3.3.1.3.8 Bonnie Claire Alternative Segments

3.3.1.3.8.1 Physiography. The physiography of the Bonnie Claire area is characterized by the southern boundary of Lida Valley and the northern portion of Sarcobatus Flat, which are depressions with numerous alkali flats. Pahute Mesa is to the east of the alternative segments; Stonewall Mountain is to the northeast (see Figure 3-134). Bonnie Claire alternative segment 2 would pass to the east of an unnamed 1,500-meter (4,900-foot)-high bedrock knoll that separates Sarcobatus Flat and Lida Valley; Bonnie Claire alternative segment 3 would pass this knoll to the west (DIRS 176184-Shannon & Wilson 2006, Figure 3). Elevations in this area range from about 1,250 to 1,400 meters (4,100 to 4,600 feet) above mean sea level.

3.3.1.3.8.2 Geology. The Bonnie Claire alternative segments would cross the eastern portion of the southwestern Nevada volcanic field. Bonnie Claire alternative segment 3 would cross a mixture of young volcanic rocks and ash-flow sedimentary rocks, while Bonnie Claire alternative segment 2 would primarily cross alluvium on the western edge of Sarcobatus Flat (DIRS 176184-Shannon & Wilson 2006, Table 5).

The two alternative segments would bypass a sequence of interconnected unnamed faults. These faults are not well studied, although recent seismic activity has been recorded in the area. In 1999, there was a magnitude 5.3 earthquake in the area between the Bonnie Claire alternative segments. As seen in Figure 3-126, many aftershocks were recorded in the area, most between magnitudes 2.0 and 3.5. Since then, earthquakes immediately around the Bonnie Claire alternative segments have been below magnitude 3.0 (DIRS 176184-Shannon & Wilson 2006, Plate 4).

Metallic minerals such as gold and copper have been found within the volcanic rocks around the Bonnie Claire alternative segments. The Wagner Mining District is in this area, and is discussed in more detail in Section 3.3.2, Land Use and Ownership.

There are no known energy or geothermal resources in the area surrounding the Bonnie Claire alternative segments, and other than gravel and alluvial materials present on the floor of Lida Valley, the Bonnie Claire alternative segments would not cross any known mineral deposits.

3.3.1.3.8.3 Soils. Soils along Bonnie Claire alternative segments 2 and 3 are derived from alluvium and ***colluvium***, and are found on hills, alluvial fan piedmonts, and fan skirts. Soils are mainly identified for Bonnie Claire alternative segment 3, because soil data are not available for the area around the Nevada Test and Training Range.

Soils with the erodes easily characteristic comprise 27 and 25 percent of the soils along Bonnie Claire alternative segments 2 and 3, respectively. Available data do not indicate any soils with the blowing soil or prime farmland characteristic.

3.3.1.3.9 Common Segment 5 (Sarcobatus Flat Area)

3.3.1.3.9.1 Physiography. The physiography of common segment 5 consists of most of Sarcobatus Flat. Pahute Mesa would be to the northeast (see Figure 3-134). Coba Mountain is a prominent feature in the area that extends from common segment 5 to the southwest (see Figure 3-135). Rail alignment elevations in the Sarcobatus Flat area would range from 1,200 to 1,250 meters (3,900 feet to 4,100 feet) above mean sea level.

3.3.1.3.9.2 Geology. Common segment 5 would cross Quaternary alluvium and mid-Tertiary ash-flow tuffs, minor lava flows, and reworked materials associated with the southwestern Nevada volcanic field. The common segment would not cross Quaternary faults (see Figures 3-134 and 3-136). Commercial minerals found within the area include gold and silver (DIRS 173841-Shannon & Wilson 2005, pp. 51 and 52). Additionally, an actively mined, relatively large gravel pit at the alluvial fan boundary between Pahute Mesa and Sarcobatus Flat would be within 0.8 kilometer (0.5 mile) of the rail alignment in this area.

Geothermal occurrences in Sarcobatus Valley include one warm spring and one hot well, which would be about 0.20 kilometer (0.12 mile) from the rail alignment.

3.3.1.3.9.3 Soils. Area soils are derived from alluvial deposits and are well drained. They occur on alluvial flats and fan piedmonts. Soils with the blowing soil characteristic comprise about 2.6 percent of the soils. There are no soils along common segment 5 with the erodes easily or prime farmland characteristics.

3.3.1.3.10 Oasis Valley Alternative Segments

3.3.1.3.10.1 Physiography. Oasis Valley alternative segments 1 and 3 would be in Oasis Valley, which is incised by the Amargosa River, an ***ephemeral stream***, and tributary washes (see Figure 3-135).

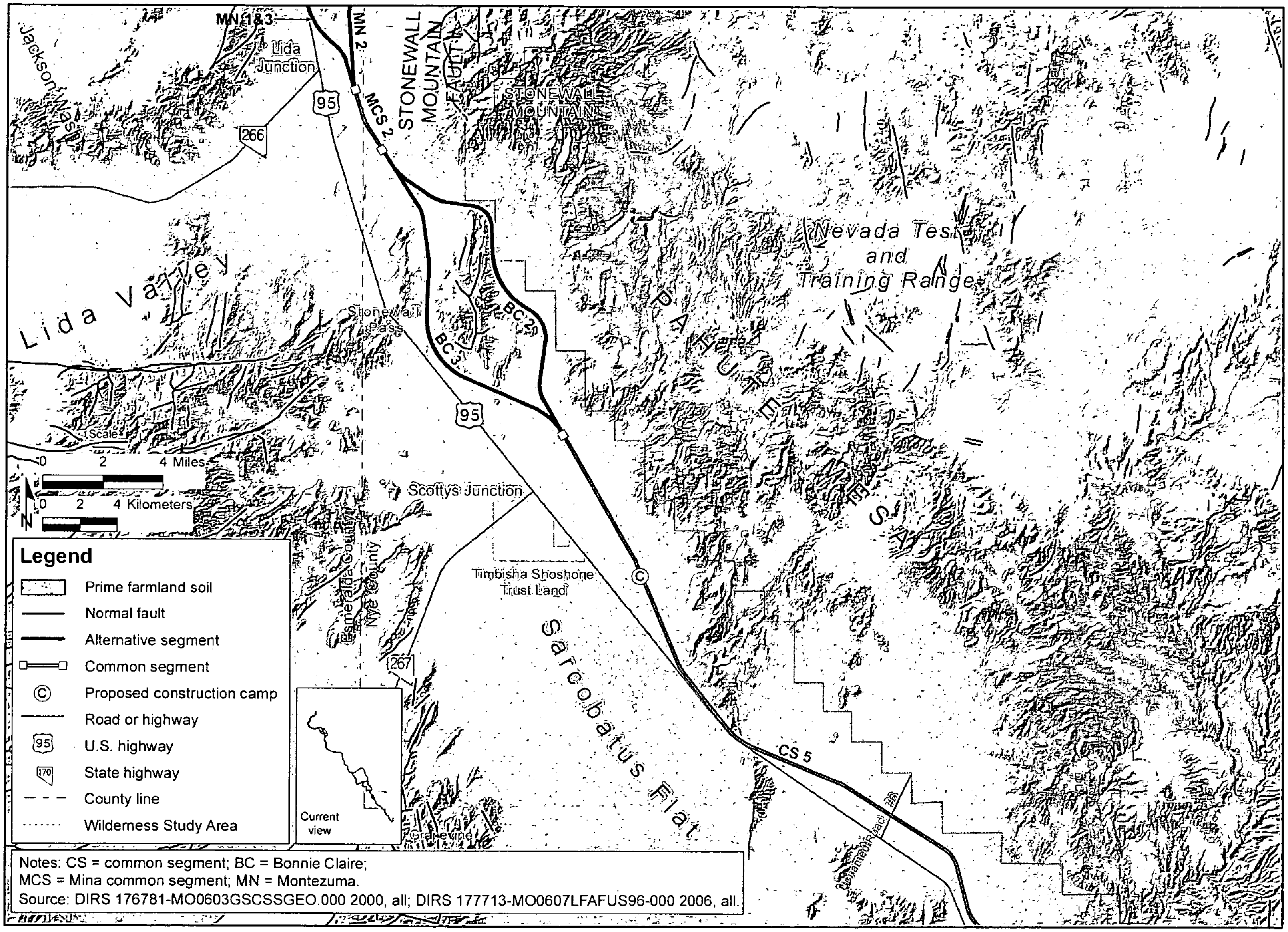


Figure 3-134. Physiographic features of common segments and alternative segments in map area 6.

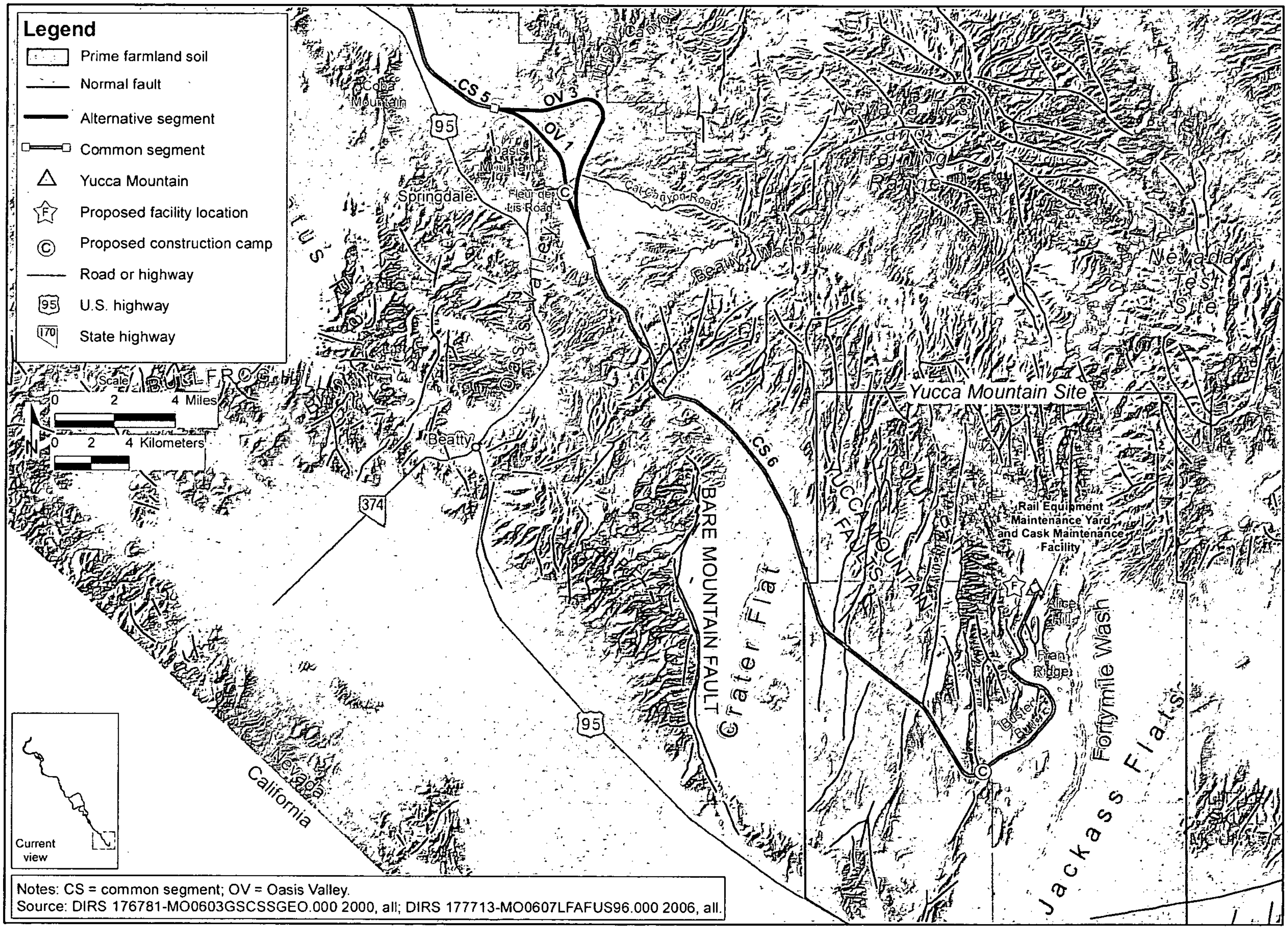


Figure 3-135. Physiographic features of common segments and alternative segments in map area 7.

Elevations range from about 1,200 to 1,300 meters (3,900 to 4,200 feet) above mean sea level. At the northwest end, the alternative segments would cross alluvial fans extending from Pahute Mesa on the north and Oasis Mountain (in Bullfrog Hills) on the south.

3.3.1.3.10.2 Geology. The two Oasis Valley alternative segments would cross sedimentary rocks overlain in part by recent sediment from alluvial fans and Amargosa River floodplain deposits. Small outcrops of young volcanic rocks from the southwestern Nevada volcanic field area are also exposed. The rail alignment would not cross Quaternary faults, commercial mineral operations, geothermal resources or materials suitable for construction purposes.

3.3.1.3.10.3 Soils. Soils along Oasis Valley alternative segments 1 and 3 are derived from alluvium and are well drained to somewhat excessively drained. Soils occur on fan skirts and fan piedmonts. Oasis Valley 1 contains approximately 13 percent soils with the blowing soil characteristic, while Oasis Valley 3 contains approximately 5.3 percent of blowing soils. There are no prime farmland or erodes easily soils along either of the Oasis Valley alternative segments.

3.3.1.3.11 Common Segment 6 (Yucca Mountain Approach)

3.3.1.3.11.1 Physiography. The physiography of common segment 6 is characterized by Beatty Wash, Crater Flat, and several ridges and valleys that make up Yucca Mountain, Busted Butte, and Jackass Flats (see Figure 3-135). The common segment would go around the east side of Busted Butte, with Fortymile Wash and most of Jackass Flats to the east. North of Busted Butte, it would cross a series of washes and valleys flanked by multiple ridges, where it would terminate near Yucca Mountain. Rail alignment elevations would range from about 1,300 meters (4,300 feet) at Tram Ridge to 1,000 meters (3,300 feet) above mean sea level at the base of Busted Butte (DIRS 176184-Shannon & Wilson 2006, Figure 3, Sheets 70 and 71).

3.3.1.3.11.2 Geology. This area is in the southern edge of the southwestern Nevada volcanic field. Common segment 6 would cross a variety of alluvial deposits and sedimentary rocks, and young volcanic rocks. Faults in the area increase in number closer to the Yucca Mountain uplands. The fault traces generally trend to the north, including the Bare Mountain Fault and the eastern and western Yucca Mountain fault groups. Displacements along faults are characterized in terms of the amount of movement per seismic event. For the set of block-bounding faults of primary significance to the ***Yucca Mountain Site***, these surface values range from 0 to 1.7 meters (0 to 5.6 feet) per event (DIRS 155970-DOE 2002, Table 3-8).

DOE has monitored seismic activity at the Nevada Test Site since 1978. The largest recorded earthquake within 50 kilometers (30 miles) of Yucca Mountain was the Little Skull Mountain earthquake in 1992 (DIRS 169734-BSC 2004, p. 4-34 and Figure 4-19), which had a magnitude of 5.6 (DIRS 169734-BSC 2004, p. 4-38). DOE buildings at the Nevada Test Site were damaged and there was also damage in Beatty, Amargosa Valley, and Mercury, Nevada. DOE would continue to monitor the seismic activity around Yucca Mountain with an array of monitoring stations spread throughout the area.

The bedrock around Mina common segment 6 contains metallic minerals such as gold and silver, and nonmetallic deposits, including fluorspar and silica (DIRS 173841-Shannon & Wilson 2005, pp. 38 to 45). There are also several hot springs around the Beatty Wash area, some of which are used by a hotel (DIRS 173841-Shannon & Wilson 2005, Plate 1).

3.3.1.3.11.3 Soils. Soils along common segment 6 occur on fan piedmonts, skirts, and fan remnants. The soils derived from Tertiary volcanic rocks and Quaternary alluvium are well drained to somewhat excessively drained. Soils on alluvial flats are derived from lake deposits and are well drained. None of the soils along common segment 6 contain prime farmland, blowing soil, or soils with the erodes easily characteristic.

3.3.2 LAND USE AND OWNERSHIP

This section describes the affected environment for land use and ownership along and adjacent to the Mina rail alignment. At the recommendation of the U.S. Bureau of Land Management (BLM; a cooperating agency in the preparation of the this Rail Alignment EIS), DOE organized this section by types of land uses rather than by rail alignment segments to enable the reader to quickly review topics of interest to them. The section provides an overview of land uses on private, American Indian, and public lands. The BLM, DOE, and the Department of Defense manage public land the Mina rail alignment would cross. The uses of public land discussed in detail in this section include grazing (within BLM-designated ***grazing allotments***), mineral and energy extraction, and recreation. This section also discusses land access and existing utility rights-of-way.

Section 3.3.2.1 describes the region of influence for land use and ownership; Section 3.3.2.2 describes private land, including relevant land-use plans; Section 3.3.2.3 describes American Indian land; Section 3.3.2.4 describes public lands, BLM ***resource management plans***, and project-related land ***withdrawals***; and Section 3.3.2.5 describes the general environmental setting and land-use characteristics along the Mina rail alignment.

Other sections of this Rail Alignment EIS describe additional subjects related to land use. Section 3.3.1, Physical Setting, describes farmland and prime farmland; Section 3.3.7, Biological Resources, describes wild horse and burro ***herd management areas***; and Section 3.3.11, Utilities, Energy, and Materials addresses utilities. Section 3.4 describes American Indian interests and concerns related to the Proposed Action.

3.3.2.1 Region of Influence

The region of influence for land use and ownership is the nominal width of the rail line construction right-of-way, and includes all private land (including patented mining claims), American Indian lands, and public land that would be fully or partially within the construction right-of-way. The land use and ownership region of influence also includes the locations of proposed railroad construction and operations support facilities outside the nominal width of the construction right-of-way.

Although the railroad operations right-of-way would be smaller than the construction right-of-way, DOE evaluated the construction right-of-way as the basis for identifying potential land-use impacts because:

- It provides a more conservative estimate of the amount of land that would be utilized than the operations right-of-way, providing an upper bound for analysis.
- The construction phase encompasses the most intensive land use in terms of noise, human activity, and disruptions to land access.
- The construction right-of-way footprint would be the basis for the initial right-of-way applications submitted to the BLM for the project.

3.3.2.2 Private Land

Private lands in Mineral, Esmeralda, and Nye Counties are either clustered in towns and along highways, or are widely scattered. Private lands make up a very small portion of these counties. Figure 3-136 provides an overview of privately owned lands near the Mina rail alignment.

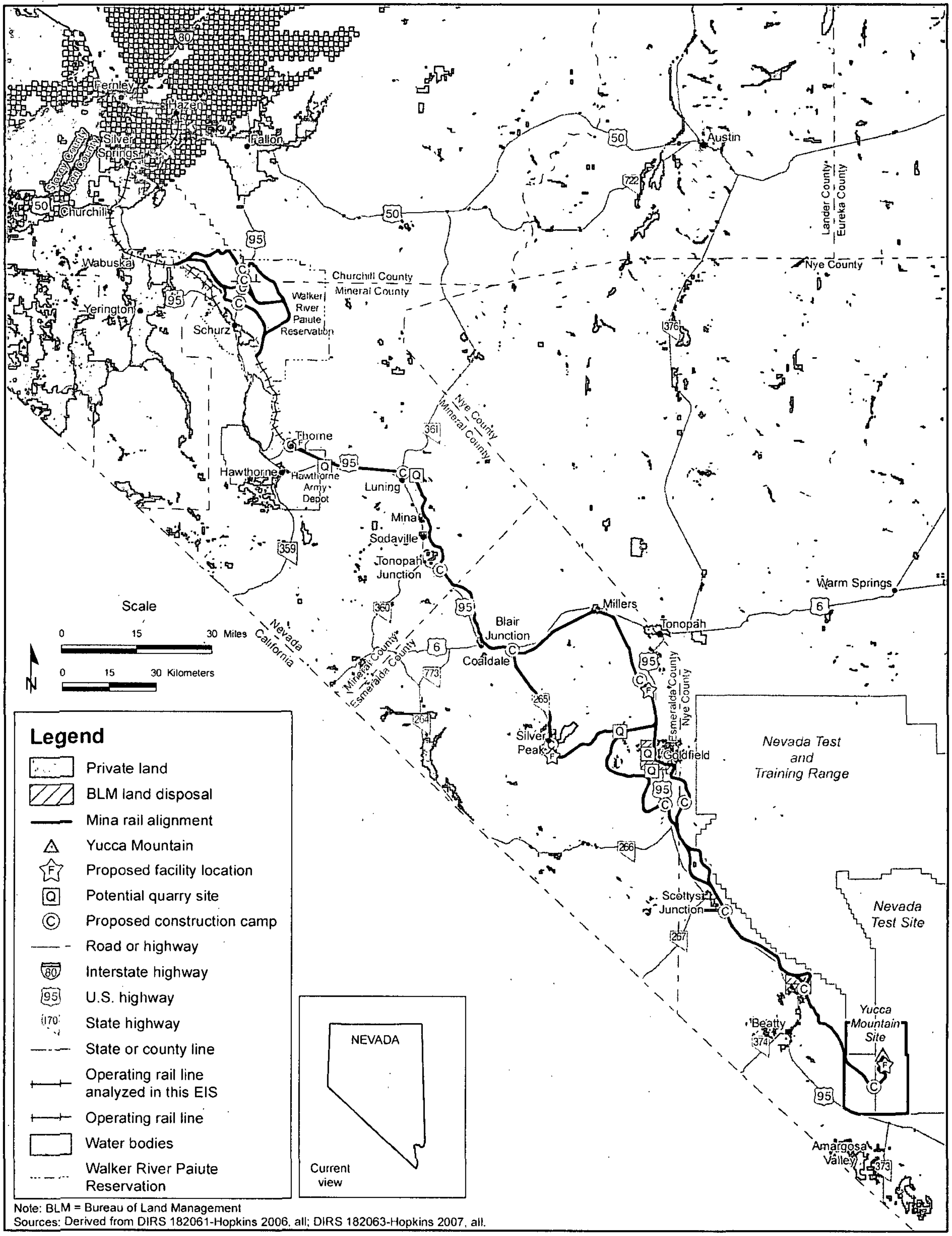


Figure 3-136. Private land along the Mina rail alignment.

3.3.2.2.1 County Land-Use Plans

The Mina rail alignment would cross parts of Churchill, Lyon, Mineral, Esmeralda, and Nye Counties. County plans that could affect land use along the rail alignment include the *Churchill County Master Plan* (DIRS 180482-Churchill County 2005, all), the *Esmeralda County Master Plan* (DIRS 176770-Duval et. al. 1976, all) and *Nye County Comprehensive Plan* (DIRS 147994-McRae 1994, all).

3.3.2.2.1.1 Churchill County. In Churchill County, the northernmost section of the Mina rail alignment would be the existing Union Pacific Railroad Hazen Branchline. A portion of Schurz alternative segment 6 would cross land within Churchill County, although entirely within the Walker River Paiute Reservation. Therefore, there would be no construction activities that could affect land use and ownership within lands under the jurisdiction of Churchill County, and its master plan would not apply to the Mina rail alignment.

3.3.2.2.1.2 Lyon County. A portion of the Union Pacific Railroad Hazen Branchline, all of Department of Defense Branchline South, and 0.6 kilometer (0.4 mile) of the western portions of the Schurz alternative segments lie within Lyon County. Lyon County is in the process of updating its 1990 Comprehensive Master Plan and the process will last through 2008. However, the Mina rail alignment would travel on existing railroad, within the Walker River Paiute Reservation, or on BLM-administered land for its entire length through Lyon County. Because there would be no new railroad construction on land under Lyon County jurisdiction, the Lyon County master plan would not apply to the Mina rail alignment.

3.3.2.2.1.3 Mineral County. Mineral County covers more than 9,900 square kilometers (3,800 square miles), of which 81.3 percent is controlled and managed by the federal government. The Walker River Paiute Reservation is at the very northern end of Mineral County. In the Hawthorne area, the Department of Defense has large land holdings used for storage of conventional weapons. In Hawthorne, land uses are mixed, with primarily commercial and residential developments on the highway corridor. In Mina and Luning, the predominant land uses are small tourist commercial and residential (DIRS 180702-Mineral County Nuclear Projects Office 2005, p. 30). While there are zoning designations within Hawthorne, Walker Lake, Mina, and Luning (DIRS 180702-Mineral County Nuclear Projects Office 2005, pp. 26 to 29), there are no county master plans or town land-use plans in Mineral County that would apply to the Mina rail alignment.

3.3.2.2.1.4 Esmeralda County. The BLM manages more than 92 percent of the approximately 9,000 square kilometers (3,600 square miles) in Esmeralda County. Two percent of the land in Esmeralda County is National Forest land, and a small portion of the county falls within Death Valley National Park. Less than 5 percent of the land in the county is privately owned. The two most heavily populated areas in Esmeralda County at the issuance of the *Esmeralda County Master Plan* were Goldfield and Silver Peak (DIRS 176770-Duval et. al. 1976, p. 25). Goldfield is the county seat for Esmeralda County; there are no incorporated cities in the county. Under the *Esmeralda County Master Plan*, land use has been divided into three basic categories: multiple use, agriculture, and urban expansion. The multiple-use category is suggested for those areas where federal or state ownership is expected to remain. Grazing, mining and prospecting, and recreation activities are recommended under the multiple-use concept. The plan also recommends that residential and commercial development be concentrated in the existing communities of Goldfield and Silver Peak, where public facilities can be most economically concentrated (DIRS 176770-Duval et. al. 1976, p. 73).

3.3.2.2.1.5 Nye County. Nye County has an area of approximately 47,000 square kilometers (18,000 square miles) and is the largest county in Nevada. The federal government manages almost 93 percent of the county's land. Federally owned or managed lands in Nye County include the Nevada Test and

Training Range, the Nevada Test Site, BLM-administered public land, a portion of Death Valley National Park, and portions of the Humboldt-Toiyabe National Forest. Private lands in Nye County are used for residential, commercial, and industrial purposes largely, but not exclusively, within the boundaries of unincorporated towns, and agricultural and mining uses both inside and outside these towns. The *Nye County Comprehensive Plan* guides growth and development, but is not equivalent to a zoning ordinance, nor does it regulate the use of land. However, the Nye County Board of Commissioners may choose to enact a zoning ordinance or other growth-management mechanisms to accomplish certain objectives of the plan. The plan also serves as a framework for local land-use plans and other growth-management mechanisms (DIRS 147994-McRae 1994, all).

3.3.2.2.2 Local Land-Use Planning

The initial design phase for the Mina rail alignment emphasized avoiding private land, which is generally concentrated near towns. While distinct town boundaries are not always available, DOE believes the rail alignment would not fall within Hawthorne, Luning, Mina, Sodaville, Tonopah Junction, Coaldale, Blair Junction, Millers, Silver Peak, Klondike, Ralston, Lida Junction, Scottys Junction, Springdale, or Beatty, which would be the towns or places closest to the rail alignment. A portion of Montezuma alternative segments 2 and 3 would pass through private lands to the south of Millers, but this very small town does not have zoning or land-use plans.

Montezuma alternative segment 2 would also pass through Goldfield. Goldfield, an unincorporated town, is the county seat for Esmeralda County. The Goldfield census county division encompasses an area of more than 3,900 square kilometers (1,500 square miles) (DIRS 176855-U.S. Census Bureau 2003, p. 5). During its most prominent mining period at the beginning of the 20th Century, a number of passenger and freight railroad lines served Goldfield. The Goldfield Historic District, listed on the *National Register of Historic Places* in 1982 and entered onto the *Nevada State Register of Historic Places* on December 7, 2005, is in Goldfield and roughly bounded by Fifth Street, Miner Avenue, Spring Street, Elliot Street, and Crystal Avenue (DIRS 176854-National Register of Historic Places 1982, all). Although there is no zoning plan for Goldfield, the historic nature of its buildings and features are generally protected by the designation of its historic district. The Goldfield Historic District would be about 0.7 kilometer (0.4 mile) northwest of the Montezuma alternative segment 2 construction right-of-way.

3.3.2.2.3 Private Parcels

Table 3-81 lists the number of privately owned parcels of land that are within the construction right-of-way of each Mina rail alignment segment. Figures 3-137 through 3-143 show privately owned land along the Mina rail alignment segments.

Table 3-81. Private land that would be within or intersect the Mina rail alignment construction right-of-way.

Rail line segment[a]	Number of parcels	Area of parcels (square kilometers)[b]
Mina common segment 1	1	0.21
Montezuma alternative segment 2	34	0.24
Montezuma alternative segment 3	1	0.01
Oasis Valley alternative segment 1	1	0.04

a. No other segments would intersect private land.
b. To convert square kilometers to acres, multiply by 247.10.

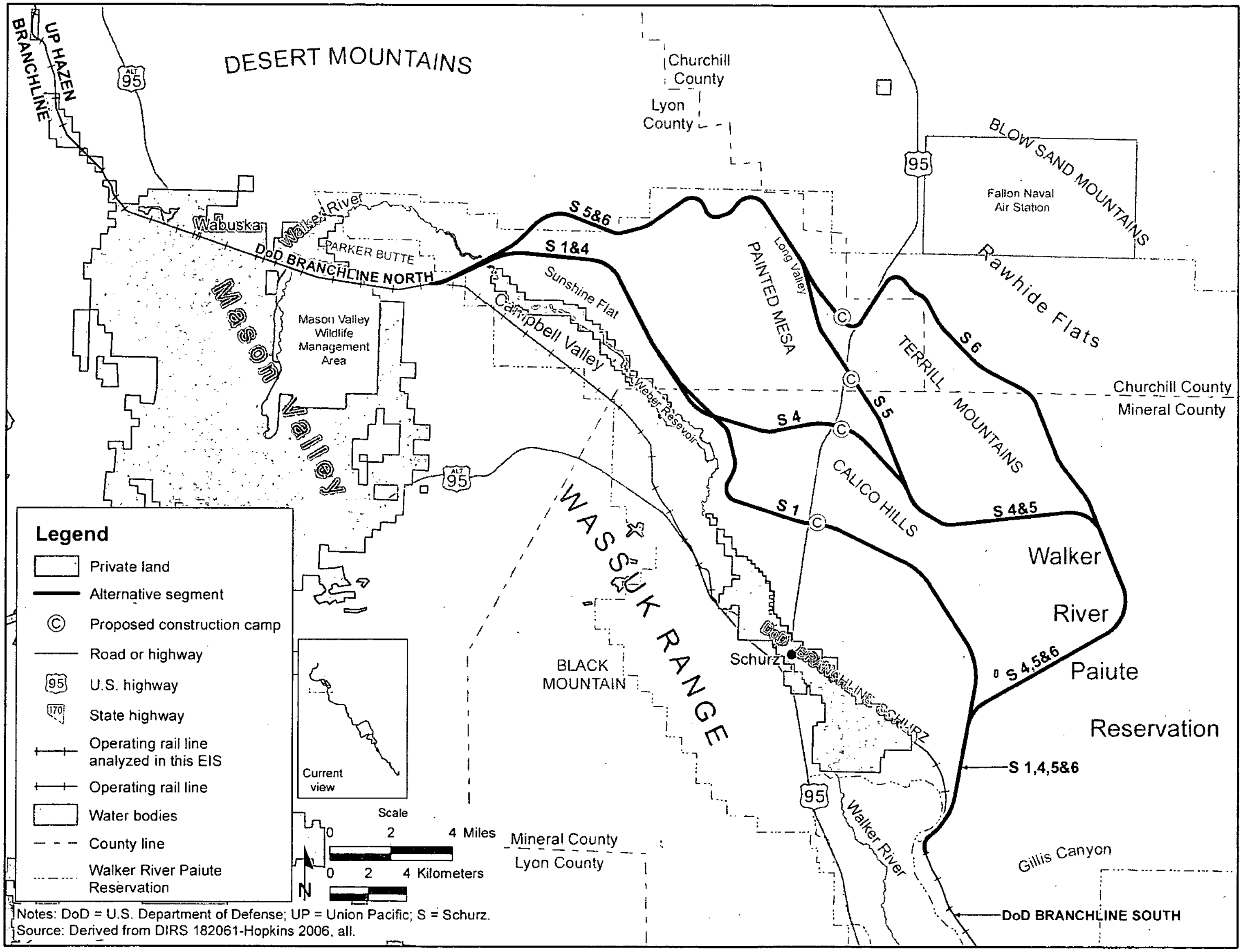


Figure 3-137. Private land within map area 1.

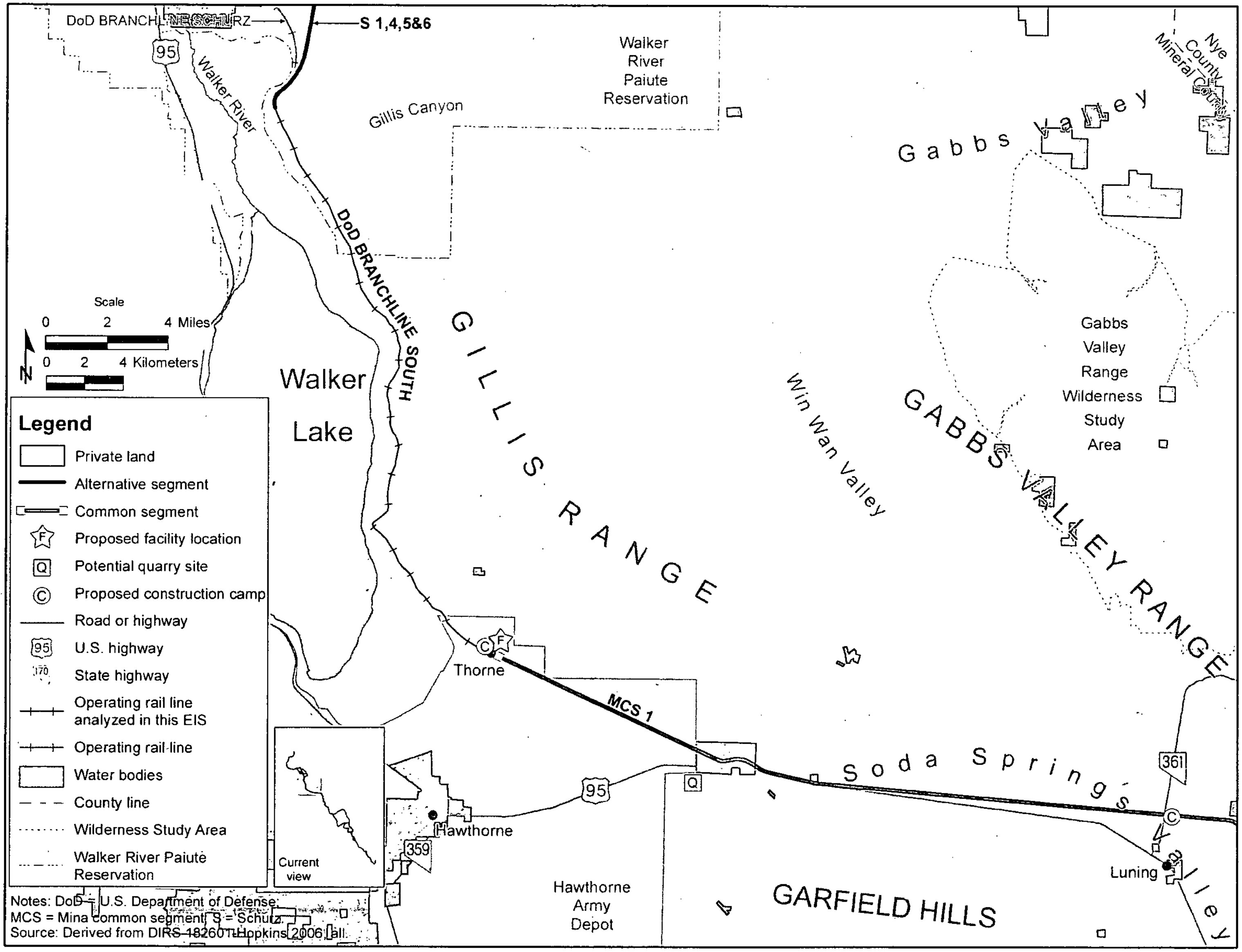


Figure 3-138. Private land within map area 2.

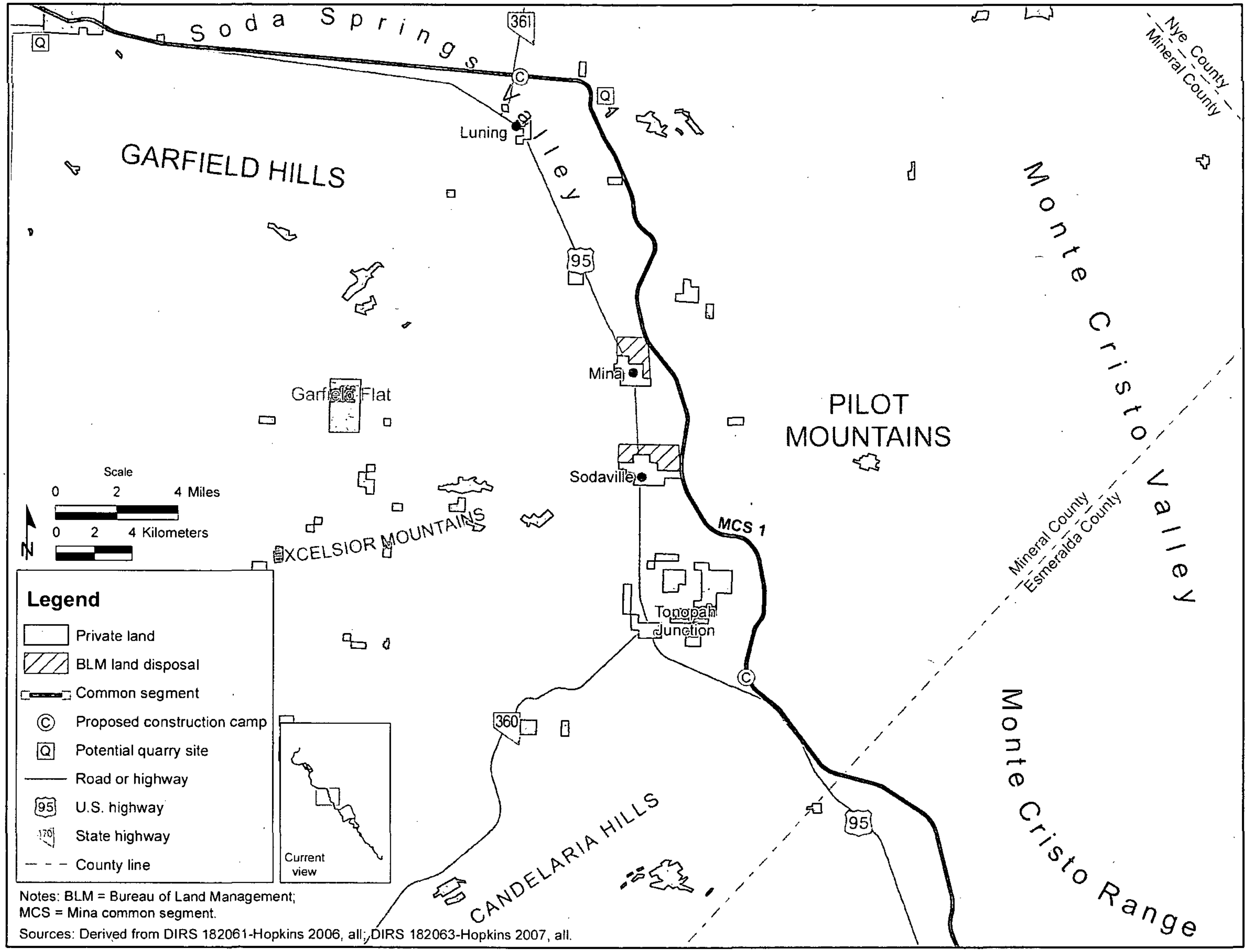
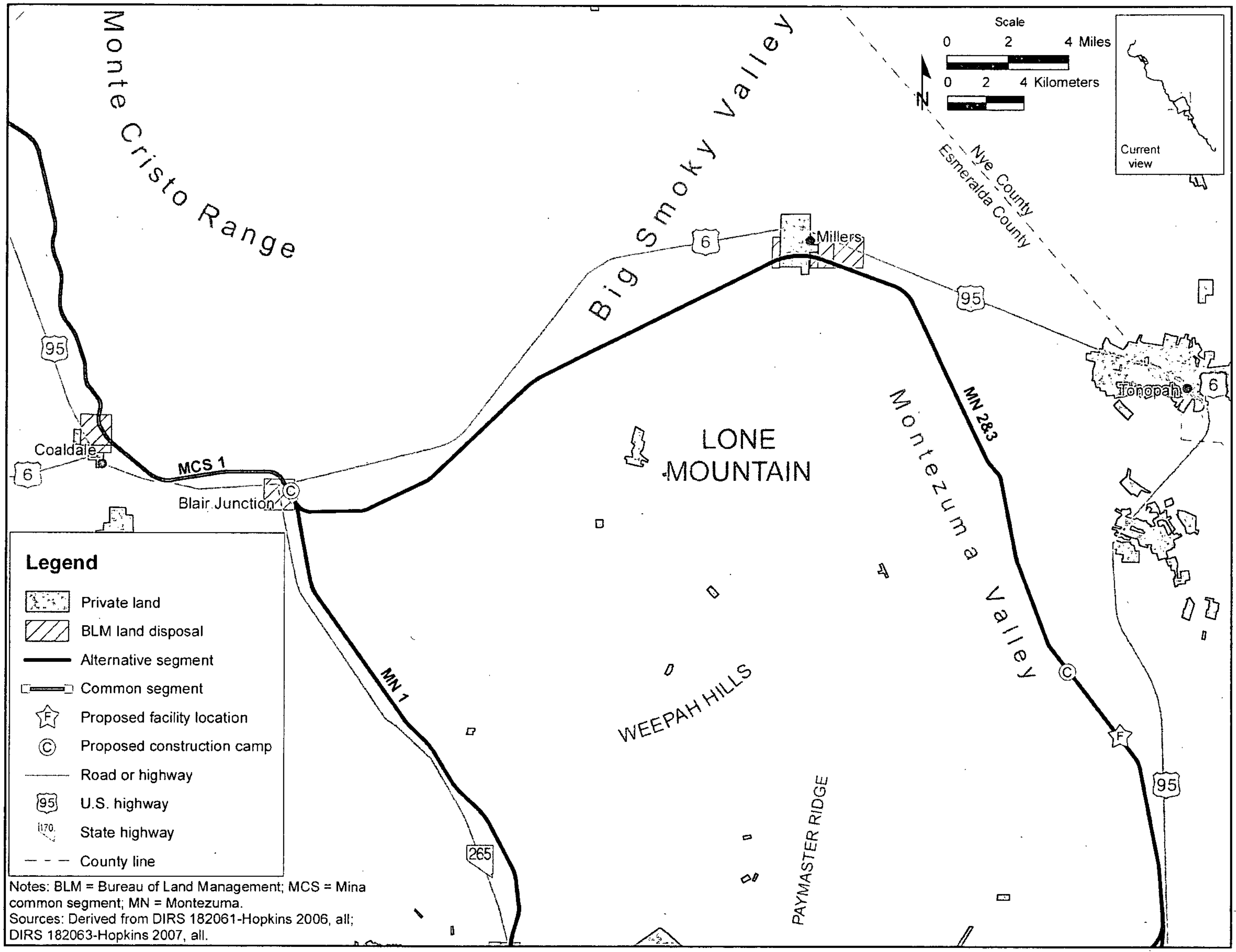


Figure 3-139. Private land within map area 3.



Notes: BLM = Bureau of Land Management; MCS = Mina common segment; MN = Montezuma.
Sources: Derived from DIRS 182061-Hopkins 2006, all; DIRS 182063-Hopkins 2007, all.

Figure 3-140. Private land within map area 4.

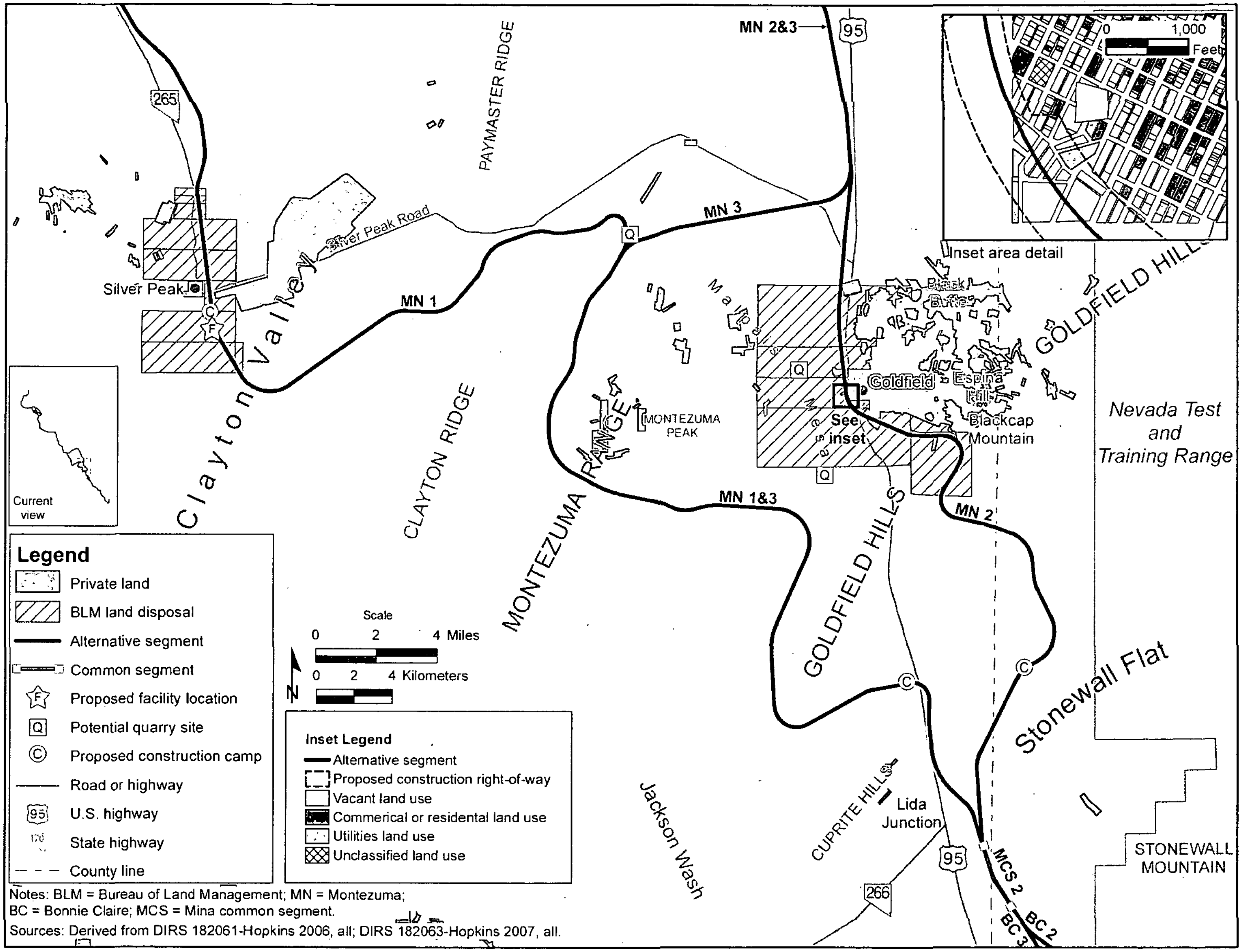


Figure 3-141. Private land within map area 5.

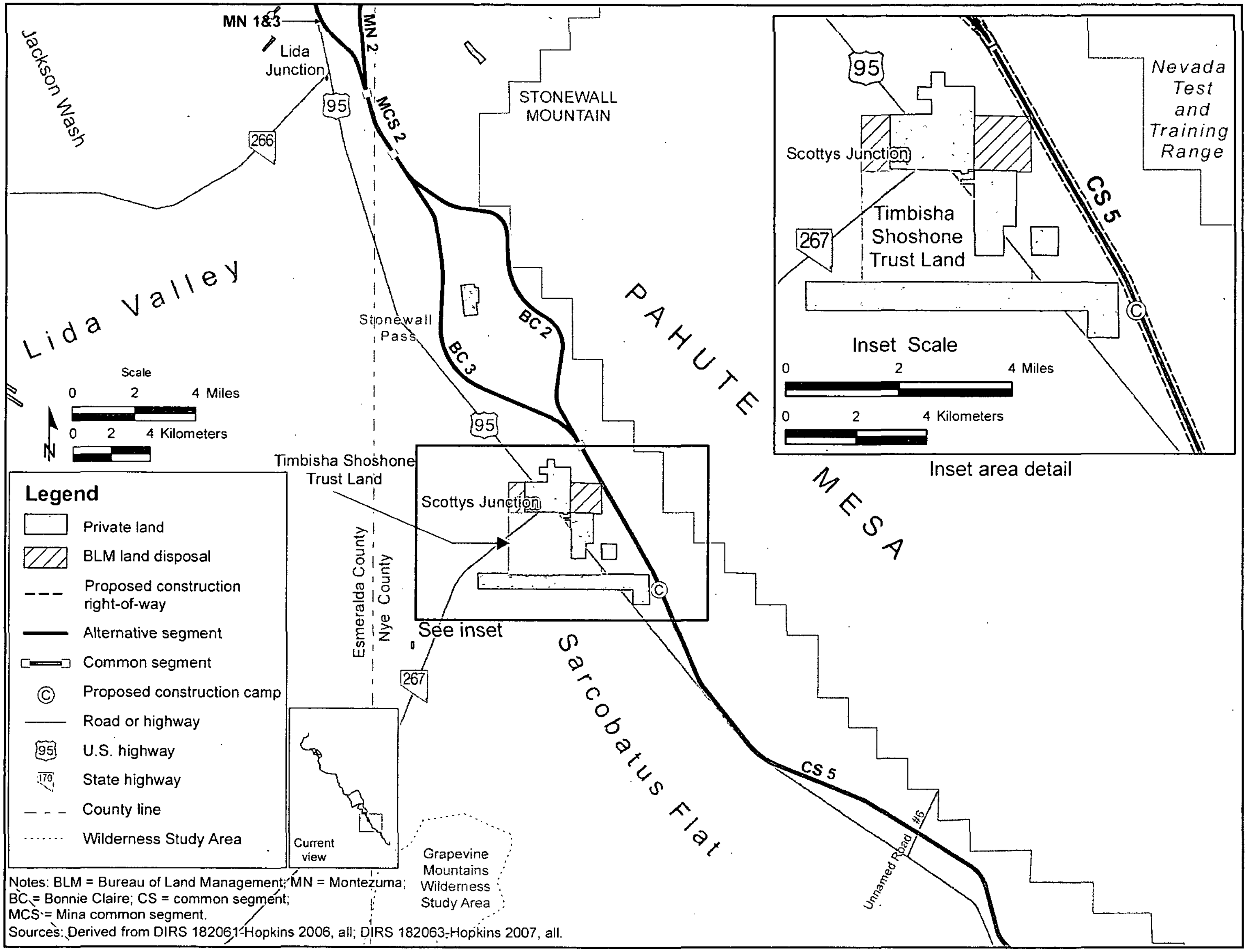
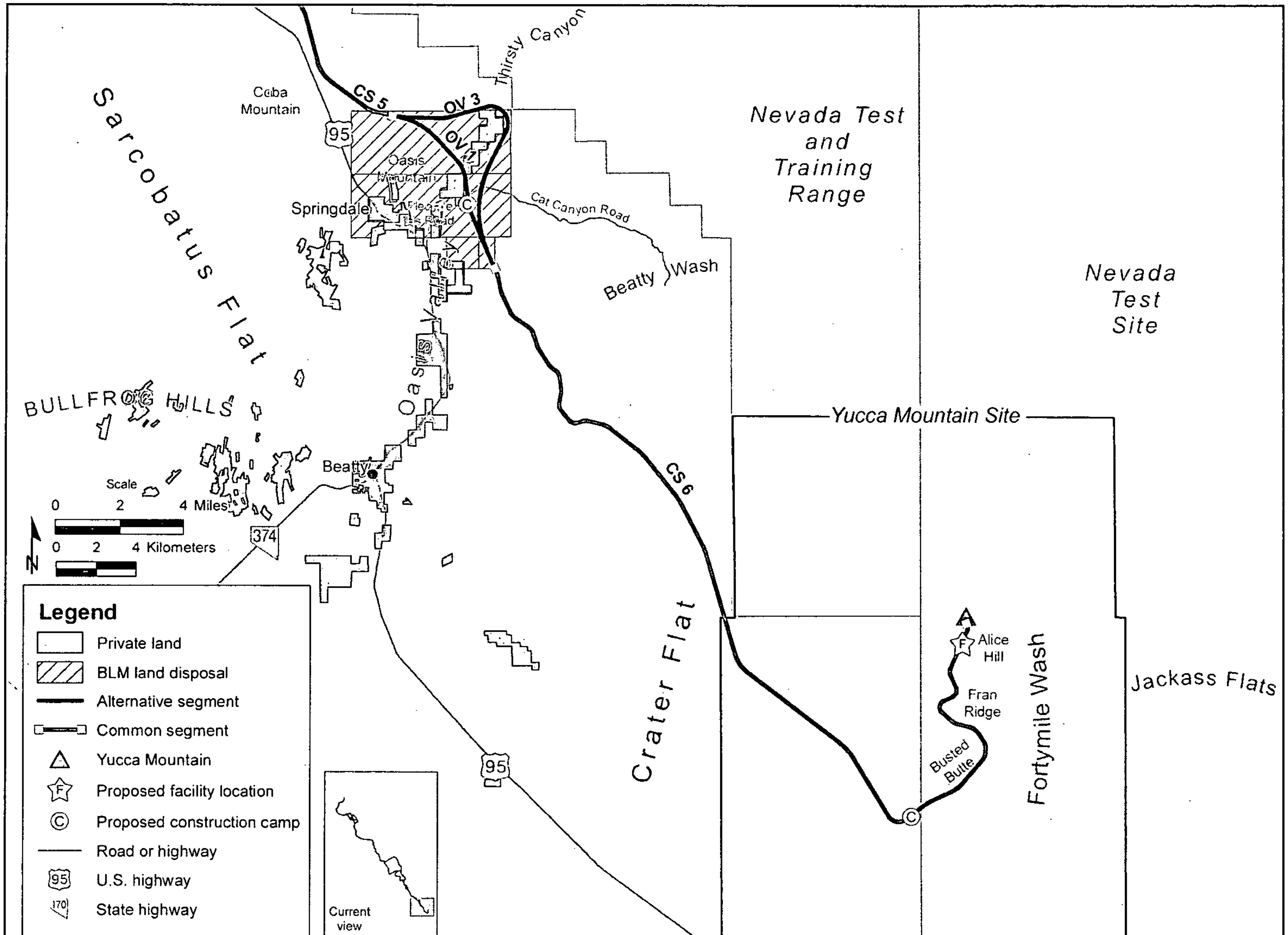


Figure 3-142. Private land within map area 6.



Notes: BLM = Bureau of Land Management; CS = common segment; OV = Oasis Valley.
Sources: Derived from DIRS 182061-Hopkins 2006, all; DIRS 182063-Hopkins 2007, all.

Figure 3-143. Private land within map area 7.

3.3.2.3 American Indian Land

3.3.2.3.1 Walker River Paiute Reservation

The Walker River Paiute Reservation is 68 kilometers (42 miles) south of Fallon and 37 kilometers (23 miles) east of Yerington (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 1). The Reservation consists of 1,308 square kilometers (323,200 acres) of land across Churchill, Lyon, and Mineral Counties (DIRS 182302-Miller Ecological Consultants 2005, p. 3-50).

The Reservation was established on November 29, 1859, by letter from the Indian Affairs Commissioner to the General Land Office requesting that land from sale or settlement for Indian use in the northeastern part of the Walker River Valley, including the Walker River Reservation, be established. The constitution of the Walker River Paiute Tribe was finalized on March 26, 1937 (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 1).

At present, 8.5 square kilometers (2,100 acres) of Reservation land is used for agriculture (primarily alfalfa and grass hay) (DIRS 182302-Miller Ecological Consultants 2005, p. 3-50). More than 50 percent of the Reservation is rangeland. Small ranching businesses manage livestock, primarily cattle (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 2). The town of Schurz, the only town on the Reservation, consists of private property with residential and business uses. The Department of Defense operates a branchline across the Reservation, through Schurz. The Weber Dam and Reservoir are also on Reservation land.

The Walker River Paiute Tribe divides land into 0.08-kilometer (20-acre) allotments (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 1). Many of the allotments have multiple owners through inheritance (182302-Miller Ecological Consultants 2005, p. 3-49). There is no adopted land-use plan for the Reservation, although the Tribal Council in effect controls land-use decisions (DIRS 182302-Miller Ecological Consultants 2005, p. 3-49).

Table 3-82 summarizes the distances and areas of existing and proposed rail line segments within the Walker River Paiute Reservation.

Table 3-82. Distances of existing and proposed rail line segments through the Walker River Paiute Reservation.

Segment	Approximate distance through the Reservation (kilometers)[a]	Approximate area of Reservation land that would be within the rail line construction right-of-way (square kilometers)[b]
Existing Department of Defense Branchline through Schurz (existing rail to be removed as part of the Proposed Action)	44	Not applicable
Schurz alternative segment 1	51	3.4
Schurz alternative segment 4	65	4.7
Schurz alternative segment 5	66	5.0
Schurz alternative segment 6	64	5.3

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert square kilometers to acres, multiply by 247.10.

3.3.2.3.2 Timbisha Shoshone Trust Land

The Timbisha Homeland Act transferred into trust 31.4 square kilometers (7,754 acres) of land for the Timbisha Shoshone Tribe. The land is not contiguous; it is made up of five separate parcels in California and Nevada. The parcel near Scottys Junction covers approximately 11.3 square kilometers (2,800 acres).

During the public scoping period for this Rail Alignment EIS, the Timbisha Shoshone Tribe requested that DOE alter the rail alignment to avoid their land (DIRS 174558-Sweeney 2004, all). The segment nearest the Timbisha Shoshone Trust Land near Scottys Junction, common segment 5, would be more than 3 kilometers (2 miles) east.

3.3.2.4 Public Land

Several agencies manage public lands near or encompassing the Mina rail alignment, including the BLM, DOE, and the Department of Defense. The Walker River Paiute Tribal Council manages Walker River Paiute Reservation lands.

Based on the construction right-of-way of the longest possible Mina rail alignment, the BLM manages 113.3 square kilometers (28,000 acres) of the land the rail line would cross, the Department of Defense manages 4.6 square kilometers (1,145 acres), the Walker River Paiute Tribe manages 5.3 square kilometers (1,315 acres), DOE manages 4.1 square kilometers (1,020 acres), and up to 0.45 square kilometer (71 acres) is privately owned.

The Mina rail alignment would travel through the Walker River Paiute Reservation. The Reservation does not have a land-use plan. The Mina rail alignment would also travel through the Hawthorne Army Depot. The Depot does not have a master plan but its land use is governed in part by its draft Integrated Natural Resource Management Plan (DIRS 181899-Hawthorne Army Depot, all).

3.3.2.4.1 BLM-Administered Land

Approximately 89 percent of the lands along the Mina rail alignment are BLM-administered public lands. Therefore, the proposed railroad project would in large part be subject to BLM land use plans. The BLM manages public lands under the multiple-use concept, which balances the present and future needs of the American people. The BLM implements this concept through resource management plans, which are long-range, comprehensive land-use plans intended to provide for multiple uses and identify planning objectives and policies for designated areas. Resource management plan objectives are implemented through activity plans, such as allotment management plans and wildlife ***habitat*** management plans. BLM resource management plans that apply to the Mina rail alignment are included in the following:

- *Carson City Field Office Consolidated Resource Management Plan* (Carson City Consolidated Resource Management Plan (DIRS 179560-BLM 2001, all)
- *Tonopah Resource Management Plan and Record of Decision* (Tonopah Resource Management Plan; DIRS 173224-BLM 1997, all)
- *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (Las Vegas Resource Management Plan; DIRS 176043-BLM 1998, all)

The northern segments of the Mina rail alignment would pass through public lands covered by the Carson City Consolidated Resource Management Plan. After the Mina rail alignment would cross from Mineral County into Esmeralda County, the land would be covered by the Tonopah Resource Management Plan. A portion of common segment 6 would pass through lands covered by the Las Vegas Resource Management Plan. Table 3-83 lists the distances each Mina rail alignment segment would pass through lands administered by the various BLM districts.

Table 3-83. Mina rail alignment crossing distances within each BLM resource management plan area.

Rail line segment	Carson City District/ Resource Management Plan area (kilometers)[a,b]	Battle Mountain District/Tonopah Resource Management Plan area (kilometers)	Las Vegas District/Resource Management Plan area (kilometers)
Union Pacific Railroad Hazen Branchline and Department of Defense Branchline North[c]	69	0	0
Schurz alternative segment 1	51	0	0
Schurz alternative segment 4	65	0	0
Schurz alternative segment 5	71	0	0
Schurz alternative segment 6	72	0	0
Department of Defense Branchline South	35	0	0
Mina common segment 1	85	35	0
Montezuma alternative segment 1	0	120	0
Montezuma alternative segment 2	0	120	0
Montezuma alternative segment 3	0	140	0
Mina common segment 2	0	3	0
Bonnie Claire alternative segment 2	0	20	0
Bonnie Claire alternative segment 3	0	20	0
Common segment 5	0	40	0
Oasis Valley alternative segment 1	0	10	0
Oasis Valley alternative segment 3	0	14	0
Common segment 6	0	38	13
Total rail alignment distance by BLM district (shortest to longest alignment)	240 to 261	266 to 290	13

a. To convert kilometers to miles, multiply by 0.62137.
b. Individual segment lengths are rounded to two significant figures.
c. Within boundary but not under jurisdiction.

To construct and operate the proposed railroad along the Mina rail alignment, DOE would apply for a BLM ***right-of-way grant***. Section 503 of the Federal Land Policy and Management Act (43 United States Code [U.S.C.] 1761) provides for designation of right-of-way corridors and encourages the utilization of common rights-of-way to minimize environmental impacts and the proliferation of separate rights-of-way. BLM policy is to encourage prospective applicants to locate their proposals within existing corridors. Resource management plans describe these corridors and right-of-way avoidance areas – areas for which the BLM would avoid granting new rights-of-way unless there are no other options. ***Areas of Critical Environmental Concern*** are generally considered right-of-way avoidance areas.

Resource management plans also designate areas of potential land disposal within their management areas. Therefore, BLM in consultation with DOE must assess whether a railroad along the Mina rail alignment would conflict with or adversely affect land disposal plans. Section 203(a) of the Federal Land Policy and Management Act allows for public land to be sold (disposed of) if it meets one of the following criteria:

Areas of Critical Environmental Concern are places within the public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, and other natural systems, or processes or to protect life and safety from natural hazards (DIRS 181386-BLM 2001, p. 2).

- The land is difficult or uneconomic to manage as a part of the public lands.
- The land is not suitable for management by another federal department or agency.
- The land was acquired for a specific purpose and it is no longer required for that, or any other, federal purpose.
- Disposal of the land will serve important public objectives that can be achieved prudently or feasibly only if the land is removed from public ownership and these objectives outweigh other public objectives or values that will be served by maintaining the land in federal ownership.

Sections 3.3.2.4.1.1 through 3.3.2.4.1.3 describe the planning areas and objectives of the applicable Resource Management Plans in relation to lands and realty, corridors, and access and recreation.

3.3.2.4.1.1 Carson City Consolidated Resource Management Plan. The BLM Carson City Field Office administers more than 21,000 square kilometers (5.28 million acres) of federal public land in 11 counties in western Nevada and eastern California. Relevant management objectives related to land tenure adjustments, corridors, and access are listed below (DIRS 179560-BLM 2001, all).

- Lands and realty
  - Designate for potential future disposal approximately 750 square kilometers (180,000 acres) of BLM-administered public lands including lands that are difficult and uneconomic to manage (such as scattered parcels south of Hawthorne and in Smith and Mason Valleys, and checkerboard lands near Fernley, Silver Springs, and the Carson Sink [a large playa in northwestern Nevada, formerly the terminus of the Carson River]); land that would support community expansion (such as land west of Yerington; land surrounding Luning, Mina, Sodaville, Fallon, Gabbs, Reno, and Verdi; lands east of Montgomery Pass, near Honey Lake Valley and Dixie Valley); lands with possible agricultural potential (such as Smith Valley, Mason Valley, Honey Lake Valley, and Edwards Creek); and lands along the East Walker River identified for exchange to benefit BLM programs (DIRS 179560-BLM 2001, p. LND-3). The Mina common segment 1 construction right-of-way would overlap the eastern edge of disposal areas near Mina and Sodaville.
  - Transfer of land from federal ownership is subject to the following provision: mineral rights will be reserved to the United States unless there are no known mineral values in the land or the proposed non-mining development of the land is of more value than the minerals and the reservation of mineral rights interferes with such proposed non-mining development (DIRS 179560-BLM 2001, p. LND-7).
  - Rights-of-way will be reserved where appropriate to provide public access prior to disposal of public lands (DIRS 179560-BLM 2001, p. LND-7).
  - When public lands are disposed of or devoted to a public purpose that precludes livestock grazing, the permittee and lessee will be given 2 years prior notification, except in the cases of emergency (for example, military defense requirements in time of war, natural disasters, and

national emergency needs) before their grazing permit and grazing lease and grazing preference may be cancelled in whole (DIRS 179560-BLM 2001, pp. LND-7 and 8).

- Livestock permits would be adjusted, if necessary, to reflect decreases in public land forage available for livestock grazing use within an allotment as a result of land tenure adjustments (DIRS 179560-BLM 2001, p. LND-8).
- Applicants for major rights-of-way shall submit a plan of development prior to issuance of a land-use authorization that addresses specific construction, operation, maintenance, or termination features that will satisfactorily mitigate the impacts (DIRS 179560-BLM 2001, p. LND-8).

- Corridors
  - Provide for an east-west and north-south network of right-of-way corridors in the Field Office area of jurisdiction (DIRS 179560-BLM 2001, p. ROW-1).
  - Designate 1,104 kilometers (686 miles) of rights-of-way, which include existing transmission lines, and identify 351 kilometers (218 miles) of planning corridors. All corridors are 3 kilometers (2 miles) wide and private lands are not included in these corridors (DIRS 179560-BLM 2001, p. ROW-1).
  - Within the Walker Resource Area, designate a corridor (C-F) following the existing major powerline from the Fort Churchill Power Plant to southern Nevada. Portions of this route also contain U.S. Highway 95, a railroad, telephone, and other power lines (DIRS 179560-BLM 2001, p. ROW-2).
  - Future right-of-way corridors will be evaluated on a case-by-case basis, but should be as consistent as possible with the Western Regional Corridor Study (DIRS 179560-BLM 2001, p. ROW-3).
  - Existing roads and trails will be used whenever possible during construction (DIRS 179560-BLM 2001, p. ROW-4).
- Access and recreation
  - All public lands under Carson City Field Office jurisdiction are designated open to off-highway vehicle use unless they are specifically restricted or closed. Off-highway vehicle use will be eliminated through or in the immediate vicinity of any surface-water source, such as a spring or seep; in any ***riparian*** area associated with meadows, marshes, springs, seeps, ponds, lakes, reservoirs or streams; in any channel bank or streambed of a ***perennial stream***; or in a threatened or endangered plant location (DIRS 179560-BLM 2001, p. REC-7).
  - Off-highway vehicle access is restricted to designated trails and roads on the west side of Walker Lake (DIRS 179560-BLM 2001, p. REC-3).
  - Special Recreation Management Area designation will be maintained for Walker Lake (DIRS 179560-BLM 2001, p. REC-5).
  - The following plans will be followed for recreation activities and planning: Walker Lake Recreation Management Plan (December 1979); and Recreation Project Plan for Walker Lake (April 1992) (DIRS 179560-BLM 2001, p. REC-8).
- Minerals and energy

  Public lands in the area of jurisdiction are open to mineral and energy development activity, although within the Walker Planning Area, about 45 square kilometers (11,000 acres) are either segregated against mineral entry under the Classification and Multiple Use Act or withdrawn from mineral entry by the formal withdrawal process (DIRS 179560-BLM 2001, p. MIN-1).

3.3.2.4.1.2 Tonopah Resource Management Plan. Located in south-central Nevada in Nye and Esmeralda Counties, the Tonopah Planning Area encompasses approximately 25,000 square kilometers (6.1 million acres) of public land and approximately 670 square kilometers (165,000 acres) of private land. Significant resources and program emphases include locatable minerals, livestock grazing, wild horses and burros, realty, cultural resources, and wildlife (DIRS 173224-BLM 1997, p. 1). Relevant land-use management objectives related to land and realty, corridors, and access are summarized below.

- Lands and realty
  - Discretionary disposal of approximately 274 square kilometers (68,000 acres) of public land (DIRS 173224-BLM 1997, p. 2). Approximately 91 square kilometers (230,000 acres) have been identified for potential disposal in the vicinity of the Goldfield, about 2 square kilometers (5,800 acres) have been identified for potential disposal near Scottys Junction, and approximately 160 square kilometers (39,000 acres) have been identified for potential disposal near Beatty (acreage based on GIS data) (DIRS 181617-Hopkins 2007, all).

    Mina common segment 1 would intersect two parcels designated for disposal at Coaldale Junction and one parcel at Blair Junction. Montezuma alternative segment 1 would intersect nine parcels designated for disposal near Silver Peak. Montezuma alternative segments 2 and 3 would intersect four parcels at Millers, and Montezuma alternative segment 2 would intersect six parcels at Goldfield.
- Corridors
  - Approximately 1,100 kilometers (670 miles) designated for transportation and utility corridors in the planning area (DIRS 173224-BLM 1997, p. 2).
  - Rights-of-way allowed (if compatible with values) on approximately 600 square kilometers (149,000 acres) (DIRS 173224-BLM 1997, p. 2). (There are no right-of-way exclusion areas within the Mina rail alignment region of influence.)
  - Designated right-of-way corridors within the planning area will be 5 kilometers (3 miles) wide except where there are topographic constraints. Grants for rights-of-way are still required for facilities placed within designated corridors. Designation of a corridor does not mean that future rights-of-way are restricted to corridors, nor does it mean that the BLM has committed to approving all right-of-way applications within corridors (DIRS 173224-BLM 1997, p. A-38).
- Access and recreation
  - Vehicles unrestricted on 77 percent of the planning area.
  - Vehicles limited to existing roads and trails in primitive and semi-primitive non-motorized and semi-primitive motorized areas.
  - Designates seven Special Recreation Management Areas (DIRS 173224-BLM 1997, p.2)

3.3.2.4.1.3 Las Vegas Resource Management Plan. The Las Vegas Resource Management Plan provides a comprehensive framework for managing approximately 13,000 square kilometers (3.3 million acres) of public lands in Clark County and the southern portion of Nye County administered by the BLM Las Vegas Field Office. Significant resources and program emphases in the plan include threatened and ***endangered species***; land disposal actions; wilderness management; wildlife habitat; special status species; riparian areas; forestry and vegetative products; livestock grazing; wild horses and burros; land acquisition priorities; rights-of-way; cultural resources; hazardous materials management; recreation; utility corridors; and minerals (DIRS 176043-BLM 1998, p. 2). Relevant land-use management objectives related to land and realty, corridors, and access are summarized below (DIRS 176043-BLM 1998, Appendix A, pp. 16-18).

- Land and realty
  - Dispose of approximately 710 square kilometers (175,000 acres) of public lands through sale, exchange or recreation and public-purpose patent to provide for the orderly expansion and development of southern Nevada.
  - All public lands within the planning area, unless otherwise classified, segregated or withdrawn, and with the exception of Areas of Critical Environmental Concern and ***Wilderness Study Areas***, are available for land-use leases and permits at the discretion of the BLM.
  - Terminate or modify any unused, outdated, or unnecessary classifications/segregations and withdrawals on public lands to reduce the area of segregation in the plan area.
  - Acquire private lands to enhance the recovery of special status species, protect valuable resources, and facilitate the management of adjacent BLM lands.
- Corridors

  All Areas of Critical Environmental Concern and all lands within 0.4 kilometer (0.25 mile) of significant caves, exclusive of any designated corridors, are designated as right-of-way avoidance areas. (There are no Areas of Critical Environmental Concern within the Mina rail alignment region of influence; the closest area is 135 kilometers [84 miles] south of common segment 6.)
- Access and recreation
  - Ensure that a wide range of recreation opportunities are available for recreation users in concert with protecting the natural resources on public lands that attract users.
  - Provide opportunities for off-road vehicle use while protecting wildlife habitat, cultural resources, hydrological and soil resources, non-motorized recreation opportunities, natural and aesthetic values, and other uses of the public land.

The Las Vegas Proposed Resource Management Plan/Final Environmental Impact Statement briefly mentions the Yucca Mountain Project in sections titled "Income and Employment" and "Social Setting, Attitudes, and Values." In the Income and Employment section the document notes that there could be population growth in Amargosa Valley as a result of construction and operation of the Yucca Mountain Project. In the Social Setting, Attitudes, and Values section the document notes that people residing in Las Vegas (urbanites) expressed a higher concern than people residing in rural locations about wildlife and ***ecosystem*** values when recording their ***risk*** assessment for the proposed Yucca Mountain Project in a 1995 social research survey conducted by the University of Nevada Las Vegas (DIRS 176043-BLM 1998, pp. 3-81 and 3-82).

3.3.2.4.1.4 Project-Related Public Land Withdrawals. The BLM announced Public Land Order 7653 on December 28, 2005 (70 *Federal Register* [*FR*] 76854). The Order withdrew 1,249 square kilometers (308,600 acres) of public lands within the Caliente rail corridor from surface and mining entry for 10 years to allow DOE to evaluate the lands for the potential construction, operation, and maintenance of the proposed railroad to Yucca Mountain. The withdrawal applies only to BLM-administered public lands. The withdrawal area extends approximately 0.8 kilometer (0.5 mile) from either side of the centerline of the proposed rail alignment. The actions covered by this withdrawal meet the BLM definition of ***casual use*** as set forth in 43 Code of Federal Regulations (CFR) 2801.5. On January 10, 2007, the BLM announced that DOE had filed an application requesting a second land withdrawal (72 *FR* 1235). The Department filed the application to cover post-scoping changes in the Caliente rail alignment and to address the addition of the Mina rail alignment. The application requested the withdrawal of an additional 842 square kilometers (208,037 acres) of public lands from surface and mineral entry and the location of new mining claims through December 27, 2015, so DOE could evaluate the lands for the potential construction, operation, and maintenance of a railroad to Yucca Mountain. Chapter 6 of this EIS includes detailed information about the land withdrawal process.

The BLM granted DOE a right-of-way reservation (N-47748) for Yucca Mountain ***site characterization*** activities (DIRS 102218-BLM 1988, all). This reservation comprises 210 square kilometers (52,000 acres). The land in this reservation is open to public use, with the exception of about 20 square kilometers (5,000 acres) near the site of the proposed repository that were withdrawn in 1990 from the mining and mineral leasing laws to protect the physical integrity of the repository block. The lands in this reservation not withdrawn from the mining and mineral leasing laws contain a number of ***unpatented mining claims*** (DIRS 155970-DOE 2002, p. 3-9). This existing right-of-way reservation would be the basis for the planned land withdrawal for the Yucca Mountain Site, as described in the *Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1), where the land would transfer from BLM administrative responsibility to DOE control.

Withdrawal: Withholding an area of federal land from settlement, sale, location, or surface entry under some or all of the general land laws, for the purpose of limiting activities under those laws to maintain other public values in the area or reserving the area for a particular public purpose or program.

Casual use: Activities ordinarily resulting in no or negligible disturbance of the public lands, resources, or improvements. Examples of casual use include surveying, marking routes, and collecting data to use to prepare grant applications.

Right-of-way: The public lands the BLM authorizes a holder to use or occupy under a grant.

Grant: Any authorization or instrument (for example, easement, lease, license, or permit) the BLM issues under Title V of the Federal Land Policy and Management Act (43 U.S.C. 1761 *et seq*.).

Mineral Entry: The land is not available for the location of mining claims because the land has been withdrawn from the operation of the General Mining Law.

Surface Entry Closure: An action that would lead to the title of the land leaving the United States, including appropriation of any non-federal interest or claim (other than mining claims), land sales, any public land disposal action.

Sources: DIRS 176452-DOE 2005; 43 CFR 3809.5.

3.3.2.4.2 Department of Defense-Managed Land

3.3.2.4.2.1 Nevada Test and Training Range. The U.S. Department of Defense administers the Nevada Test and Training Range, which the U.S. Air Force uses for training. The Mina rail alignment would not cross onto the Nevada Test and Training Range. Detailed information about current and future uses of the Nevada Test and Training Range is available in the *Proposed Nevada Test and Training Range Resource and Management Plan and Final Environmental Impact Statement* (DIRS 178103-BLM 2003, all).

Most of the airspace above the Nevada Test and Training Range is "restricted" (DIRS 103472-USAF 1999, 3.1-2). Restricted airspace consists of areas where nonparticipating aircraft are subject to restriction during scheduled periods when hazardous activities are being performed. Restricted areas designated as joint use by the Federal Aviation Administration allow air traffic control to route nonparticipating aircraft through this airspace when it is not in use or when appropriate separation can be provided. Those areas not designated as joint use cannot be accessed by either non-participating civil or military aircraft at any time (DIRS 103472-USAF 1999, p. 3.1-3).

Restricted area R-4807A is designated joint use and land beneath it is comprised of an electronic battlefield with numerous tactical targets and manned electronic combat threat simulators. Portions of the Mina rail alignment that would be on land below R-4807A include portions of common segment 5; the

Oasis Valley alternative segments 1 and 2; and a portion of common segment 6 (DIRS 103472-USAF 1999, pp. 3.1-3, 3.1-4, and 3.1-6).

Restricted area R-4808S is controlled by DOE for Nevada Test Site activities and is designated joint use. The Federal Aviation Administration Los Angeles Air Route Traffic Control Center also uses R-4808S for civil aircraft overflights (DIRS 103472-USAF 1999, pp. 3.1-3, 3.1-4, and 3.1-6). A portion of common segment 6 would be on land below R-4808S as it approached the Yucca Mountain Site.

3.3.2.4.2.2 Hawthorne Army Depot. The Depot extends over approximately 600 square kilometers (150,000 acres). The northwest land area consists of approximately 180 square kilometers (45,000 acres) used primarily for military training. The industrial, administration, and housing area is centrally located and consists of about 1.3 square kilometers (330 acres). The remaining acreage (approximately 400 square kilometers [102,000 acres]) consists of active military storage and ordnance demilitarization areas (DIRS 181899-Hawthorne Army Depot, p. v). The active military areas consist of unimproved areas that service the magazine and warehouse, and areas used for rifle ranges, test ranges, and open burn/open detonation areas. These areas are surrounded by a large buffer zone of unimproved land, and on the northeast side, by Walker Lake.

There are two mining claims within the Depot. Mining activities are highly regulated, and claim holders are required to provide advance coordination of work on the claims and must be escorted at all times. The mines are not being mined and claim holders obtain access only to make minimal improvements required to continue the claims' active status (DIRS 181899-Hawthorne Army Depot, pp. vi and vii).

At present, there are no agricultural outleases and livestock grazing is prohibited because of mission security issues, environmental considerations, and the need for strict water-quality controls (DIRS 181899-Hawthorne Army Depot, p. 2-8). There are recreational areas on Mount Grant and at Walker Lake. The Depot maintains a line of security buoys across the lake to restrict access from the lake to the south shore (DIRS 181899-Hawthorne Army Depot, pp. 2-7 and 2-16).

The Union Pacific Railroad has a trackage rights agreement with the Department of Defense to operate trains from the Fort Churchill Siding across the Walker River Paiute Reservation to the Thorne Siding at the Depot on Department of Defense track. The Thorne Siding receives approximately one train a month (DIRS 180222-BSC 2006, p. 28).

DOE would construct approximately 11.5 kilometers (7 miles) of new rail line (Mina common segment 1) within the active military area of the Depot. The Department would also construct a Staging Yard, which would occupy 0.20 square kilometer (50 acres) of land on the Depot, north of the existing rail line.

3.3.2.4.3 DOE-Managed Land, Nevada Test Site

Portions of common segment 6 and some railroad operations facilities would be on Nevada Test Site land (see Figure 3-142), which DOE administers. Detailed information about current and future uses of the Nevada Test Site is available in *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 101811-DOE 1996, all). As discussed previously, land that makes up the proposed Yucca Mountain Site would be withdrawn and transferred to DOE control. Currently, a Memorandum of Agreement between the DOE National Nuclear Security Administration and the Office of Civilian Radioactive Waste Management allows the use of about 235 square kilometers (58,000 acres) on the Nevada Test Site for Yucca Mountain Project activities.

3.3.2.5 General Environmental Setting and Land-Use Characteristics

Major public land uses along the Mina rail alignment include grazing, mineral and energy extraction, and recreation. The rail alignment would cross numerous public roads and trails that provide access to public and private land and would cross BLM-authorized rights-of-way for utilities.

3.3.2.5.1 BLM Grazing Allotments

The Taylor Grazing Act of 1934 (43 U.S.C. 315-3160), as amended, authorizes the Federal Government to issue permits for grazing livestock in grazing districts to settlers, residents, and other livestock owners for an annual payment of reasonable fees. An applicant who owns a base property or controls a water source may apply to the BLM for a lease or permit to use public lands for the grazing of livestock. The BLM grazing administration regulations (43 U.S.C. 4100.0-5) define a base property as land that has the capability to produce crops or forage that can be used to support authorized livestock for a specified period of the year, or water that is suitable for consumption by livestock and is available and accessible to livestock when the public lands are used for livestock grazing. The grazing allotments are leased or permitted for 10 years and may be renewed under specific circumstances.

Livestock permitted on grazing allotments include cattle, sheep, goats, horses, and burros. Cattle and sheep are the typical livestock grazed within the Mina rail alignment region of influence. The grazing lease or permit specifies the types and numbers of livestock based on the property acreage, the period of use, and the amount of use in ***animal unit months***. The intent of assigning animal unit months is to allow grazing on public lands without exceeding the capacity of the allotment to sustain livestock (43 CFR Part 4100).

Animal unit month: A standardized unit of measurement of the amount of forage necessary for the complete sustenance of one animal for 1 month; also, a unit of measurement of grazing privileges that represents the privilege of grazing one animal for 1 month (43 CFR Part 4100).

Depending on the combination of common segments and alternative segments, the Mina rail alignment and its support facilities would cross up to 12 active grazing allotments, and 3 inactive allotments (Columbus Salt Marsh, Montezuma, and one labeled Unused) (Figures 3-144 through 3-151). Tables 3-84 and 3-85 list information about grazing allotments within the Mina rail alignment region of influence. Access to a water source is an essential requirement for livestock grazing in the high ***desert*** of Nevada. In accordance with the Nevada State Water Law, the State Engineer in the Nevada Division of Water Resources may issue permits for water rights to applicants who can demonstrate a beneficial use for the water. Once permitted, water rights are treated as property rights and can be bought and sold (DIRS 178301-State of Nevada n.d., all). Because water rights greatly influence the uses and value of land in this generally ***arid*** region, any impacts to water rights could directly impact land use. (See Section 3.3.6 for a description of ***groundwater*** resources.)

It is essential to provide adequate water for livestock within reasonable distances of grazing areas. Stockwater is water that is physically diverted from the natural water course or storage of water for use by livestock or wildlife. There are several methods for developing stockwater, including spring developments; wells, ponds, or dugouts; and pipelines with a trough or tank for storage. Table 3-85 lists stockwater features within the Mina rail alignment region of influence.

3.3.2.5.2 Mineral and Energy Resources

3.3.2.5.2.1 Mineral Resources. Commercial prospecting for minerals of value began in southern Nevada in the mid-1800s and continues to the present. Minerals currently mined include metallic and nonmetallic minerals. Gold and silver are the most important metallic minerals.

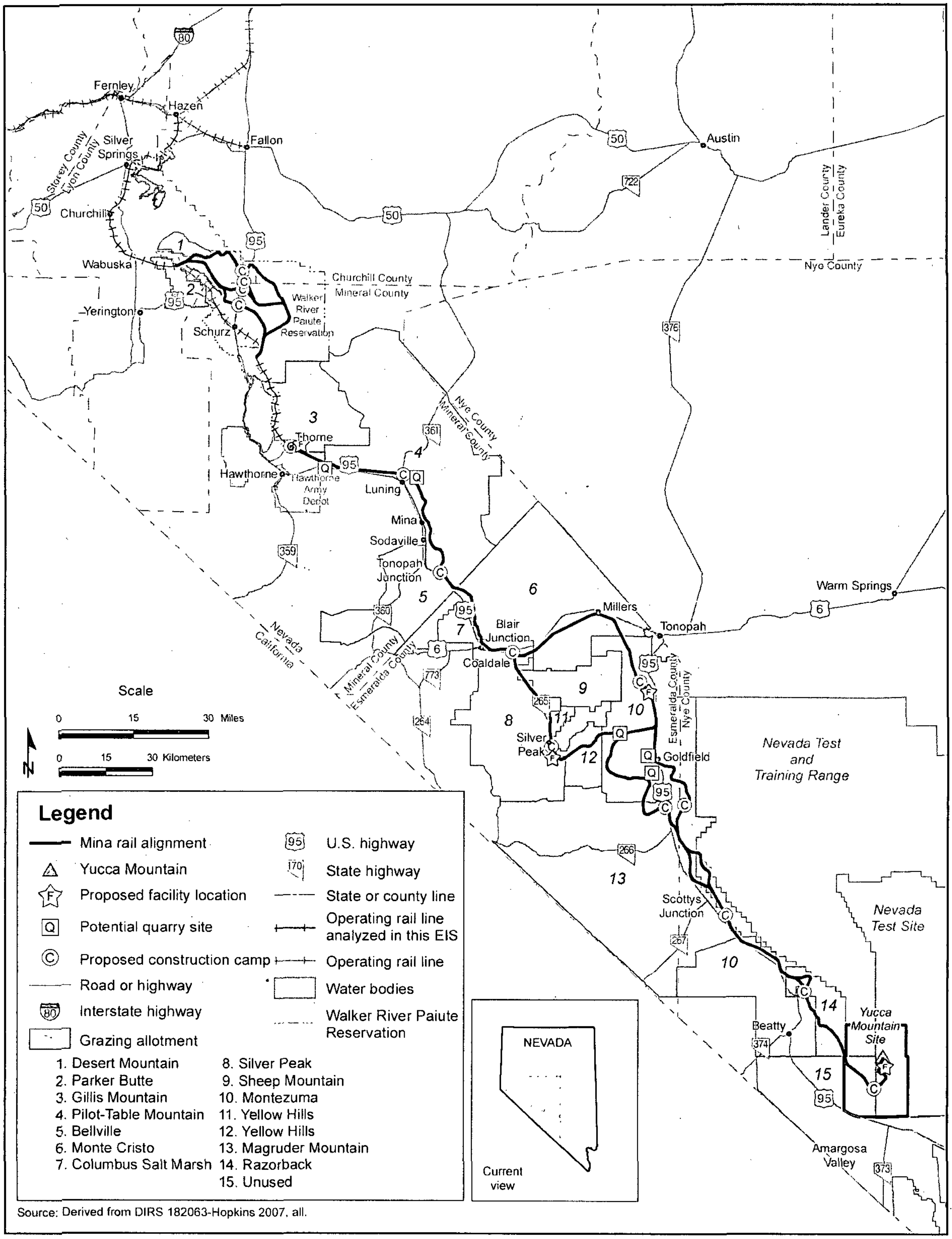


Figure 3-144. Grazing allotments along the Mina rail alignment.

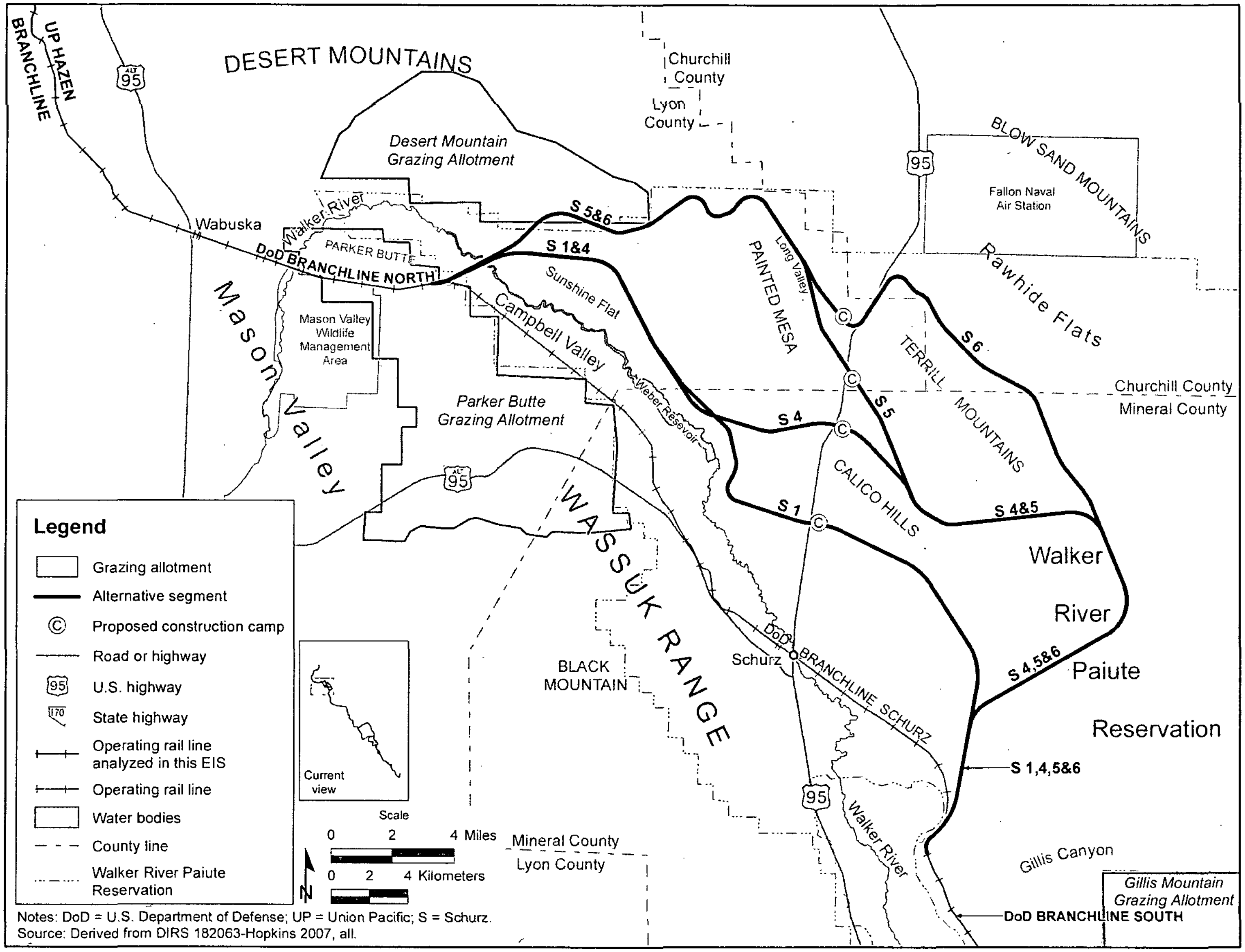


Figure 3-145. Grazing allotments with stockwater features within map area 1.

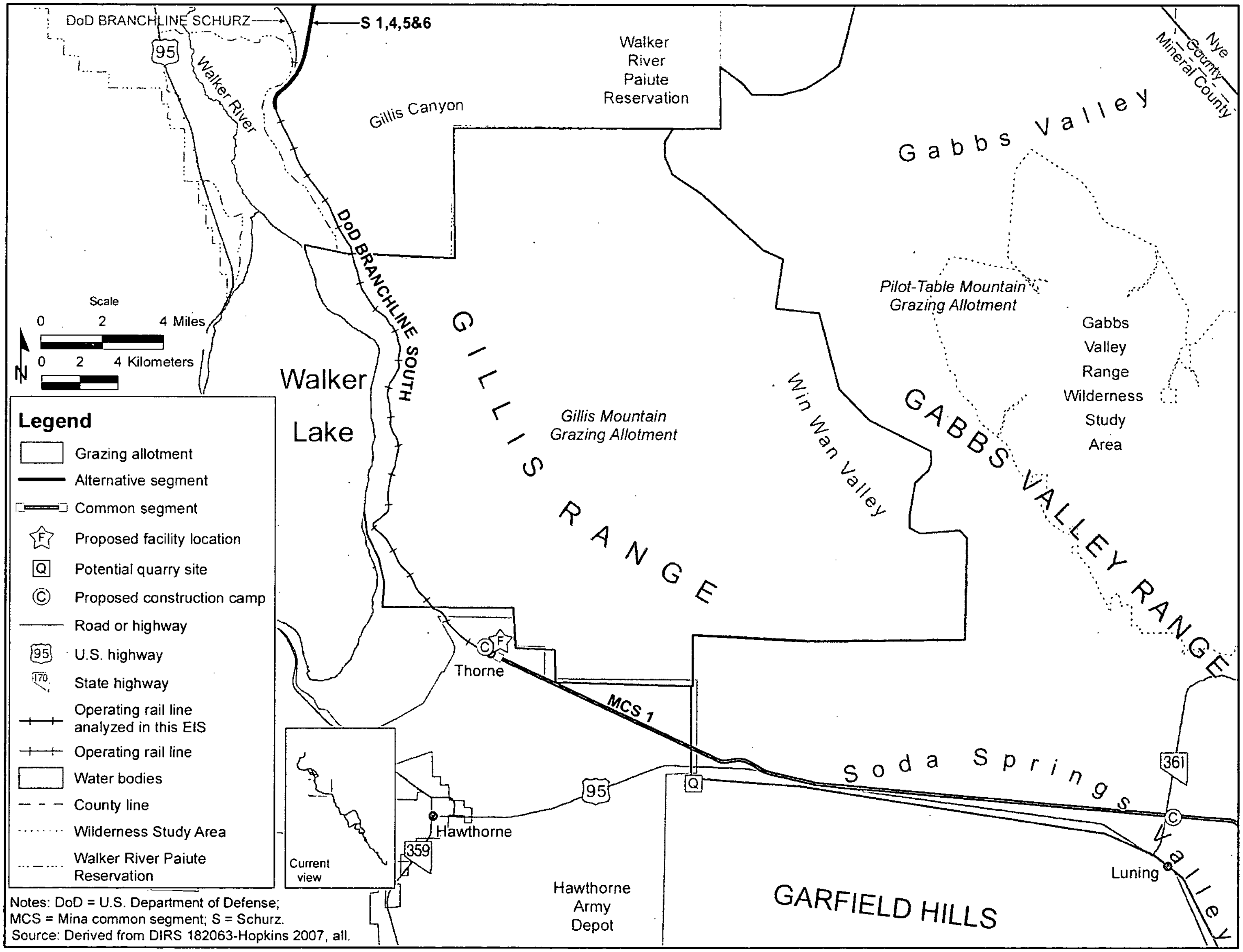
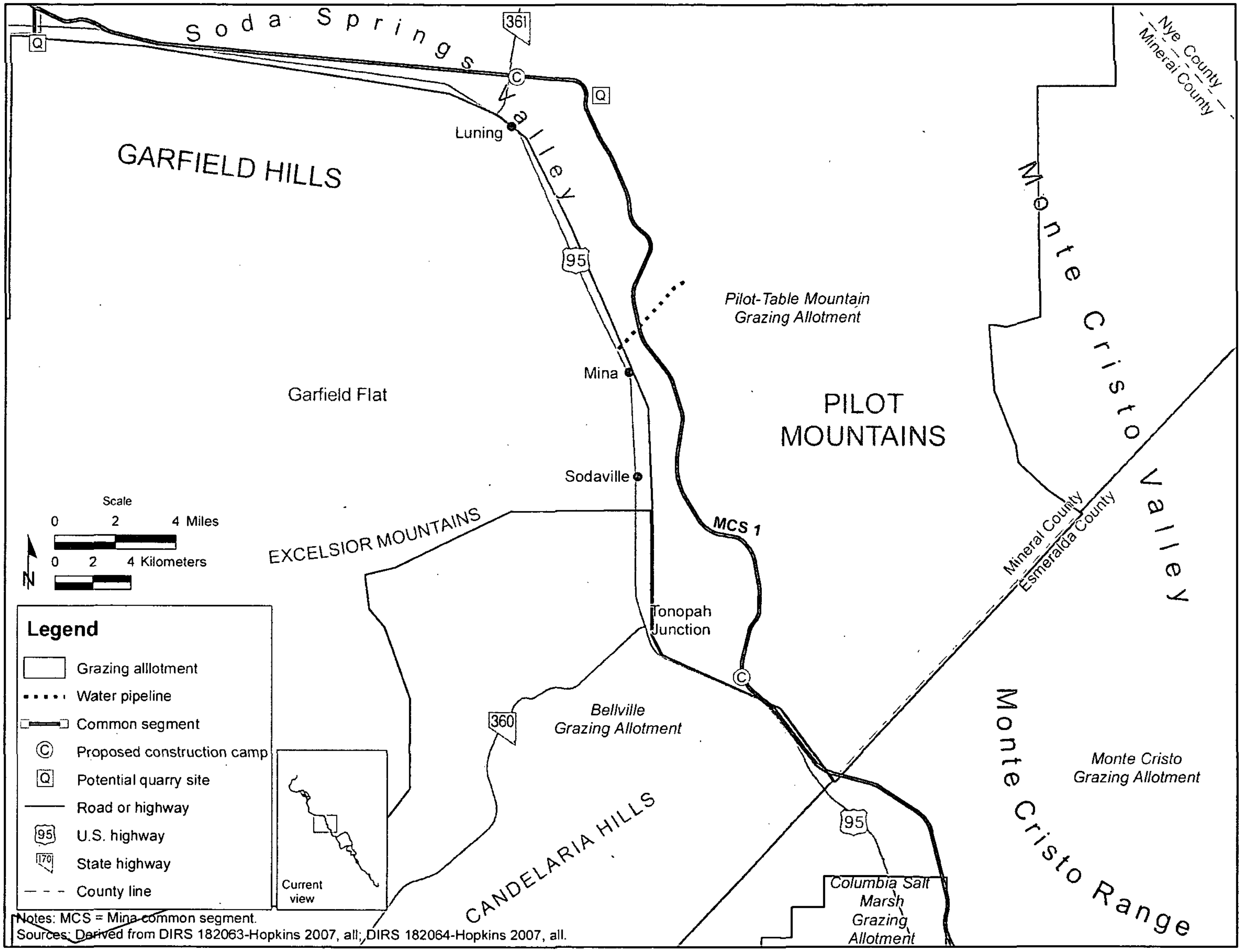


Figure 3-146. Grazing allotments with stockwater features within map area 2.



Notes: MCS = Mina common segment.
Sources: Derived from DIRS 182063-Hopkins 2007, all; DIRS 182064-Hopkins 2007, all.

Figure 3-147. Grazing allotments with stockwater features within map area 3.

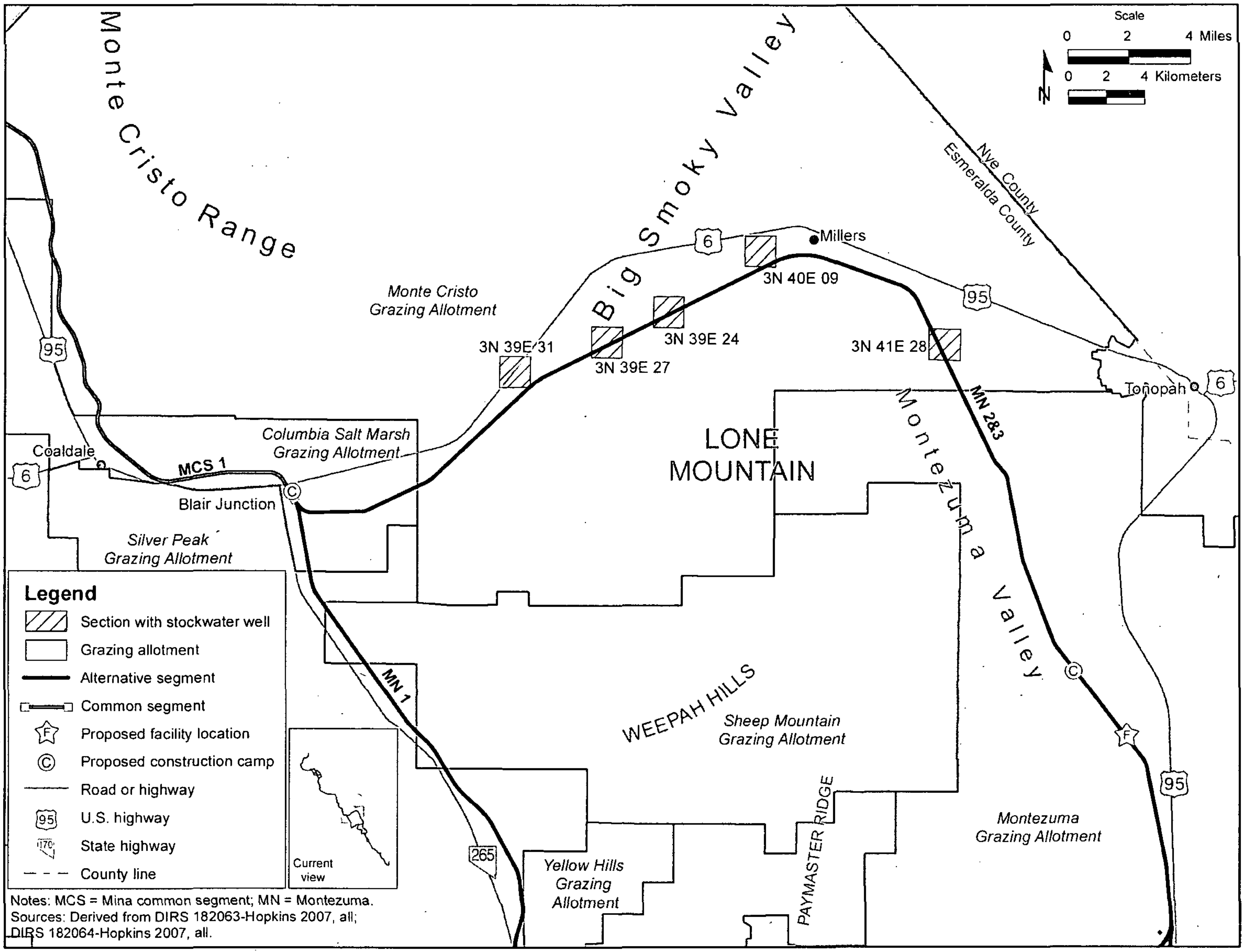


Figure 3-148. Grazing allotments with stockwater features within map area 4.

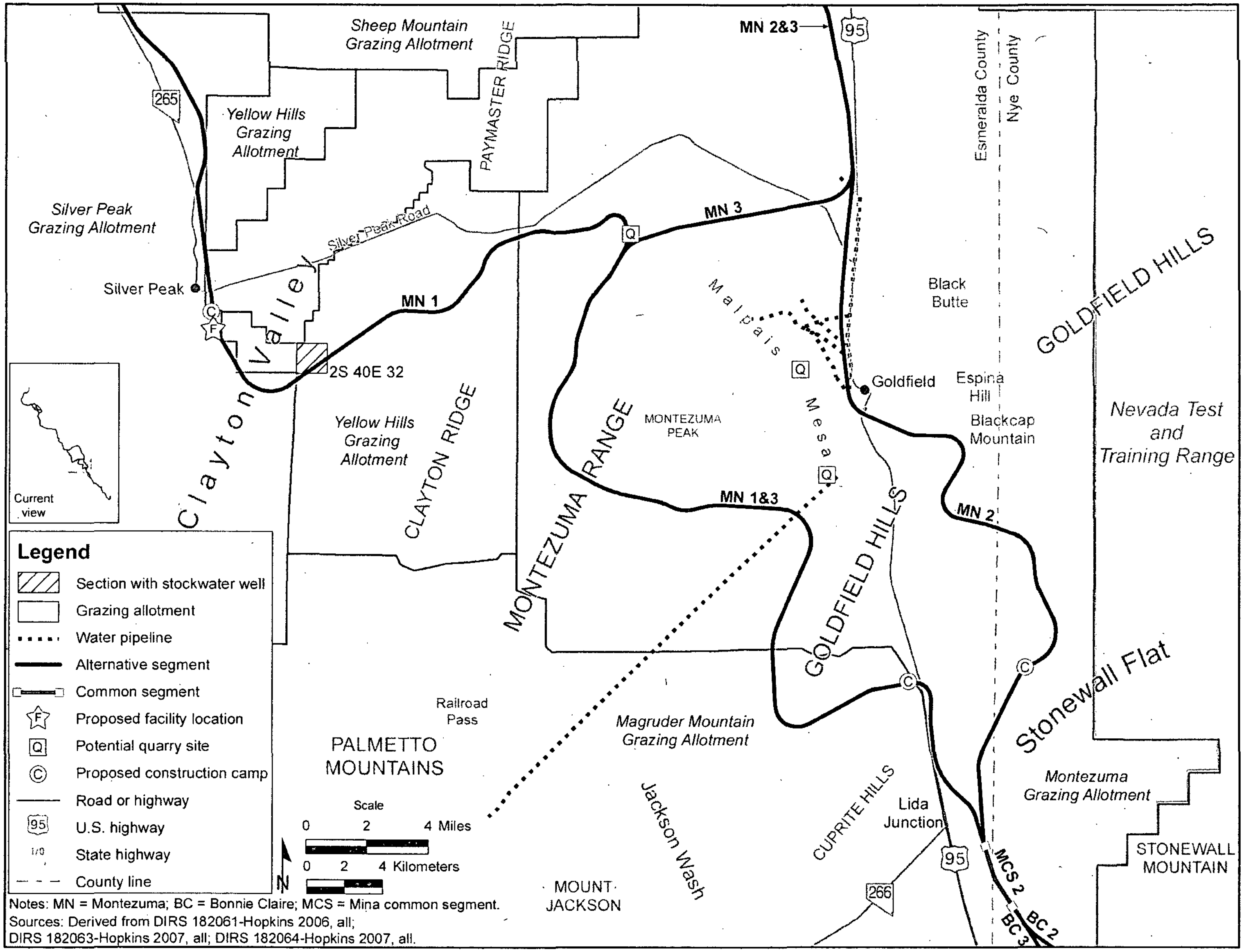


Figure 3-149. Grazing allotments with stockwater features within map area 5.

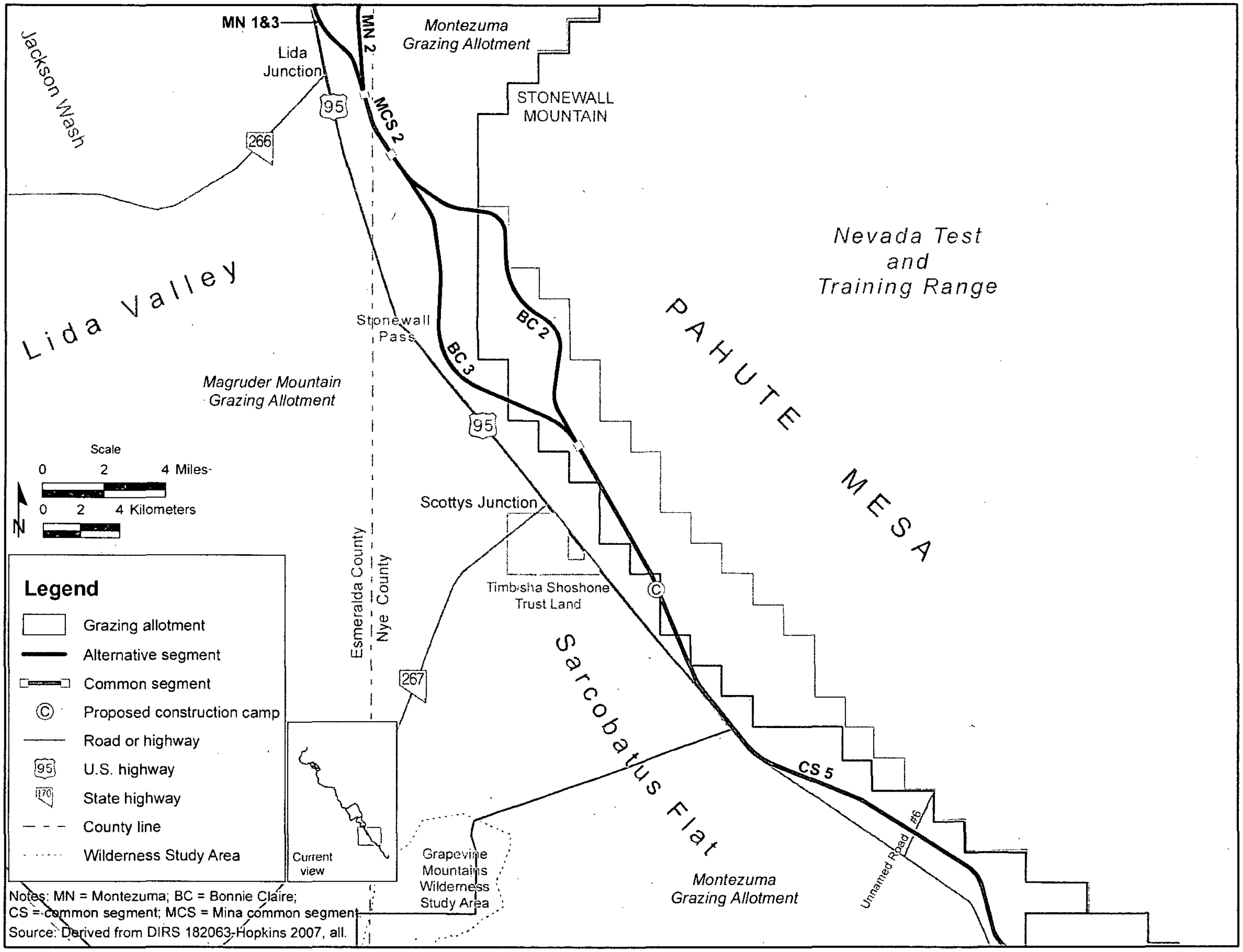
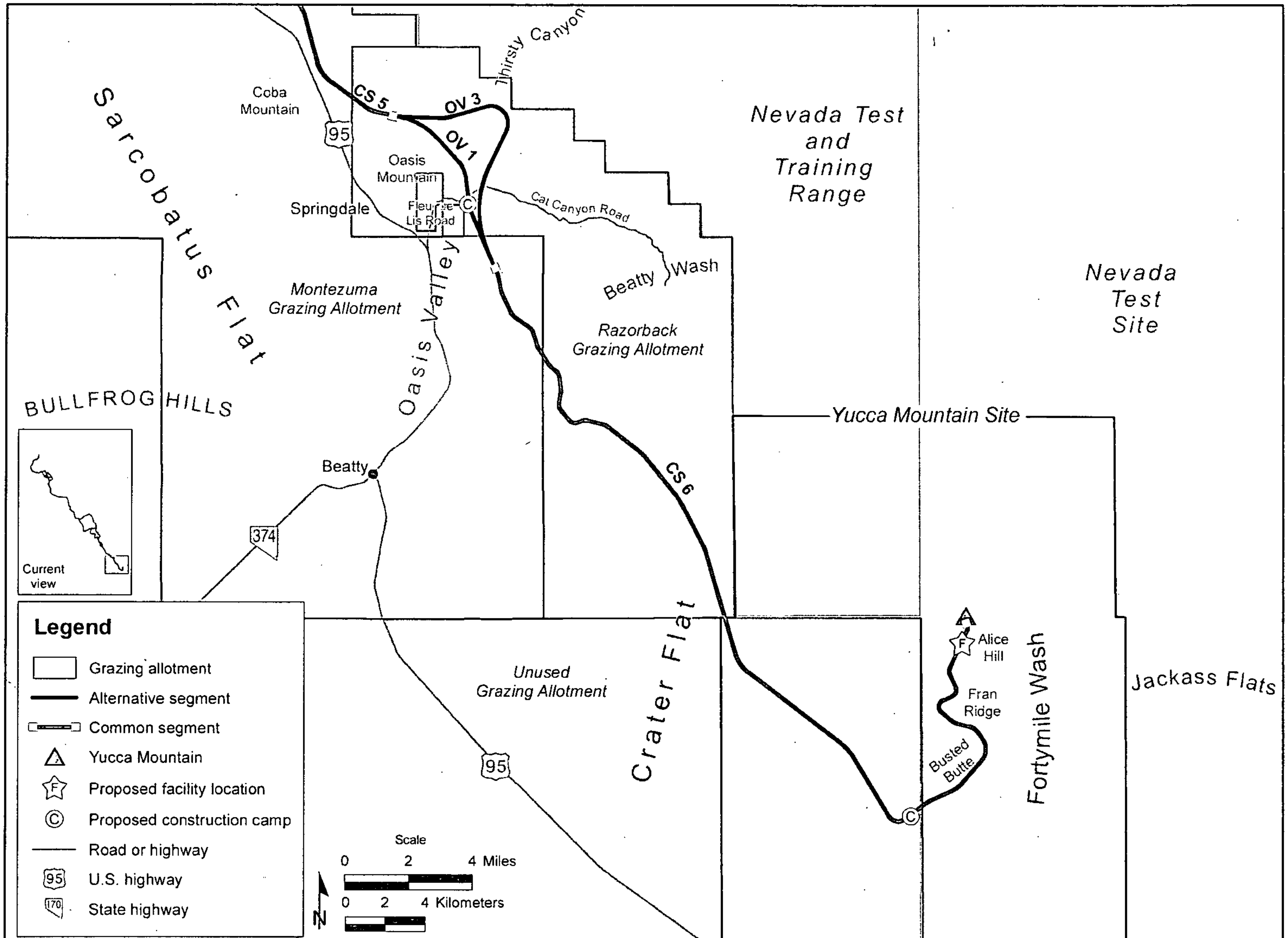


Figure 3-150. Grazing allotments with stockwater features within map area 6.



Notes: CS = common segment; OV = Oasis Valley.
Source: Derived from DIRS 182063-Hopkins 2007, all.

Figure 3-151. Grazing allotments with stockwater features within map area 7.

Table 3-84. Grazing allotment lands within the Mina rail alignment construction right-of-way (page 1 of 2).

Rail line segment/facility	Grazing allotment	Rail alignment crossing distance (kilometers)[a]	Area that would be within the construction right-of-way or disturbed (square kilometers)[b]
Union Pacific Railroad Hazen Branchline[c]	Not applicable		
Department of Defense Branchline North[d]	Not applicable		
Schurz alternative segment 1[e]	Parker Butte	0.6	0.2
Schurz alternative segment 4	Parker Butte	0.6	0.2
Schurz alternative segment 5	Parker Butte	0.6	0.2
Schurz alternative segment 5	Desert Mountain	3	0.74
Schurz alternative segment 6	Parker Butte	0.6	0.2
Schurz alternative segment 6	Desert Mountain	3	0.74
Department of Defense Branchline South[d]	Not applicable		
Staging Yard at Hawthorne	Gillis Mountain	f	0.25
Mina common segment 1	Pilot-Table Mountain	62	15
Mina common segment 1	Gillis Mountain	0.4	0.04
Mina common segment 1	Bellville	3.5	0.9
Mina common segment 1	Monte Cristo	14	6.3
Mina common segment 1	Columbus Salt Marsh	16	4.3
Potential Garfield Hills quarry	Garfield Flat	c	0.99
Potential Garfield Hills quarry	Pilot-Table Mountain	c	0.09
Potential Gabbs Range quarry	Pilot-Table Mountain	c	0.97
Montezuma alternative segment 1	Columbus Salt Marsh	3.9	23
Montezuma alternative segment 1	Silver Peak	28	8.1
Montezuma alternative segment 1	Sheep Mountain	6.2	1.9
Montezuma alternative segment 1	Yellow Hills	17	4.8
Montezuma alternative segment 1	Montezuma	51	14
Montezuma alternative segment 1	Magruder Mountain	12	3.5
Potential North Clayton quarry	Montezuma	c	1.8
Potential Malpais Mesa quarry	Montezuma	c	2.7
Potential Goldfield ES-7 quarry	Montezuma	c	1.5

Table 3-84. Grazing allotment lands within the Mina rail alignment construction right-of-way (page 2 of 2).

Rail line segment/facility	Grazing allotment	Rail alignment crossing distance (kilometers)[a]	Area that would be within the construction right-of-way or disturbed (square kilometers)[b]
Montezuma alternative segment 2	Columbus Salt Marsh	7.9	2.2
Montezuma alternative segment 2	Monte Cristo	34	10
Montezuma alternative segment 2	Montezuma	77	14
Montezuma alternative segment 3	Columbus Salt Marsh	7.9	2.2
Montezuma alternative segment 3	Monte Cristo	34	10
Montezuma alternative segment 3	Montezuma	87.8	26
Montezuma alternative segment 3	Magruder Mountain	12	3.5
Mina common segment 2	Montezuma	3.4	1.1
Bonnie Claire alternative segment 2	Montezuma	4.4	1.7
Bonnie Claire alternative segment 3	Montezuma	14	4.1
Common segment 5	Montezuma	28	7.9
Common segment 5	Razorback	2.3	0.71
Common segment 5	Magruder Mountain	2.9	0.24
Oasis Valley alternative segment 1	Razorback	7.9	1.9
Oasis Valley alternative segments 1 and 3	Razorback	1.3	0.4
Oasis Valley alternative segment 3	Razorback	12	3.4
Common segment 6	Razorback	18	5.4
Common segment 6	Montezuma	6.4	2.1
Common segment 6	Unused	15	4.7

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert square kilometers to acres, multiply by 247.10.
c. Use of the Union Pacific Hazen Branchline would not require new construction.
d. DOE would construct new sidings along Department of Defense Branchlines North and South within the existing rail line right-of-way; therefore DOE did not analyze these portions of the rail alignment. No other new construction would be required.
e. The Walker Paiute Reservation does not have BLM-administered grazing allotments.
f. Facility would not cross allotment; it would occupy the area listed in the next column.

Table 3-85. Features of grazing allotments within the Mina rail alignment region of influence.

Grazing allotment	Area (square kilometers)[a]	Animal unit months	Stockwater features that would be within the construction right-of-way
Parker Butte[b]	122	1,669	None
Desert Mountain[c]	91	840	None
Gillis Mountain[d]	650	1,924	None
Garfield Flat[e]	890	3,516	None
Pilot-Table Mountain[f]	2,070	7,900	Mina common segment 1 would cross one pipeline
Bellville[g]	630	303	None
Columbus Salt Marsh[h]	21		None
Monte Cristo[h]	2,010	9,352	Two stockwater wells along Montezuma alternative segments 2 and 3
Silver Peak[i]	1,430	436	None
Sheep Mountain[j]	360	1,740	None
Yellow Hills[k]	250	1,212	None
Magruder Mountain[l]	270	6,300	None
Montezuma[m]	2,180	--	Montezuma alternative segment 1 would cross one pipeline; Montezuma 2 would cross seven; Montezuma 3 would cross two
Razorback[m]	294.9	959	None
Unused[m]	2,130	---	None

a. To convert square kilometers to acres, multiply by 247.10.
b. Source: DIRS 181020-BLM 2007, all.
c. Source: DIRS 181023-BLM 2007, all.
d. Source: DIRS 180699-BLM 2007, all.
e. Source: DIRS 181024-BLM 2007, all.
f. Source: DIRS 181025-BLM 2007, all.
g. Source: DIRS 181026-BLM 2007, all.
h. Source: DIRS 182338-BLM 2007, all.
i. Source: DIRS 181027-BLM 2007, all.
j. Source: DIRS 181152-BLM 2007, all.
k. Source: DIRS 181029-BLM 2007, all.
l. Source: DIRS 181021-BLM 2007, all.
m. Source: DIRS 173224-BLM 1997, Appendix A (area of allotment might include private land).

Nonmetallic minerals include turquoise, decorative rock, perlite, opal, borate, limestone, clay, building stones, silica, aggregates, gypsum and salt used in industrial processes and building materials (DIRS 150524-Tingley 1998, all).

There is potential mining activity on private land (patented mining claims) and public land (unpatented mining claims). Figure 3-152 shows mining districts and areas near the Mina rail alignment. Figures 3-153 through 3-159 show the locations of sections with unpatented mining claims in relation to the construction right-of-way.

The Mina rail alignment would cross some ***mining areas*** and mining districts, as discussed below.

The Schurz alternative segment 1 construction right-of-way would pass through the very southern portion of the Calico Hills Mining District. Schurz alternative segment 4 would pass through the Calico Hills, Double Springs Marsh, and Buckley Mining Districts. Schurz alternative segment 5 would pass through the Benway, Calico Hills, Double Springs Marsh, and Buckley Mining Districts. Schurz alternative segment 6 would pass through the Holy Cross, Double Springs Marsh, and Buckley Mining Districts (see Table 3-86). These districts are described below.

- Calico Hills: This mining district coincides with the Calico Hills, which are 5 to 8 kilometers (3 to 5 miles) north and east of the Walker River on the Walker River Paiute Reservation, about 10 kilometers (6 miles) north of Schurz, Nevada. Prospecting began after 1956 and outlined a deposit, called the Hottentot prospect, estimated to contain 570,000 metric tons (625,000 tons) of iron and copper ore. However, this prospect has not been developed (DIRS 180882-Shannon &Wilson 2007, pp. 27 and 28).

- Double Springs Marsh: This mining district coincides with an elliptical playa about 13 kilometers (8 miles) east of Schurz, Nevada. The only mining activity on the playa occurred around 1898 when the Occidental Alkali Company produced considerable amounts of high-grade soda from saline crust on the playa surface (DIRS 180882-Shannon & Wilson 2007, pp. 31 and 32).

- Buckley: Very little is known about this mining district. Activity in the district dates from around 1906 and there was no mining activity reported in the district as of the late 1990s. Deposits in the district typically contain small amounts of gold, silver, and copper minerals (DIRS 180882-Shannon and Wilson 2007, pp. 33 and 34).

- Benway: This district is about 16 kilometers (10 miles) north of Schurz and 2 kilometers (1 mile) west of U.S. Highway 95 and lies entirely within the Walker River Paiute Reservation. Two types of ore deposits have been explored in this district – copper-silver-gold bearing quartz and calcite veins, and disseminated sulfide deposits. There are at least 10 veins containing gold, silver, and copper minerals that are as much as 6 meters (20 feet) wide and 2 kilometers long. Drilling at the disseminated sulfide deposits revealed extensive amounts of disseminated pyrite and only minor amounts of disseminated copper, lead, and zinc sulfides that were too deep or too low-grade to be of economic interest (DIRS 180882-Shannon & Wilson 2007, pp. 21 and 22).

- Holy Cross: Silver and gold were first discovered in the Holy Cross Mining District in 1910, on the Silver Star claim near what is now Camp Terrell. From 1911 to 1965, there was intermittent production of silver, gold, and other metals from mines in the southwest Holy Cross Mining District, and the Pyramid Mine in the Camp Terrell area operated for a short period in the 1980s. Although production was high in the past, the veins are narrow and the zones with ore grade are small and sparsely distributed. Therefore, it is doubtful if any of the small mines were profitable in the past and unlikely that enough ore remains undiscovered to make any of them profitable enough to reopen in the future (DIRS 180882-Shannon & Wilson 2007, pp. 18 and 19).

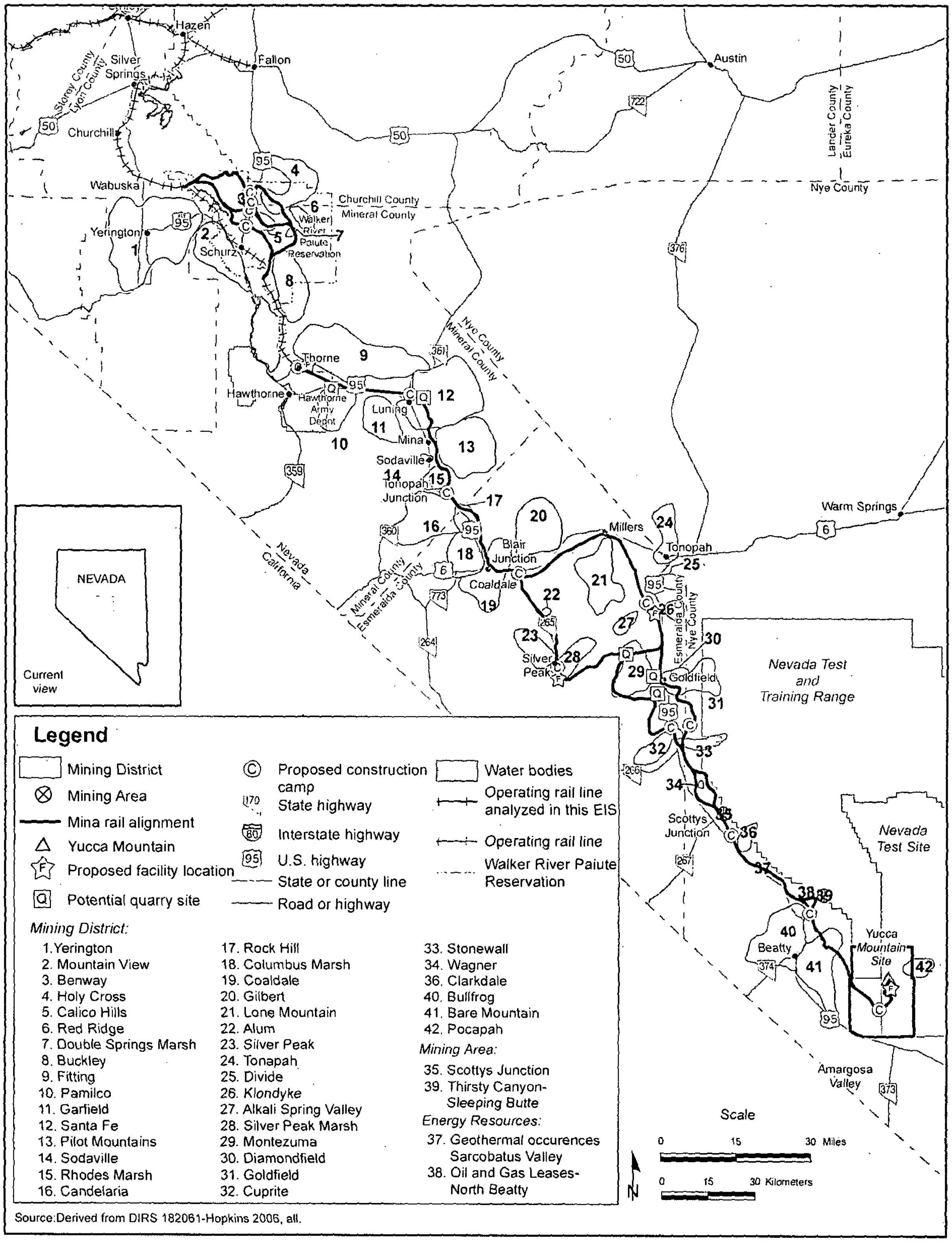
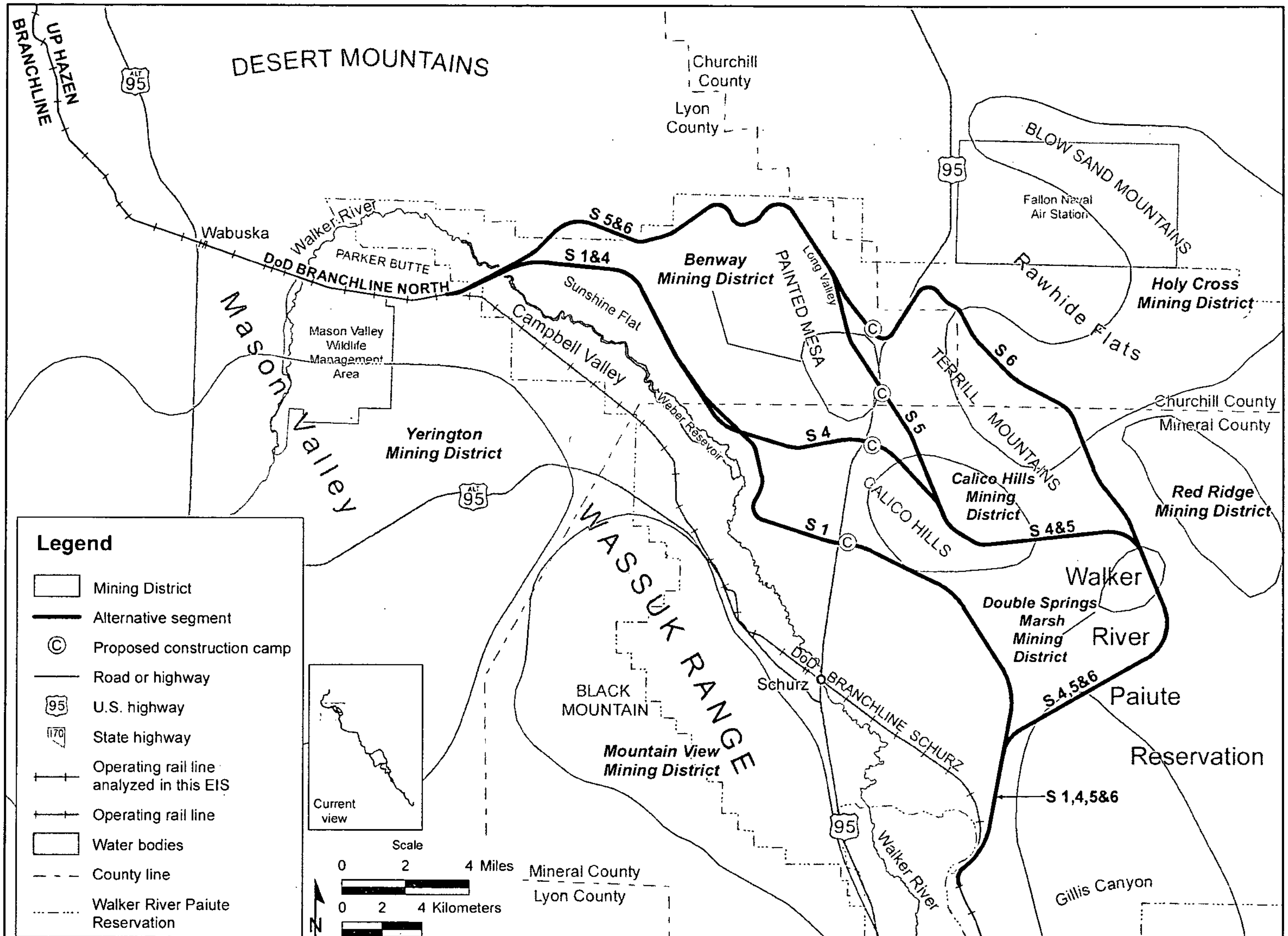


Figure 3-152. Mineral and energy resources along the Mina rail alignment.



Notes: DoD = U.S. Department of Defense; UP = Union Pacific; S = Schurz.
Sources: Derived from DIRS 182061-Hopkins 2006, all.

Figure 3-153. Mineral and energy resources within map area 1.

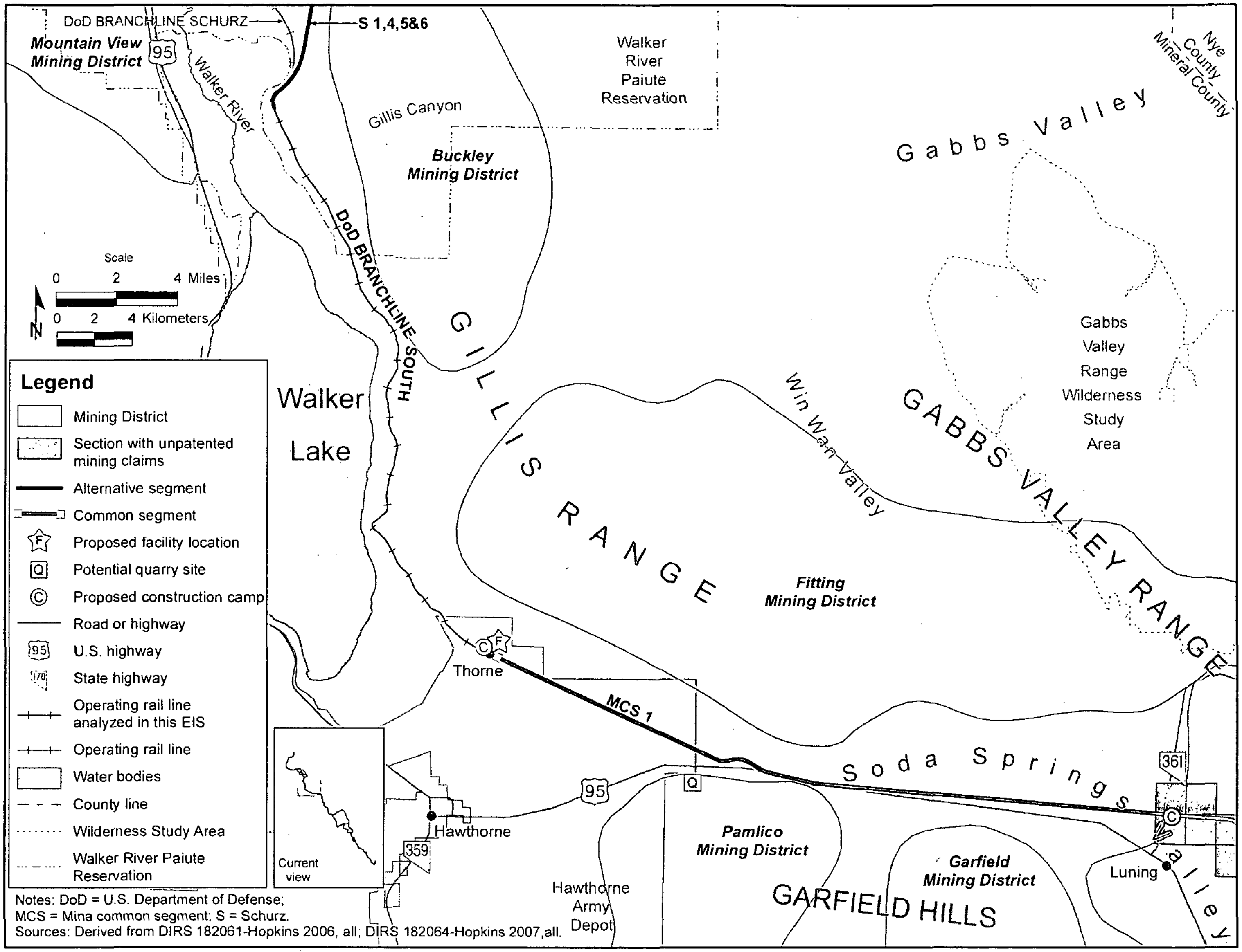


Figure 3-154. Mineral and energy resources within map area 2.

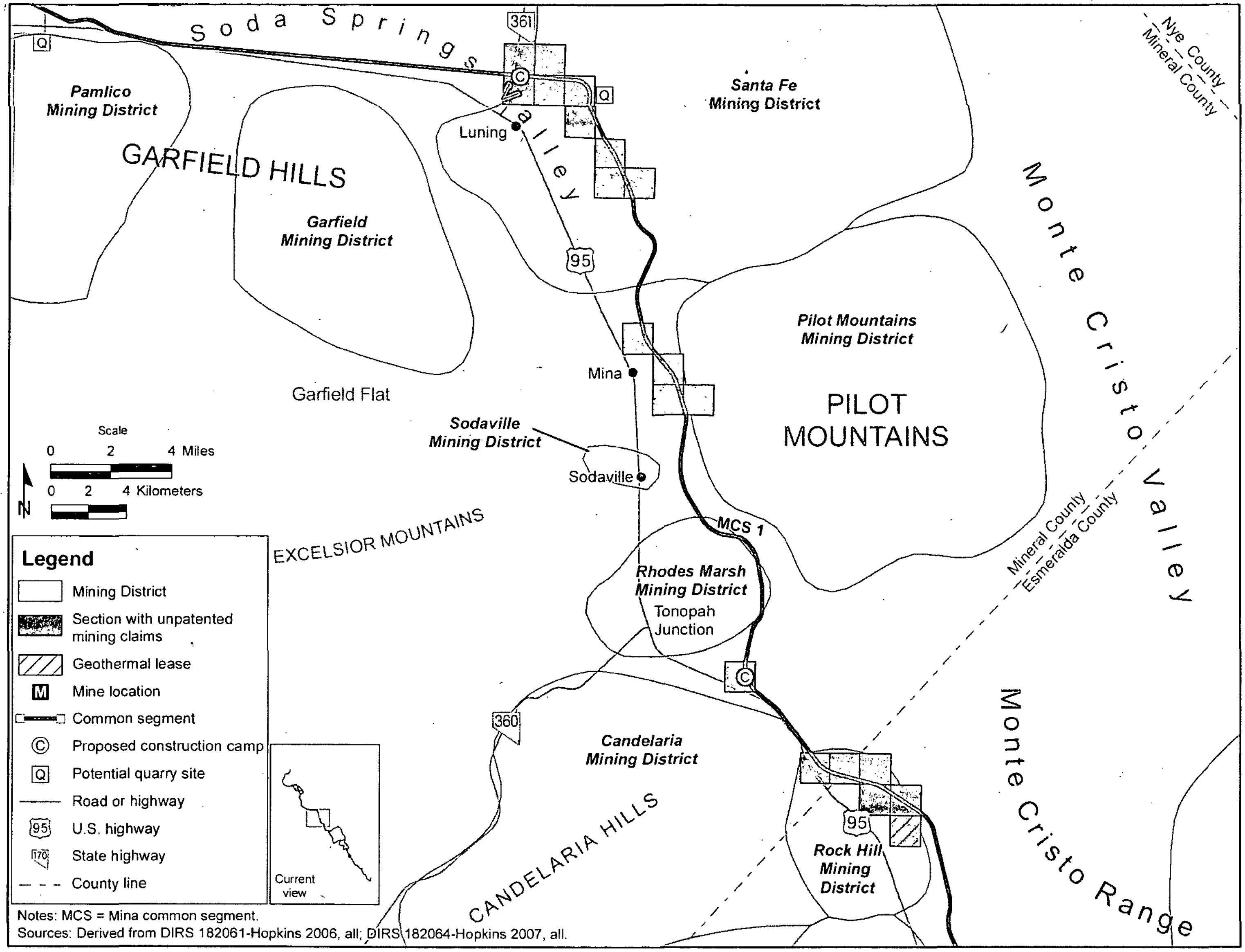


Figure 3-155. Mineral and energy resources within map area 3.

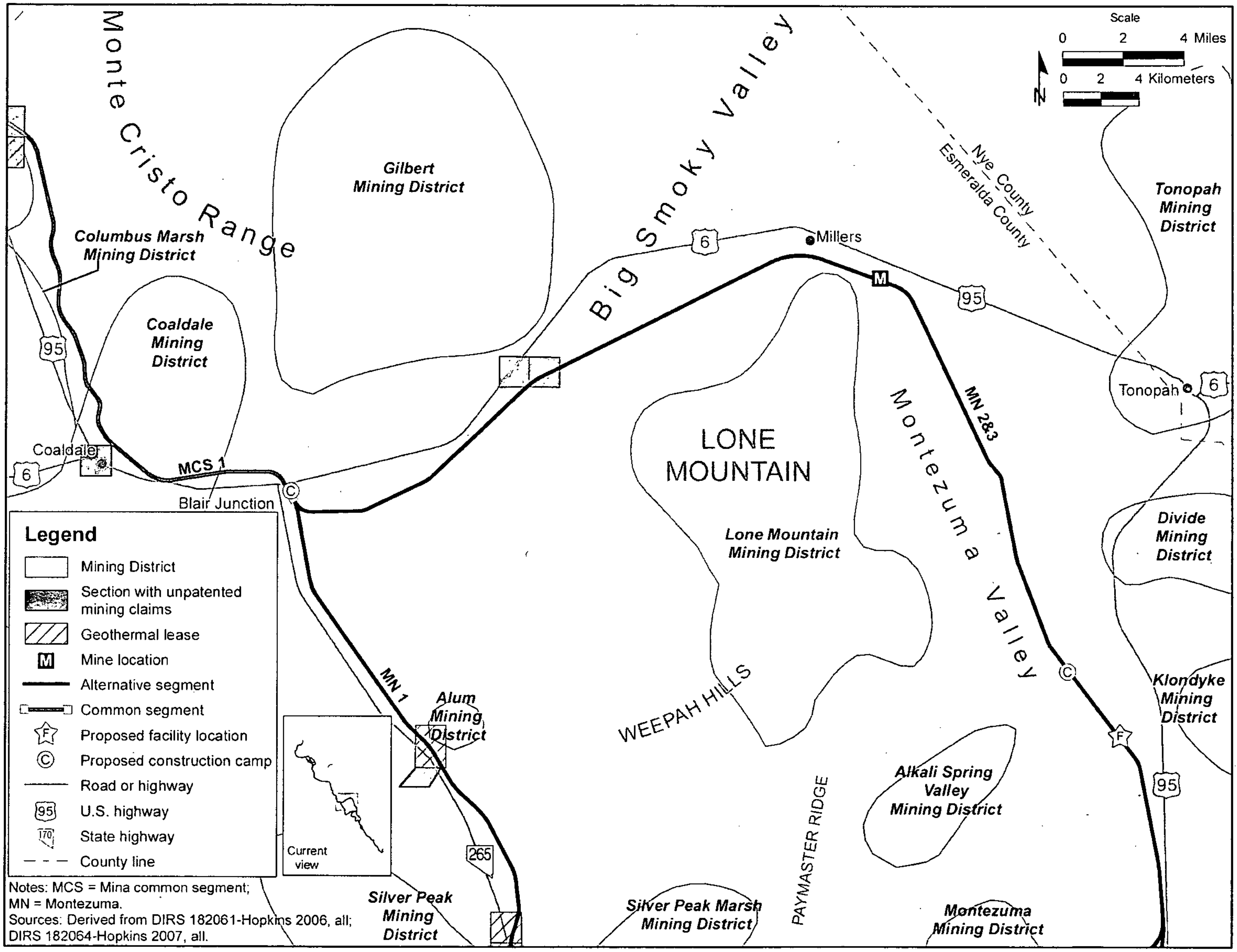


Figure 3-156. Mineral and energy resources within map area 4.

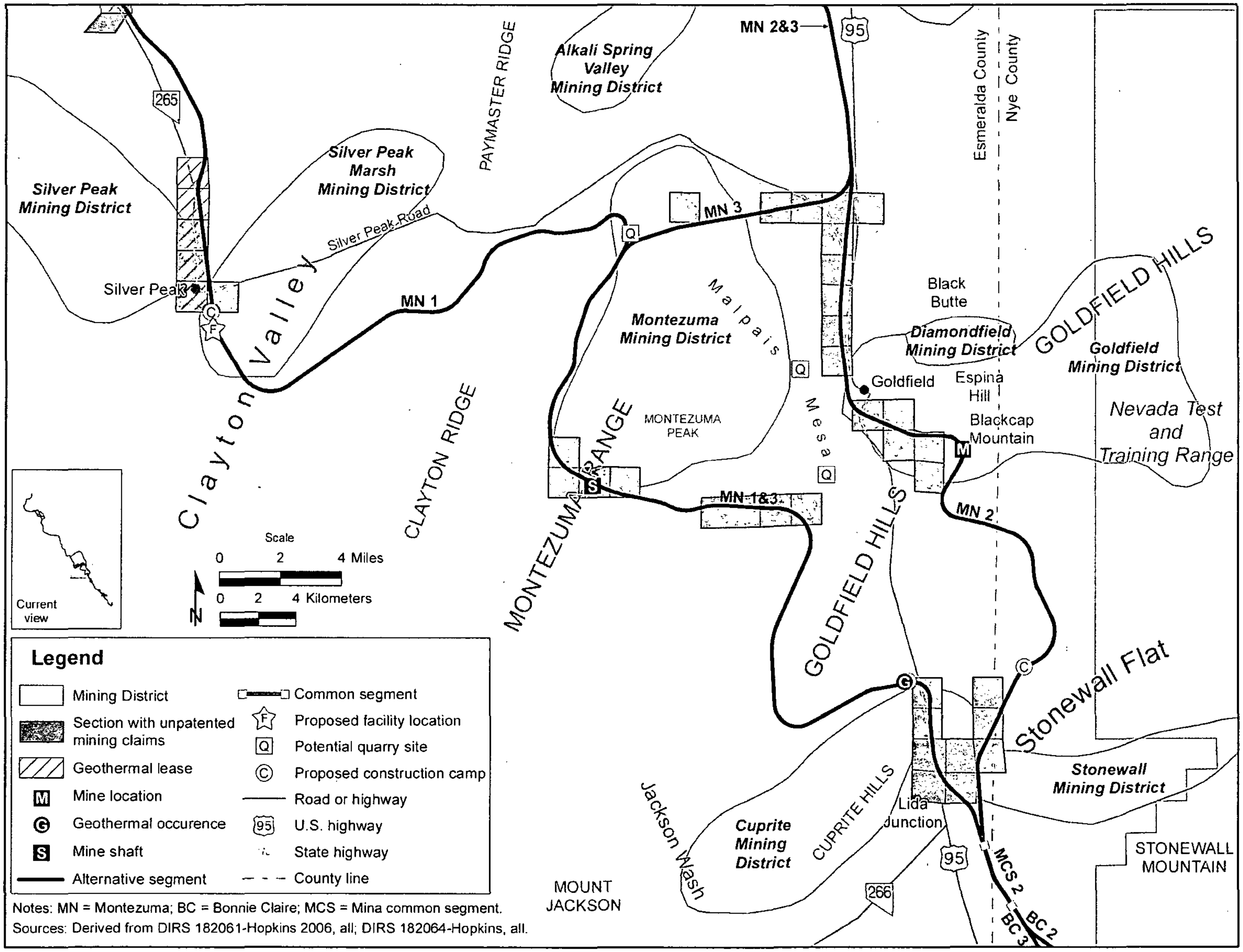


Figure 3-157. Mineral and energy resources within map area 5.

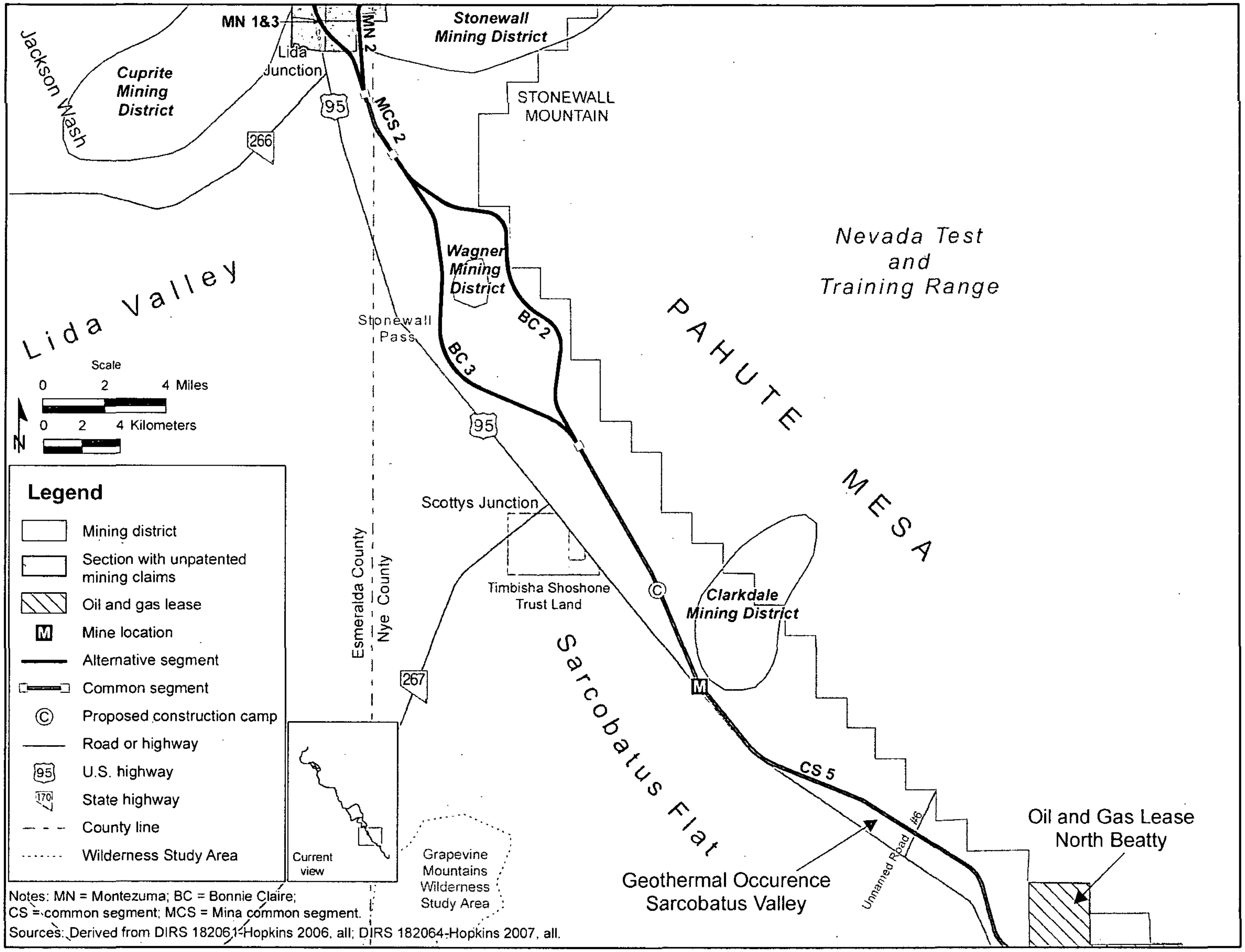


Figure 3-158. Mineral and energy resources within map area 6.

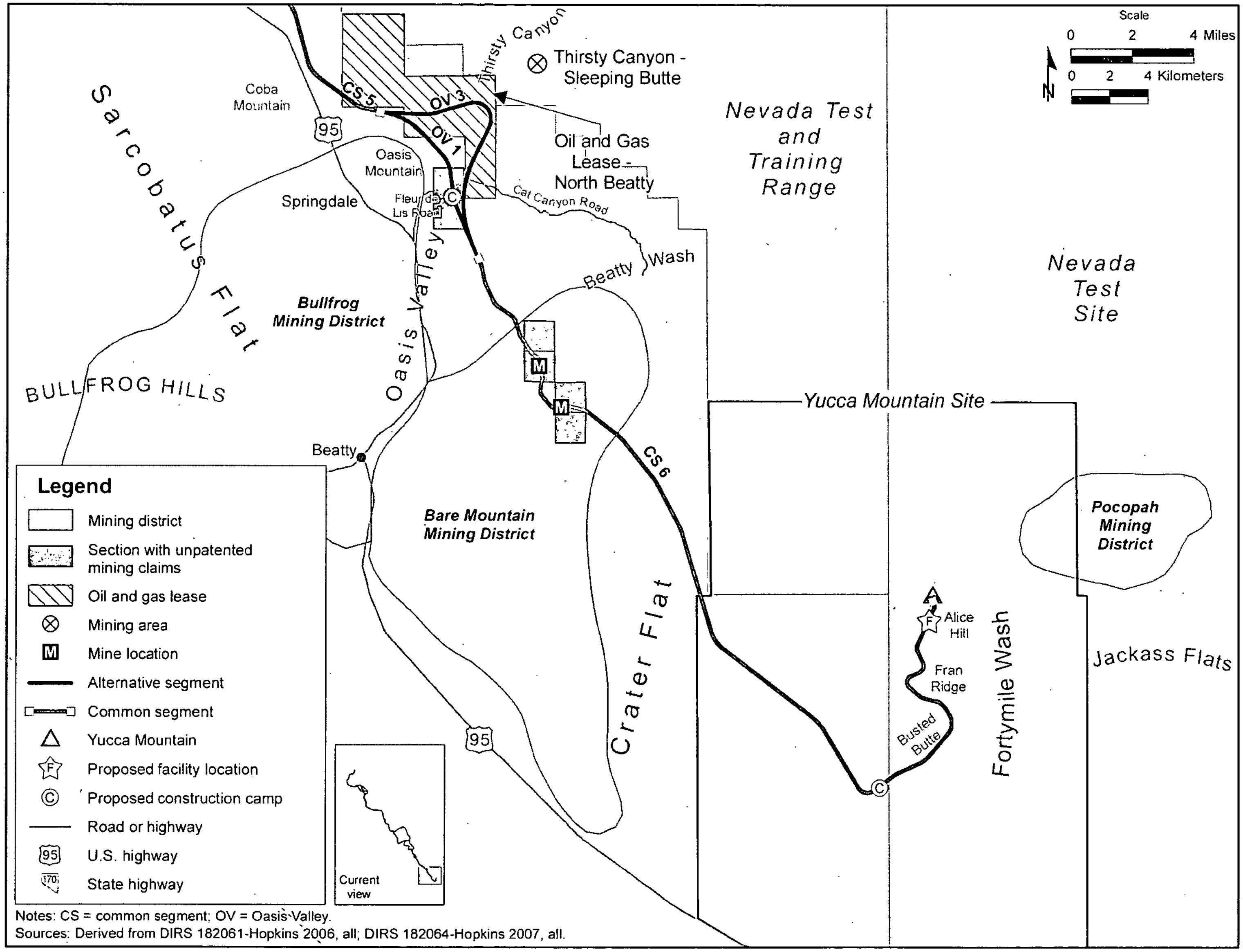


Figure -159. Mineral and energy resources within map area 7.

Table 3-86. Mining districts the Schurz alternative segments would cross.

Mining district	Schurz alternative segment 1	Schurz alternative segment 4	Schurz alternative segment 5	Schurz alternative segment 6
Calico Hills	X	X	X	
Double Springs Marsh		X	X	X
Buckley		X	X	X
Benway			X	
Holy Cross				X

Mina common segment 1 would pass through the Santa Fe, Rhodes Marsh, Rock Hill, and Coaldale Mining Districts. The construction right-of-way would also intersect the outermost boundaries of the Pilot Mountains and Candelaria Mining Districts. These districts are described below.

- Santa Fe: The Santa Fe Mining District is large and diverse geologically and mineralogically. From 1883 to 1894, the Santa Fe Mine produced primarily silver. From 1900 to 1929, copper-lead deposits containing silver were mined. From 1988 to 1995, the Santa Fe-Calavada mine produced over 10 million metric tons (12 million tons) of ore containing 10 million grams (356,700 ounces) of gold, 20 million grams (721,523 ounces) of silver, and an unknown amount of mercury. The New York Canyon area has major copper deposits. The Canyon Copper Company recently staked 550 mining claims and now controls 1,003 claims encompassing more than 81 square kilometers (20,000 acres) in the New York Canyon area, and the company reports that it is planning more exploration of the area in 2007. Nevada Sunrise LLC currently holds claims to the New Boston and Blue Ribbon mines, reported to contain scheelite, molybdenite, chalcopyrite, pyrite and fluorite, but the company's exploration plans are unknown (DIRS 180882-Shannon & Wilson 2007, pp. 40 to 43). Mina common segment 1 would bisect active mining claims and authorized or pending notice(s) of intent in the New York Canyon area east of Luning (DIRS 180882-Shannon & Wilson 2007, Table 1).
- Rock Hill: This mining district is 13 to 23 kilometers (8 to 14 miles) northwest of Coaldale. Mina common segment 1 would cross through the Redlich claim block in the northern part of the Rock Hill Mining District. The Miranda Gold Corporation is actively exploring this claim. Current exploration is focused on 122 lode claims near Redlich Summit that have geologic indicators for gold (DIRS 180882-Shannon & Wilson 2007, pp. 71 to 73).
- Coaldale: This district includes a clay mine (Blanco Mine) that is worked intermittently approximately 11 kilometers (6.7 miles) south-southwest of Mina common segment 1 (DIRS 180882-Shannon & Wilson 2007, pp. 75 and 76).
- Pilot Mountains: The Pilot Mountains Mining District covers the entirety of the Pilot Mountains and has been referred to alternatively as the Pilot or Sodaville Mining District. It includes all of the Telephone Canyon and Graham Springs Mining Districts. The primary commodities produced from this district are mercury and tungsten, with minor production or reported occurrences of gold, copper, silver, molybdenum, antimony, turquoise and montmorillonite. It appears that there has been no significant mining in this district since 1956 (DIRS 180882-Shannon & Wilson 2007, pp. 52 and 53).
- Rhodes Marsh: This district is 8 kilometers (5 miles) south of Mina, Nevada, and coincides with Rhodes Salt Marsh. This area has been known as a source of saline minerals since the 1860s and part of the area is covered by patented mining claims. Mina common segment 1 would follow the eastern edge of the district. There are no production records after 1934 for any minerals at Rhodes Marsh. Neither active mining nor evidence of recent exploratory activity was observed on the marsh during an October 2006 site visit (DIRS 180882-Shannon & Wilson 2007, pp. 58 and 59).

- Candelaria: This district is in the Candelaria Hills and is bordered on the north by Rhodes Marsh and on the east by Rock Hill. From 1873 to 1996, the district produced 4 million grams (167,200 ounces) of gold, 18.1 million grams (63 million ounces) of silver, 32 million grams (72,000 pounds) of copper, 18.9 million grams (4.16 million pounds) of lead, and 10.2 million grams (2.26 million pounds) of zinc. Mina common segment 1 would pass more than 8 kilometers (5 miles) from major historic and recent mining areas in the district and would be generally separated from the district by U.S. Highway 95 (DIRS 180882-Shannon & Wilson 2007, pp. 61 and 62, and Table 1).

Montezuma alternative segment 1 would pass through the Silver Peak Marsh, Montezuma, and Cuprite Mining Districts. Montezuma alternative segment 2 would pass through the Goldfield and Stonewall Mining Districts. Montezuma alternative segment 3 would pass through Montezuma and Cuprite Mining Districts (see Table 3-87). These districts are described below:

- Silver Peak Marsh: This district is entirely in Esmeralda County and is alternatively known as the Clayton Valley Mining District. Lithium, sylvite, and halite are the only commodities the district produces, but there are reported occurrences of halite, borates, and potash. At present, this district is the only domestic source of lithium. The Chemetall Foote Corporation and its predecessor companies have produced lithium, sylvite, and halite from this district since 1966 and production is ongoing (DIRS 180882-Shannon & Wilson 2007, pp. 94 to 96).
- Montezuma: This district covers the northern part of the Montezuma Range on and around Montezuma Peak in eastern Esmeralda County. Montezuma is primarily a silver-lead district, with minor production of gold and copper, and occurrences of mercury and bismuth. Historically, productive deposits have generally occurred in the western part of the district near the Montezuma townsite. The district was discovered in 1867 and the last production was reported as late as 1931 (DIRS 180882-Shannon & Wilson 2007, pp. 96 and 97).
- Cuprite: Coal was discovered in this district in 1893, which led to a series of unsuccessful attempts to mine coal and market it in the 1890s and early 1900s. During World War II, coal mining was revisited, but the coal was found to be too impure for commercial use and no production has been recorded since. Uranium and turquoise have also been discovered in the district, although there is no current production. Copper ore was discovered in this district in 1905. The Cuprite district is about 19 to 24 kilometers (12 to 15 miles) south of Goldfield, Nevada. There is evidence of recent mining claims and recent trenching and drilling at the northeastern portion of the district, west of U.S. Highway 95. There appears to be a relatively large geothermal system in the area. There is also a silica quarry in the district (DIRS 180882-Shannon & Wilson 2007, pp. 105 to 107). Goldfield: Goldfield is the largest center of mining in the region of influence. This mining district consists of the Goldfield Main, McMahon Ridge, and Gemfield areas, and is in the Goldfield Hills that lie to the northeast and southwest of Goldfield, Nevada. An additional area (referred to as the Tom Keane area) has been the subject of recent (2003) exploration efforts. The Goldfield Project consists of 385 patented and 849 unpatented claims covering more than 83 square kilometers (20,600 acres) in Esmeralda and Nye Counties. At present, one company has a large and active exploration program and is consolidating mining lands in and near Goldfield (DIRS 173841-Shannon & Wilson 2005, pp. 60, 62, and 72).
- Stonewall: Most of the past mining activity in this district is approximately 5 kilometers (3 miles) east of Montezuma alternative segment 2. This district was reportedly prospected for gold and silver as early as 1905 (DIRS 173841-Shannon & Wilson 2005, p. 56). Veins of gold and silver currently under exploration in this district are prominent at areas mined in the past and continue easterly away from the rail alignment.

Table 3-87. Mining districts the Montezuma alternative segments would cross.

Mining district	Montezuma alternative segment 1	Montezuma alternative segment 2	Montezuma alternative segment 3
Silver Peak Marsh	X		
Montezuma	X		X
Cuprite	X		X
Goldfield		X	
Stonewall		X	

Mina common segment 2 would not cross any mining districts.

The Bonnie Claire alternative segments would be west of the Scottys Junction Mining Area and the Wagner Mining District would lie between these segments. Neither segment's construction right-of-way would cross these mining locations. The Wagner Mining District has a number of patented mining claims, although none would fall within the construction right-of-way for either Bonnie Claire alternative segment. The main rock types within the Wagner Mining District are shale, quartzite, and intercalated limestone. There have been recent exploration efforts in this district by several companies (DIRS 173841-Shannon & Wilson 2005, p. 55).

The closest mining districts to common segment 5 would be Clarkdale Mining District to its east and Bullfrog Mining District to its south where it would meet the Oasis Valley alternative segments. The Oasis Valley alternative segments are between the Bullfrog Mining District and the Thirsty Canyon-Sleeping Butte Mining Area. The Clarkdale Mining District contains discontinuous, narrow zones containing some gold and silver mineralization (DIRS 173841-Shannon & Wilson 2005, p. 52). The Bullfrog Mining District contains small, localized areas of gold, silver, and lesser copper mineralization (DIRS 173841-Shannon & Wilson 2005, p. 46). The Thirsty Canyon-Sleeping Butte Mining Area has been historically quarried for decorative rock and building stone (DIRS 173841-Shannon & Wilson 2005, p. 49).

Common segment 6 would cross the northeastern portion of the Bare Mountain Mining District, although the vast majority of past mining activity occurred more than 3 kilometers (2 miles) south of this common segment. The district contains gold-bearing veins, and some veins contain silver. The district also contains a variety of minerals and semi-precious stones, including opal, chalcopyrite, malachite, azurite, galena, pyrite, limonite, hematite, fluorite, and gypsum (DIRS 173841-Shannon & Wilson 2005, pp. 38, 41, and 42).

The only patented mining claims that would fall within or intersect the Mina rail alignment construction right-of-way would be along the Montezuma alternative segment 2. Table 3-88 lists the number of sections containing unpatented mining the rail line construction right-of-way would cross.

The existence of abandoned or active mining tunnels and shafts near the rail alignment would also be a concern for safety reasons. There is one underground mine that would be within the Montezuma alternative segment 1 or 3 construction right-of-way, approximately 3 kilometers (2 miles) east of private land at Millers. There would be one tunnel/shaft within the Montezuma alternative segment 1 or 3 construction right-of-way and one tunnel/shaft within the Montezuma alternative segment 2 construction right-of-way in the Goldfield area, as shown in Figure 3-157. DOE obtained the data on locations of tunnels and caves, mining shafts, and underground mines from the Nevada Bureau of Mines and Geology (DIRS 180882-Shannon & Wilson 2007).

Table 3-88. Numbers of unpatented mining claims that may intersect the Mina rail alignment construction right-of-way.[a]

Rail line segment	Number of sections with unpatented mining claims[a]	Unpatented mining claims across all sections [b]
Mina common segment 1	20	388
Montezuma alternative segment 1	17	202
Montezuma alternative segment 2	24	655
Montezuma alternative segment 3	19	249

a. Source: DIRS 181617-Hopkins 2007.
b. Data are provided by Township, Range, and Section and might not fall within the rail line construction right-of-way. DOE would need to verify the actual numbers and locations of unpatented mining claims before applying for a right-of-way grant.

However, none of the tunnels, shafts, and underground mines in this dataset is identified as having been field verified by the Division of Mines. Furthermore, this dataset might not include very old tunnels, shafts, and underground mines that were not recorded.

3.3.2.5.2.2 Energy Resources. The Basin and Range Province is considered a favorable area for geothermal resources because it has higher-than-average heat flow and is an area of crustal expansion, where faults can provide permeable reservoirs and conduits for deep circulation of water, and the crust is so thin it has a higher-than-average heat flux. Several hundred wells have been drilled in Nevada to discover high-temperature geothermal steam resources (DIRS 173841-Shannon & Wilson 2005, p. 32).

Geothermal resources are present as hot springs and thermal waters near Hazen, Hawthorne, Mina, Redlich, Silver Peak, Sarcobatus Flat, Scottys Junction, Panaca (Owl Warm Springs), Cedar Spring, Stonewall Flat, and Beatty Warm Springs.

The following paragraphs describe energy leases, the geographic locations of which are identified based on the township-range system, the method by which public land in Nevada and many other states was surveyed before being made available for purchase or homesteading. The township is the major subdivision of land; it is numbered north to south and measures 36 square miles; range is the east/west location identifier; sections are 1-square-mile areas within townships. Township, range, and section are abbreviated T, R, and S; directional information is abbreviated N, S, E, and W. Thus, E/2 T2S R39E refers to the east half of Township 2 South, Range 39 East).

The following Mina rail alignment segments would cross geothermal leases:

- Mina common segment 1 (Warm Wells north of Columbus Marsh) – The BLM issued a block of leases (all but one are still active) located in T3N and T4N, R36E. Mina common segment 1 would cross the northeastern-most leased section of the lease block (Section 26, T4N, R36E). Figure 3-155 shows these leases (DIRS 180882-Shannon & Wilson 2007, pp. 122 and 123).
- Montezuma alternative segment 1 (Alum District – Warm Wells) – A block of current and expired BLM geothermal leases are present in the southern Big Smoky Valley. Montezuma alternative segment 1 would cross several leases with an effective date of March 1, 2003, in S/2 T1N, R38.5. Figure 3-156 shows these leases (DIRS 180882-Shannon & Wilson 2007, p. 122).
- Montezuma alternative segment 1 (Silver Peak Marsh District – Silver Peak Hot Springs) – would cross several geothermal leases obtained by Western Geothermal Partners LLC in Section 34, T1S, R39E and several sections in E/2 T2S, R39E. Figure 3-157 shows these leases (DIRS 180882-Shannon & Wilson 2007, pp. 120 and 121).

There are geothermal occurrences (springs and wells) in Sarcobatus Valley along U.S. Highway 95 south of Scottys Junction (DIRS 173842-Shannon & Wilson 2005, p. 50).

There are no producing oil or gas wells within 16 kilometers (10 miles) of the Mina rail alignment north of common segment 5 (DIRS 180882-Shannon & Wilson 2007, p. 116). The rail alignment would cross several areas of expired or relinquished (closed) oil and gas leases. The closest oil and gas lease is approximately 3 kilometers (2 miles) northeast of Mina, Nevada, which is approximately 1.6 kilometers (1 mile) east of Mina common segment 1. The BLM authorized this lease in September 2006 (DIRS 180882-Shannon & Wilson 2007, pp. 117 and 118). The BLM also authorized an oil and gas lease on the north slope of the Pilot Mountains in July 2006; however, Mina common segment 1, the rail line segment that would be closest to this lease, would pass approximately 6 kilometers (4 miles) west of this area (DIRS 180882-Shannon & Wilson 2007, p. 117).

Fourteen sections of land constitute a single oil and gas lease (one permittee) 19 kilometers (12 miles) north of Beatty, Nevada, along the southwest flank of Pahute Mesa in southern Nye County (DIRS 179587-Wilson 2007, all). Oasis Valley alternative segment 3 would cross 7 of the 14 sections and Oasis Valley alternative segment 1 would cross 2 sections of this oil and gas lease block.

As of January 2007, no BLM coal leases (active or closed) have been identified within 16 kilometers (10 miles) of the Mina rail alignment (DIRS 180882-Shannon & Wilson 2007, p. 118).

3.3.2.5.3 Recreation and Access

This section describes the recreational areas within the Mina rail alignment region of influence and the secondary roads and trails the rail alignment would cross. Figures 3-160 through 3-167 show recreational areas in the region of influence.

3.3.2.5.3.1 Churchill County. Outdoor recreation in Churchill County includes a mixture of dispersed and location-specific activities (DIRS 180482-Churchill County 2005, p. 9-1). There are no developed BLM recreation sites within 1.6 kilometers (1 mile) of the Mina rail alignment. U.S. Highway 50 intersects and parallels the Union Pacific Railroad Hazen Branchline for approximately 11 kilometers (7 miles) in Churchill and Lyon Counties. U.S. Highway 50, which traces the routes of the historic transcontinental Lincoln Highway, has recently been marketed as the "Loneliest Road in America" for its extreme remoteness (DIRS 180483-NPS 2004, p. 21).

The Union Pacific Railroad Hazen Branchline abuts the Lahontan State Recreation Area, tracing the area's northern boundary for approximately 6.5 kilometers (4.0 miles). The site, managed by the Nevada Division of State Parks, Department of Conservation and Natural Resources, is primarily focused on the Lahontan Reservoir and associated water-based activities (fishing, boating, waterskiing) as well as recreational vehicle and tent camping (DIRS 180481-Nevada Division of State Parks [n.d.], all).

3.3.2.5.3.2 Lyon County. Recreation on BLM lands in Lyon County is managed primarily for dispersed recreation, with developed recreation only at certain high-use sites. There are no developed BLM recreation areas along the portions of Union Pacific Railroad Hazen Branchline, Department of Defense Branchline North, or Schurz alternative segments in Lyon County.

In addition to Lahontan State Recreation Area, the State of Nevada manages two recreation areas in the region of influence of existing rail segments, Fort Churchill State Historic Park and the Mason Valley Wildlife Management Area.

Fort Churchill State Historic Park preserves the ruins of a Civil War-era U.S. Army fort and Pony Express station (DIRS 180459-Nevada Division of State Parks [n.d.], all). Department of Defense Branchline North crosses about 1 kilometer (0.6 mile) of this park.

The 54 square-kilometer (13,375-acre) Mason Valley Wildlife Management Area, administered by the Nevada Department of Wildlife, provides a mosaic of game habitats from open water to wetlands and upland areas (DIRS 180480-NDOW [n.d.], all). Department of Defense Branchline North runs adjacent to the northern boundary of the Wildlife Management Area for more than 5 kilometers (3 miles).

Schurz alternative segments 1 and 4 would come within 1 kilometer (0.6 mile) of Weber Reservoir, a recreational water body straddling the boundary of Lyon and Mineral Counties and managed by the Walker River Paiute Tribe.

A **Back Country Byway** is a vehicle route that traverses scenic corridors utilizing secondary or back country road systems (DIRS 181598-BLM 2007).

The Fort Churchill to Wellington ***Back Country Byway*** begins on Nevada State Highway 2B at Fort Churchill State Historic Park and runs 80 kilometers (50 miles) west to Wellington, Nevada (DIRS 180461-BLM 2006, all). This unimproved road parallels the existing rail line at a distance of approximately 460 meters (1,500 feet) at its closest for 0.8 kilometer (0.5 mile) before the two diverge.

3.3.2.5.3.3 Mineral County. BLM lands in Mineral County are managed primarily for dispersed recreation, with developed recreation opportunities available only at a few sites. The BLM and Nevada Division of State Parks manage facilities at Walker Lake and the Walker River Paiute Tribe operates facilities at Weber Reservoir. Only one Wilderness Study Area, the Gabbs Valley Range Wilderness Study Area, is near any proposed or existing rail lines in the county, but at approximately 7.5 kilometers (4.6 miles) from Mina common segment 1, it would be outside the region of influence.

Existing Department of Defense Branchline South follows the periphery of Walker Lake, at a distance of no closer than 0.7 kilometer (0.44 mile), for approximately 20 kilometers (12 miles) of the lake's eastern shore. Walker Lake serves as a regional focal point for water-based recreational activities, and is a designated recreation area for the State of Nevada and the BLM (DIRS 180702-Mineral County Nuclear Projects Office 2005, pp. 15 and 30).

Mina common segment 1 would cross a BLM-designated recreation area south of Mina, Nevada, for approximately 19 kilometers (12 miles).

Organized, reoccurring recreation events near the proposed Mina rail alignment typically involve off-highway vehicle based recreation. These events have historically been of both a competitive (speed-based races) and non-competitive (road-rallies, scenic/***historic tourism***, etc.) nature and range widely in the number of participants and communication with BLM managers). The BLM requires that the organizers of these events submit applications for a Special Recreation Permits that describe the details and logistics of each event, such as course and operations plans (DIRS 181599-BLM Special Recreation Permit requirements). Because part of the draw of these events is the wide open spaces and large distances participants are able to traverse, courses often cross several BLM administrative districts or counties. One of the largest of these annual off-highway vehicle events near the Mina rail corridor is the "Las Vegas to Reno" race, which crosses the Battle Mountain, Carson City, and Ely BLM districts (DIRS 181600-BLM 2005, all).

There are very few BLM-permitted off-highway vehicle races and special recreation events in the Mina rail alignment region of influence in Mineral County. Mina common segment 1 would cross approved race routes in several locations. Permitted off-highway vehicle events in the area have included the Las Vegas to Reno Race and Dual Sport Tour (DIRS 182283-Callan 2007). All approved race routes that the rail line would cross are on existing roads and trails.

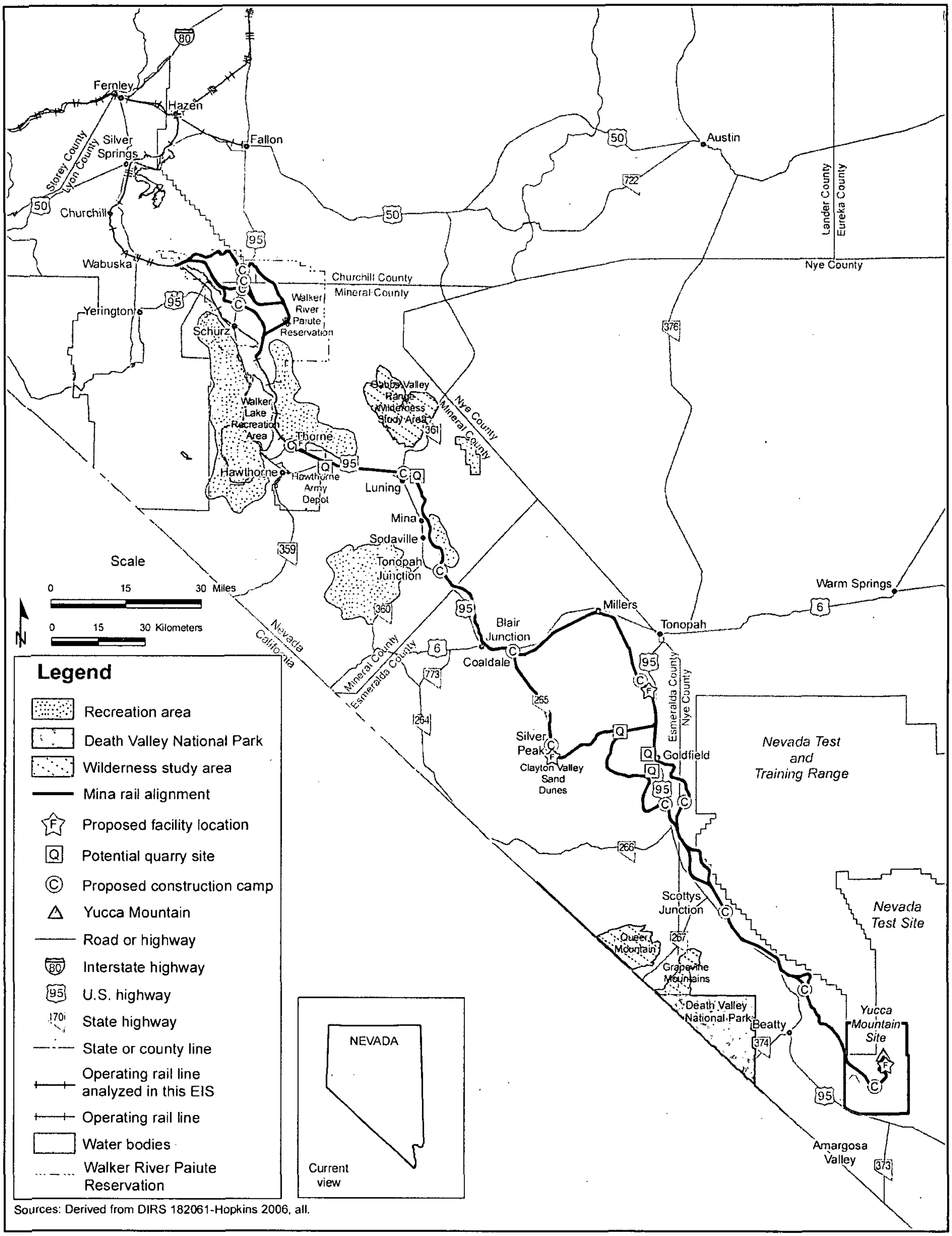


Figure 3-160. Recreation areas and roads along the Mina rail alignment.

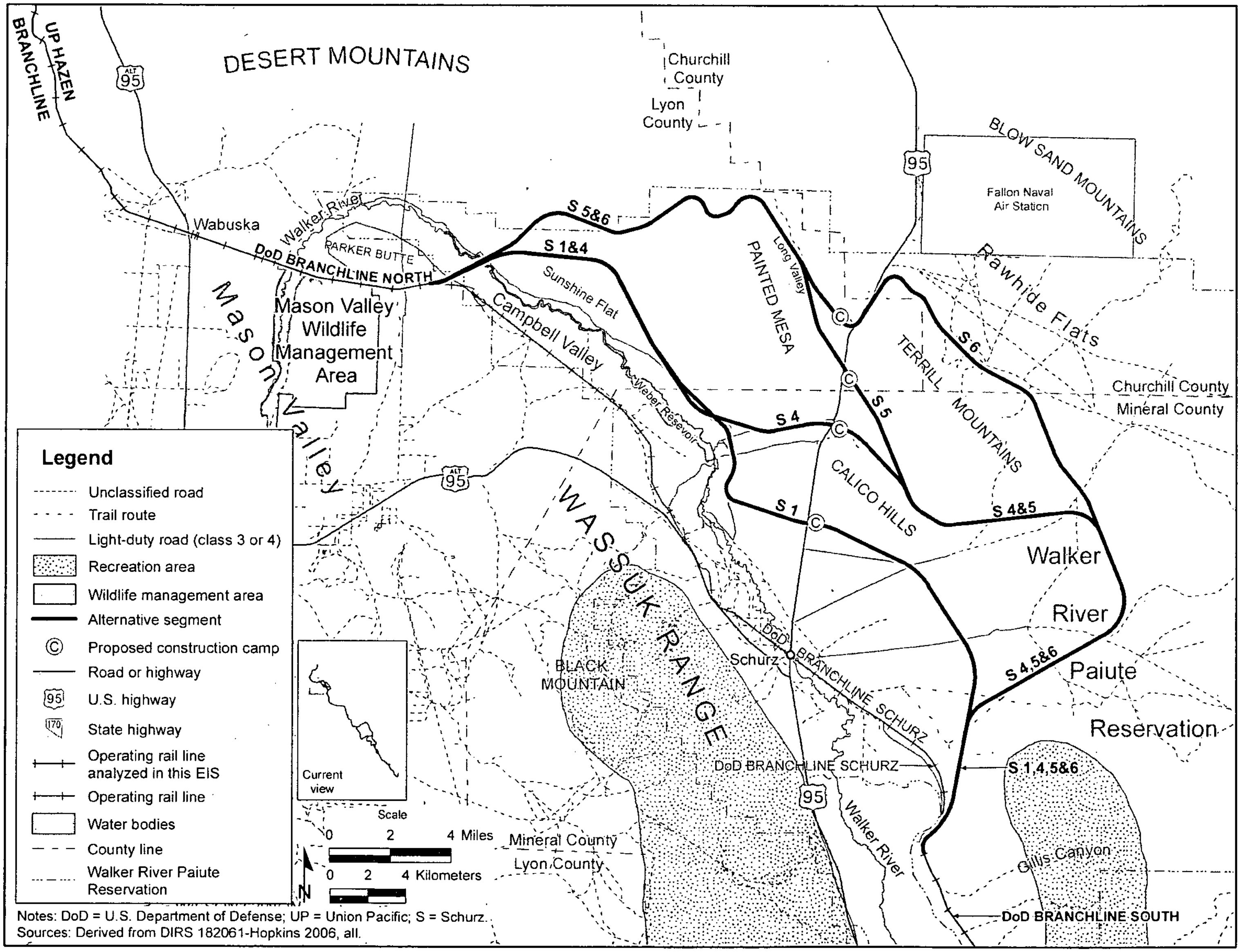


Figure 3-161. Recreation areas and roads within map area 1.

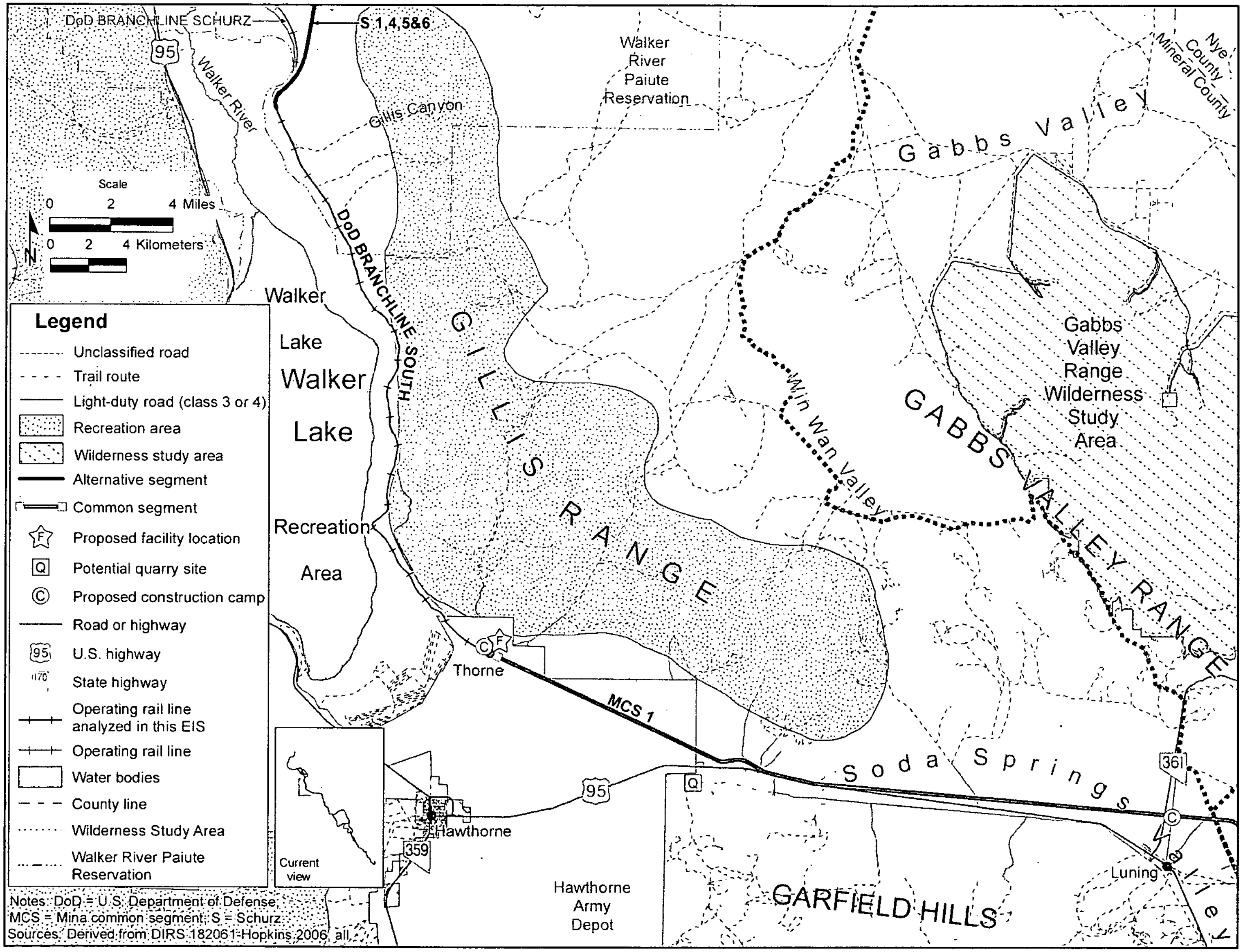


Figure 3-162. Recreation areas and roads within map area 2.

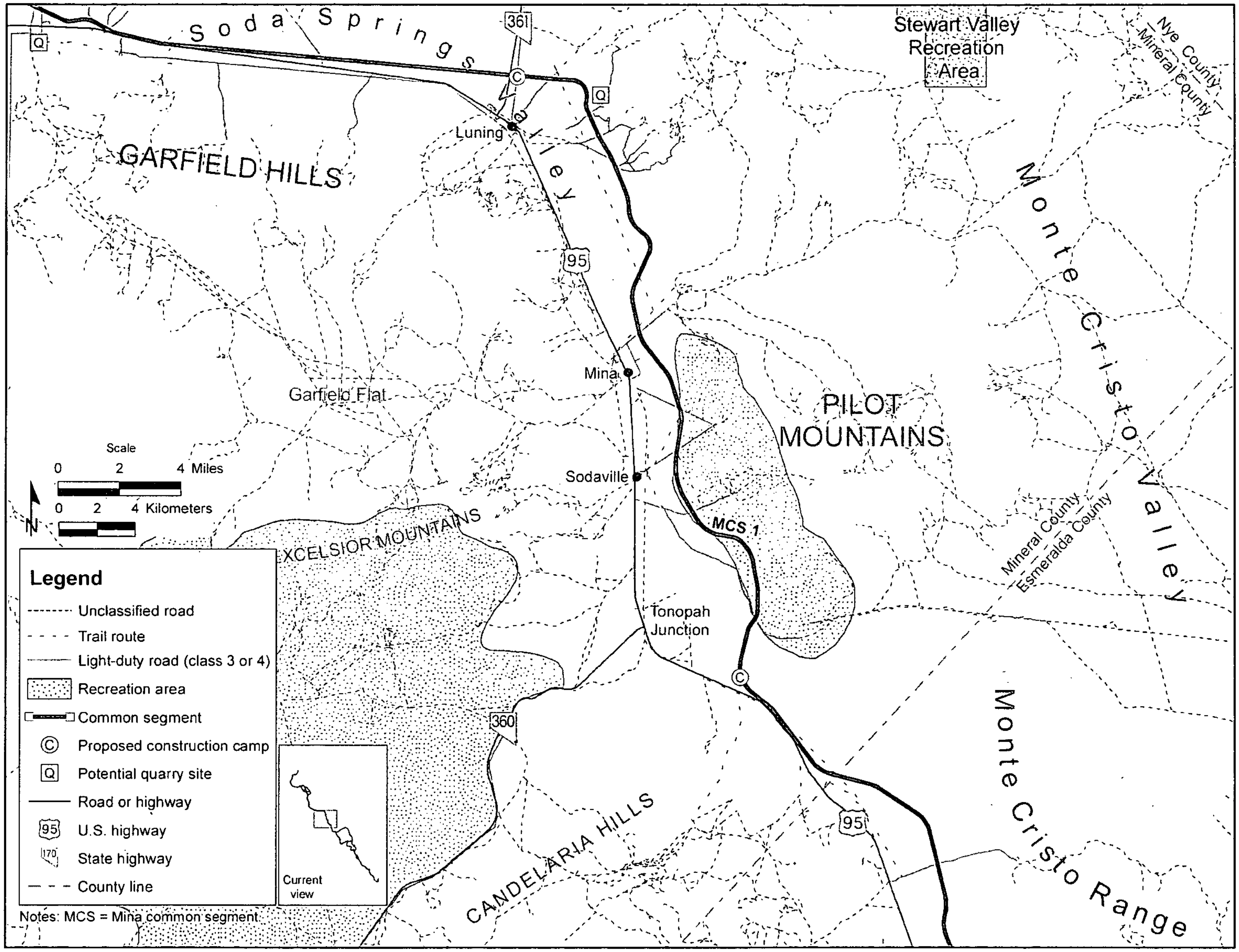


Figure 3-163. Recreation areas and roads within map area 3.

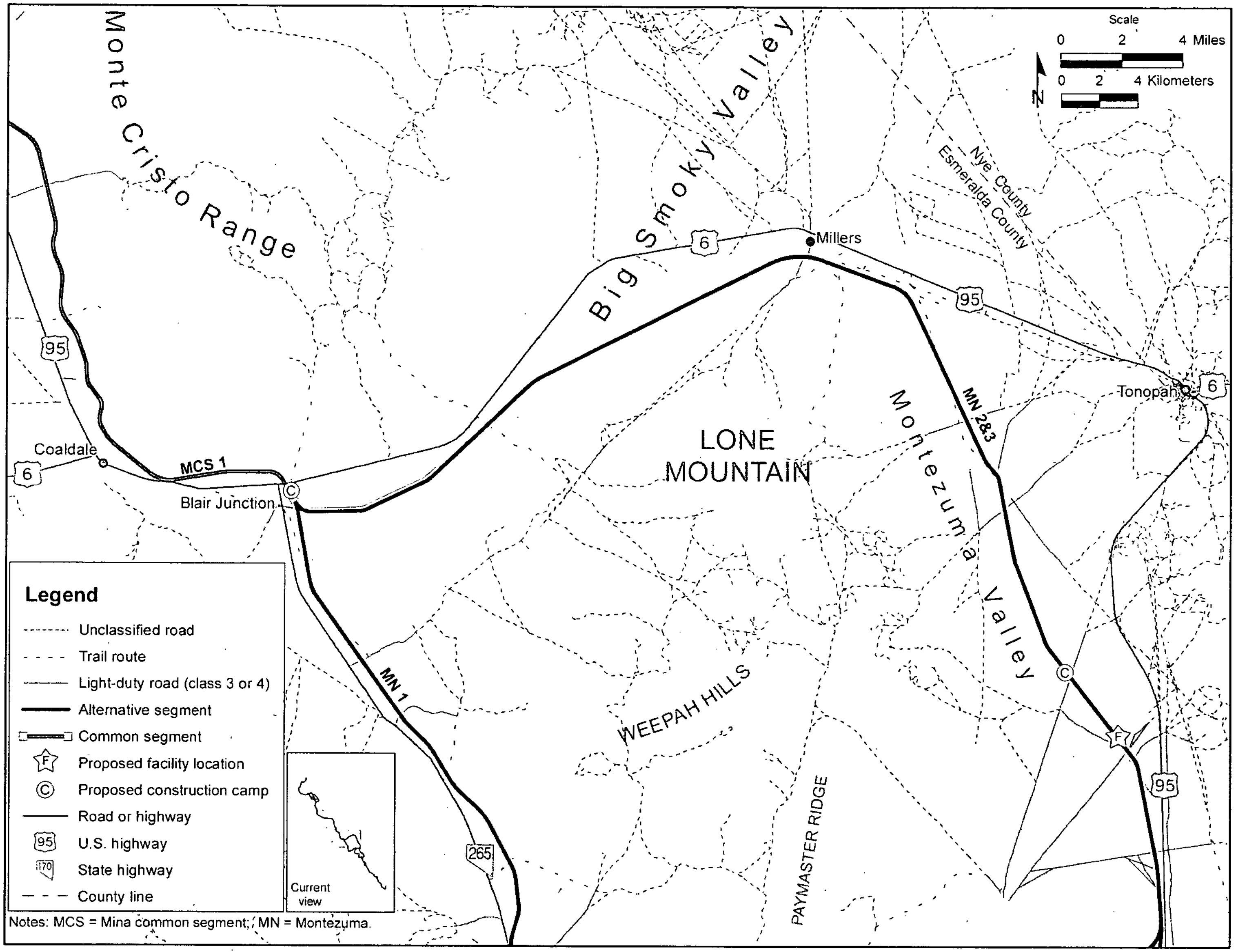


Figure 3-164. Recreation areas and roads within map area 4.

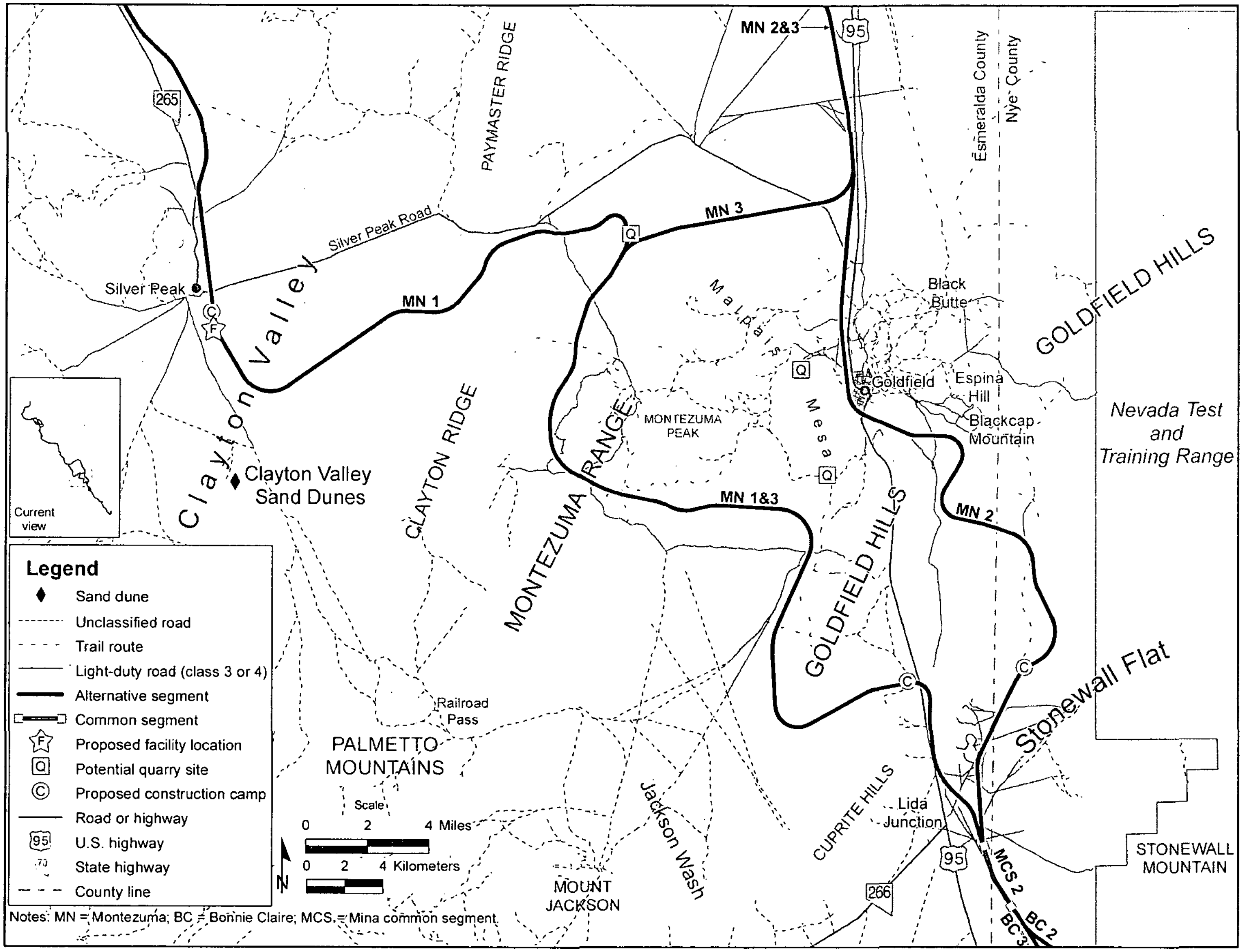


Figure 3-165. Recreation areas and roads within map area 5.

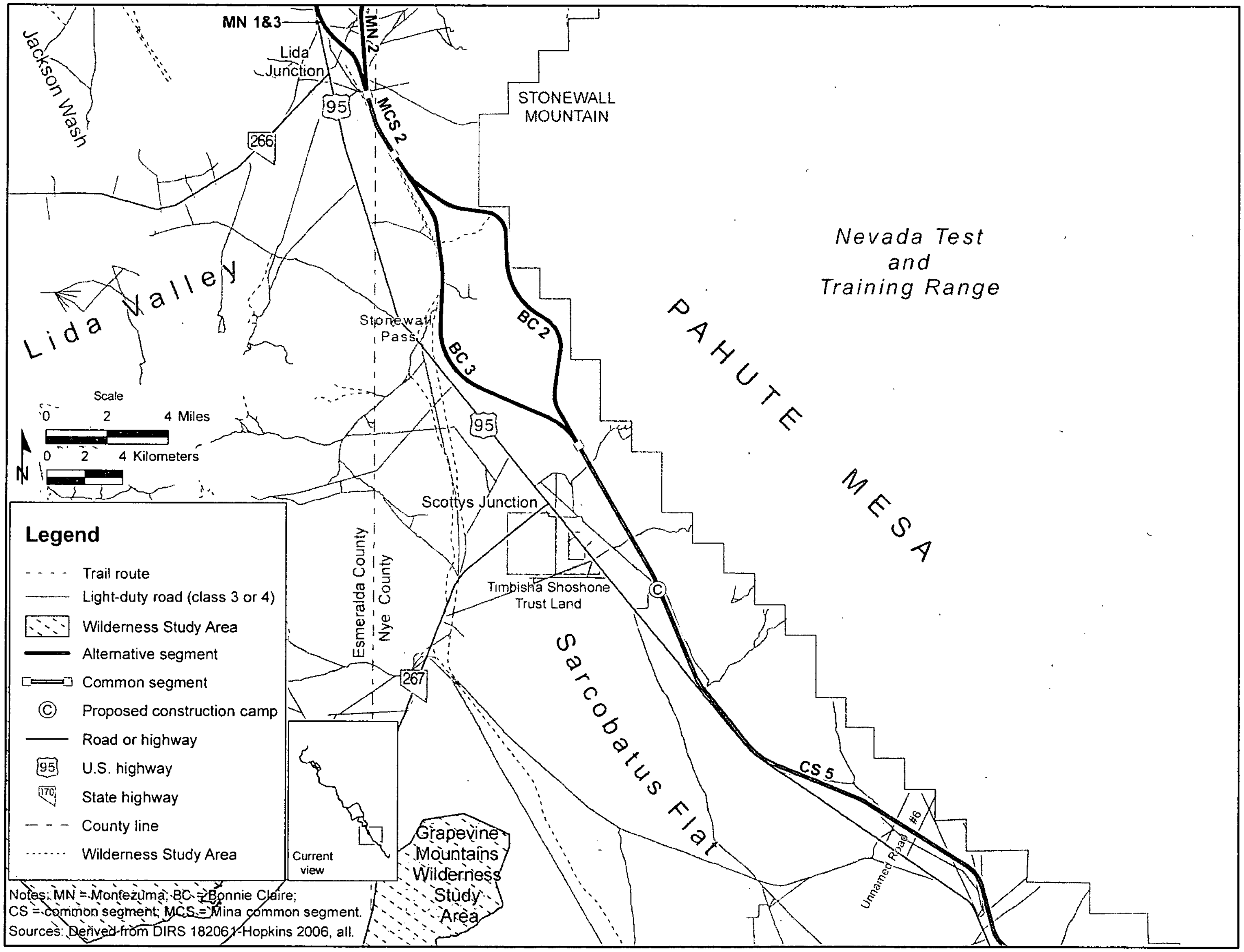


Figure 3-166. Recreation areas and roads within map area 6.

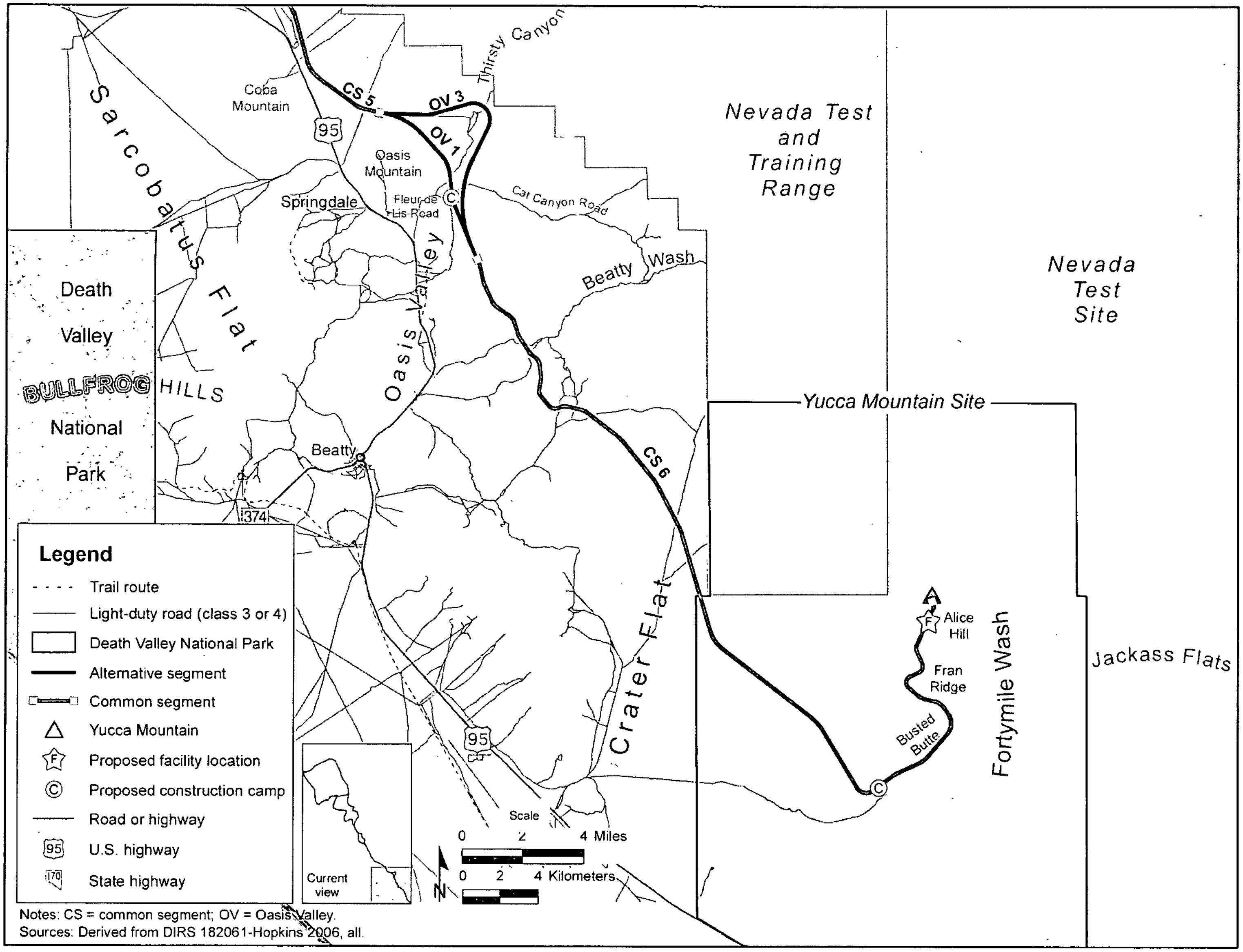


Figure 3-167. Recreation areas and roads within map area 7.

3.3.2.5.3.4 Esmeralda County. Recreation in Esmeralda County is generally dispersed and includes off-highway vehicle events, sometimes near the Mina rail alignment. The county is home to numerous largely abandoned towns and historical sites, many of which are in old mining districts and areas for hunting and fishing (DIRS 176770-Duval et al. 1976, p. 28). The closest Wilderness Area or Wilderness Study Area to the rail alignment in Esmeralda County would be Silver Peak Wilderness Study Area, which would be approximately 21 kilometers (13 miles) away from Montezuma alternative segment 1, outside the region of influence. The closest BLM-designated Special Recreation Management Areas, the Clayton Valley Sand Dunes Special Recreation Management Areas and the Crescent Sand Dunes Special Recreation Management Area, are also outside the Mina rail alignment region of influence, approximately 4.5 kilometers (2.8 miles) and 14 kilometers (8.8 miles) away, respectively.

Mina common segment 1 would cross near the southwestern edge of the Monte Cristo Range, an area under consideration by the Nevada Legislature as a Nevada State Park. Proponents of the proposed state park cite the area's unique geology as its major appeal and justification for park designation (DIRS 180460-Robb-Bradick et al. 2006, all). At present, the BLM manages the area as open to all individual, commercial, or competitive recreational uses (DIRS 173224-BLM 1997, p. 34).

A number of BLM-permitted off-highway vehicle races and permitted special recreation events take place annually in areas around the Mina rail alignment common segments and alternative segments in Esmeralda County. Montezuma alternative segment 2 would cross previously used race routes approximately 10 times, with most crossings occurring as the alternative segment neared Goldfield. Montezuma alternative segment 3 would cross previously used race routes approximately 15 times, while Montezuma alternative segment 1 would cross race routes approximately five times, principally in areas south of the Silver Peak. Most approved race routes are on existing roads and trails.

3.3.2.5.3.5 Nye County. Recreation on BLM-administered lands in Nye County is generally dispersed, and there would be no developed recreation sites within 1.6 kilometers (1 mile) of the Mina rail alignment. Dispersed recreation opportunities in Nye County include hunting, camping, exploration and sightseeing, and off-highway vehicle recreation and events.

There are very few off-highway vehicle events in the Mina rail alignment region of influence in Nye County. Common segment 6 would cross race routes several times. All approved race routes the rail line would cross are on existing roads and trails.

3.3.2.5.3.6 Land Access. The Mina rail alignment would cross a number of class 3 or 4 roads and unpaved trail routes (see Table 3-89).

> A **class 3 road** is a light-duty, paved or improved road.
>
> A **class 4 road** is an unimproved, unsurfaced road (includes track roads in back country).
>
> **Trail routes** are trails and roads passable only with a 4-wheel drive vehicle (also called Jeep trails).
>
> Source: DIRS 181598-BLM [n.d.].

3.3.2.5.4 Utility and Transportation Corridors

3.3.2.5.4.1 Utility Rights-of-Way. Figures 3-168 through 3-175 show the major utilities and utility corridor networks in the Mina rail alignment region of influence. The figures do not identify smaller, local electric distribution lines, typically in the 14- to 25-kilovolt range, with linear right-of-way reservations along major roads, or local water, sewer, power, or telephone lines serving individual residences or businesses, or their corresponding rights-of-way.

3.3.2.5.4.2 Utility Corridors. As stated in Section 3.3.2.4.1, BLM resource management plans designate utility and transportation corridors to consolidate the location of new and existing rights-of-way whenever feasible. Table 3-90 lists the extent to which DOE would construct each Mina rail alignment segment within BLM-designated corridors.

Table 3-89. Trails and class 3 or 4 roads the Mina rail alignment alternative segments and common segments would cross.

Segment	Walker River Paiute Reservation roads/trails	Mineral County roads	Mineral County trails	Esmeralda County roads	Esmeralda County trails	Nye County roads	Nye County trails
Union Pacific Railroad Hazen Branchline[a]	Not applicable						
Department of Defense Branchline North[b]	Not applicable						
Schurz alternative segment 1[c]	2	0	0	0	0	0	0
Schurz alternative segment 4[c]	2	0	0	0	0	0	0
Schurz alternative segment 5[c]	3	0	0	0	0	0	0
Schurz alternative segment 6[c]	2	0	0	0	0	0	0
Department of Defense Branchline South[b]	Not applicable						
Mina common segment 1[c]	0	3	0	0	0	0	0
Montezuma alternative segment 1[c]	0	0	0	1	0	0	0
Montezuma alternative segment 2[c]	0	0	0	5	0	0	0
Montezuma alternative segment 3[c]	0	0	0	5	0	0	0
Mina common segment 2[c]	0	0	0	0	0	0	0
Bonnie Claire alternative segment 2	0	0	0	0	0	0	1
Bonnie Claire alternative segment 3	0	0	0	0	0	2	2
Common segment 5	0	0	0	0	0	14	0
Oasis Valley alternative segment 1	0	0	0	0	0	3	0
Oasis Valley alternative segment 3	0	0	0	0	0	3	0
Common segment 6	0	0	0	0	0	7	0

a. Use of the Union Pacific Railroad Hazen Branchline would not require new construction or new road crossings.
b. DOE would construct new sidings along Department of Defense Branchlines North and South within the existing rail line right-of-way; therefore DOE did not analyze these portions of the rail alignment. No other new construction would be required.
c. Source: DIRS 181617-Hopkins 2007, all.

Table 3-90. Rail line segments within designated utility or transportation corridors[a].

Segment	Resource management plan	Distance (kilometers)[b] within BLM-designated corridors	Total distance (kilometers) of segment	Percent within BLM-designated corridor
Union Pacific Railroad Hazen Branchline and Department of Defense Branchline North[c,d]	Carson City	Not applicable		
Schurz alternative segment 1[e]	Carson City	Not applicable	51	Not applicable
Schurz alternative segment 4[e]	Carson City	Not applicable	65	Not applicable
Schurz alternative segment 5[e]	Carson City	0[f]	66	0
Schurz alternative segment 6[e]	Carson City	0[f]	67	0
Department of Defense Branchline South[c,d]	Carson City	Not applicable		
Mina common segment 1	Carson City	52	85	61
Mina common segment 1	Tonopah	15	35	43
Montezuma alternative segment 1	Tonopah	51	118	43
Montezuma alternative segment 2	Tonopah	35.5	118	30
Montezuma alternative segment 3	Tonopah	49.9	142	35
Mina common segment 2	Tonopah	0	3.4	0
Bonnie Claire alternative segment 2	Tonopah	0	20	0
Bonnie Claire alternative segment 3	Tonopah	1.6	20	8.0
Common segment 5	Tonopah	20	41	49
Oasis Valley alternative segment 1	Tonopah	8.3	10	83
Oasis Valley alternative segment 3	Tonopah	10	14	71
Common segment 6	Tonopah	7.8	24	33
Common segment 6	Las Vegas	4.0	27	15

a. Source: DIRS 181617-Hopkins 2007, all.
b. To convert kilometers to miles, multiply by 0.62137.
c. Use of the Union Pacific Hazen Branchline would not require new construction.
d. DOE would construct new sidings along Department of Defense Branchlines North and South within the existing rail line right-of-way; therefore DOE did not analyze these portions of the rail alignment. No other new construction would be required.
e. While there are BLM-designated corridors shown on the southern portion of the Walker River Paiute Reservation, the BLM does not have jurisdiction to authorize rights-of-way across the Reservation or designate corridors on the Reservation.
f. Schurz alternative segments 5 and 6 would travel 4.8 kilometers outside the Walker River Paiute Reservation and these portions of the segments do not fall within BLM-designated corridors.

Table 3-91 identifies 38 locations of potential utility crossings. Because some of the locations are very close together, some of the individual crossings cannot be shown on the figures. Utility lines listed in Table 3-91 are depicted on the figures by their location number designated in the table. For clarification, see Volume III-B of this Rail Alignment EIS, Map Atlas. Table 3-92 lists utilities in the regions of influence of rail line support facilities. The locations of potential utility crossings shown on figures and listed in tables are approximate. Under the Mina Implementing Alternative, the Department would review and verify their locations during final rail line design.

Table 3-91. Potential Mina rail alignment utility crossings[a] (page 1 of 2).

Rail line segment/facility	Identified utilities and utility corridors[b,c,d]	Construction right-of-way crossings	Location number
Union Pacific Railroad Hazen Branchline[e]		Not applicable	
Department of Defense Branchline North[e]		Not applicable	
Schurz alternative segment 1	Telephone line	1	1
Schurz alternative segment 1	Unidentified line	1	2
Schurz alternative segment 1	Unidentified line	1	3
Schurz alternative segment 4	Telephone line	1	1
Schurz alternative segment 4	Unidentified line	1	2
Schurz alternative segment 4	Unidentified line	1	3
Schurz alternative segment 5	Telephone line	1	1
Schurz alternative segment 5	Unidentified line	1	2
Schurz alternative segment 5	Unidentified line	1	3
Schurz alternative segment 6	Telephone line	1	1
Schurz alternative segment 6	Unidentified line	1	2
Schurz alternative segment 6	Unidentified line	1	3
Department of Defense Branchline South[e]	Not applicable		
Staging Yard at Hawthorne	Transmission/power line	1	4
Staging Yard at Hawthorne	Transmission/power line	1	5
Mina common segment 1	Transmission/power line	2	5
Mina common segment 1	Transmission/power line	1	9
Mina common segment 1	Transmission/power line	1	10
Mina common segment 1	Transmission/power line	1	11
Mina common segment 1	Transmission/power line	1	12
Mina common segment 1	Transmission/power line	1	13
Mina common segment 1	Transmission/power line	2	14
Mina common segment 1	Transmission/power line	1	15

Table 3-91. Potential Mina rail alignment utility crossings[a] (page 2 of 2).

Rail line segment/facility	Identified utilities and utility corridors[b,c,d]	Construction right-of-way crossings	Location number
Mina common segment 1	Transmission/power line	4	16
Mina common segment 1	Telephone line	3	17
Mina common segment 1	Transmission/power line	1	18
Mina common segment 1	Transmission/power line	1	19
Mina common segment 1	Transmission/power line	2	20
Mina common segment 1	Transmission/power line	1	21
Mina common segment 1	Transmission/power line	1	22
Montezuma alternative segment 1	Transmission/power line	2	23
Montezuma alternative segment 1	Transmission/power line	1	24
Montezuma alternative segment 1	Telephone line	2	25
Montezuma alternative segment 1	Transmission/power line	2	26
Montezuma alternative segment 2	Transmission/power line	1	27
Montezuma alternative segment 2	Transmission/power line	2	28
Montezuma alternative segment 2	Transmission/power line	1	29
Montezuma alternative segment 2	Transmission/power line	1	30
Montezuma alternative segment 2	Transmission/power line	1	31
Montezuma alternative segment 2	Transmission/power line	2	32
Montezuma alternative segment 2	Transmission/power line	1	33
Montezuma alternative segment 2	Telephone line	1	34
Montezuma alternative segment 2	Transmission/power line	1	35
Montezuma alternative segment 2	Telephone line	1	36
Montezuma alternative segment 3	Telephone line	2	25
Montezuma alternative segment 3	Transmission/power line	2	26
Montezuma alternative segment 3	Transmission/power line	1	27
Montezuma alternative segment 3	Transmission/power line	2	28
Montezuma alternative segment 3	Transmission/power line	1	29
Montezuma alternative segment 3	Transmission/power line	1	30
Montezuma alternative segment 3	Transmission/power line	1	31
Montezuma alternative segment 3	Transmission/power line	1	32
Montezuma alternative segment 3	Transmission/power line	1	33
Montezuma alternative segment 3	Transmission/power line	1	37
Mina common segment 2	None	None	None
Bonnie Claire alternative segments	None	None	None

a. Sources: DIRS 181617-Hopkins 2007, all.
b. Electric distribution lines along major roads may not have been identified. Utilities serving individual residences or businesses have not been identified.
c. Use of the Union Pacific Railroad Hazen Branchline would not require new construction or new utility crossings.
d. Lines listed as "unidentified" are so listed in the Geographic Information System database.
e. DOE would construct new sidings along Department of Defense Branchlines North and South within the existing rail line right-of-way; therefore DOE did not analyze these portions of the rail alignment. No other new construction would be required.

Table 3-92. Potential quarry site utility crossings.[a]

Potential quarry site	Identified utilities and utility corridors	Number of crossings
Garfield Hills	Transmission/power line	1
Garfield Hills	Transmission/power line	1
Gabbs Range	None	None
North Clayton	Transmission/power line	1
Malpais Mesa	Pipeline	1
ES-7	Water line	1
ES-7	Water line	1
ES-7	Transmission/power line	1

a. Source: DIRS 181617-Hopkins 2007, all.

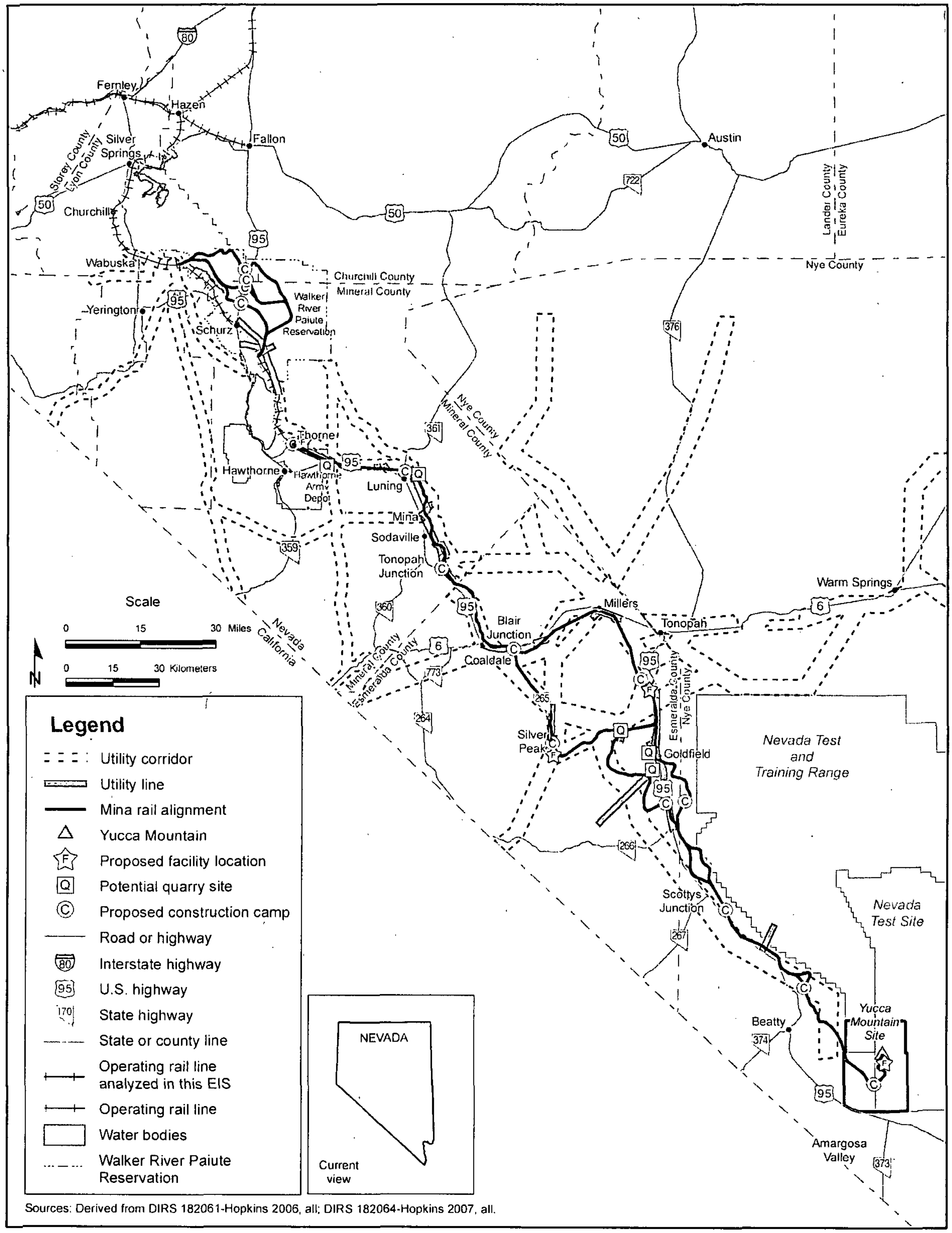


Figure 3-168. Utility corridors along the Mina rail alignment.

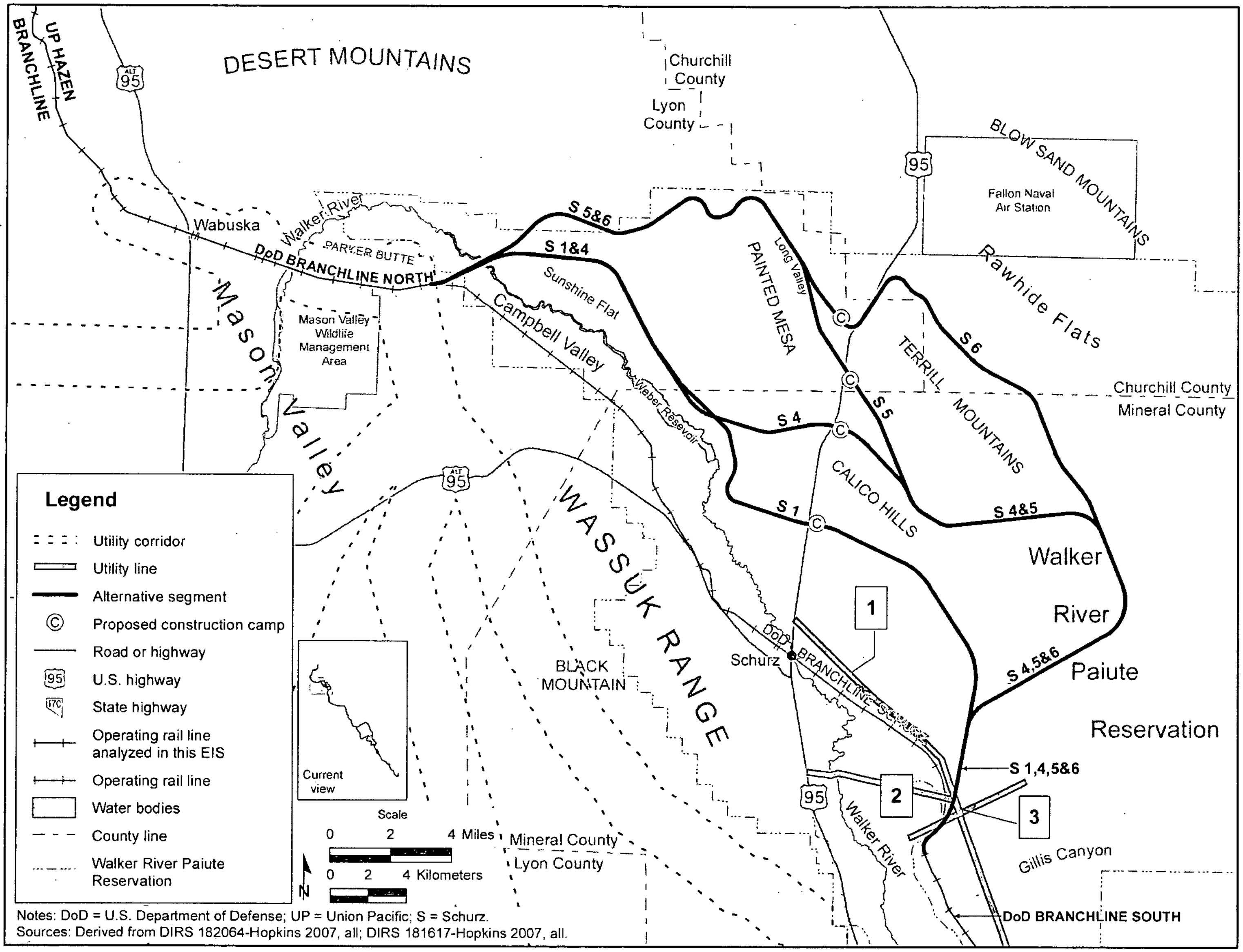


Figure 3-169. Utility corridors within map area 1.

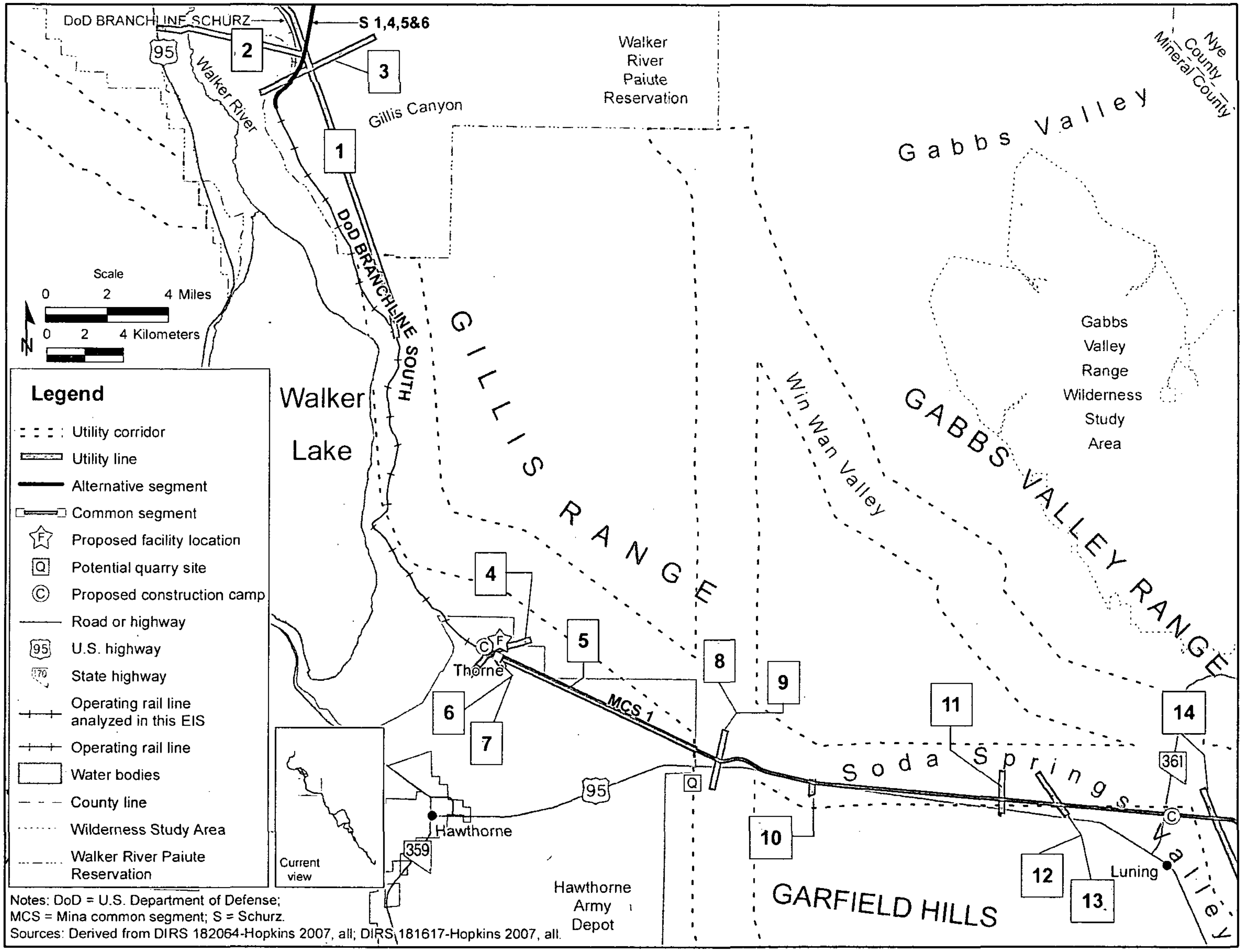
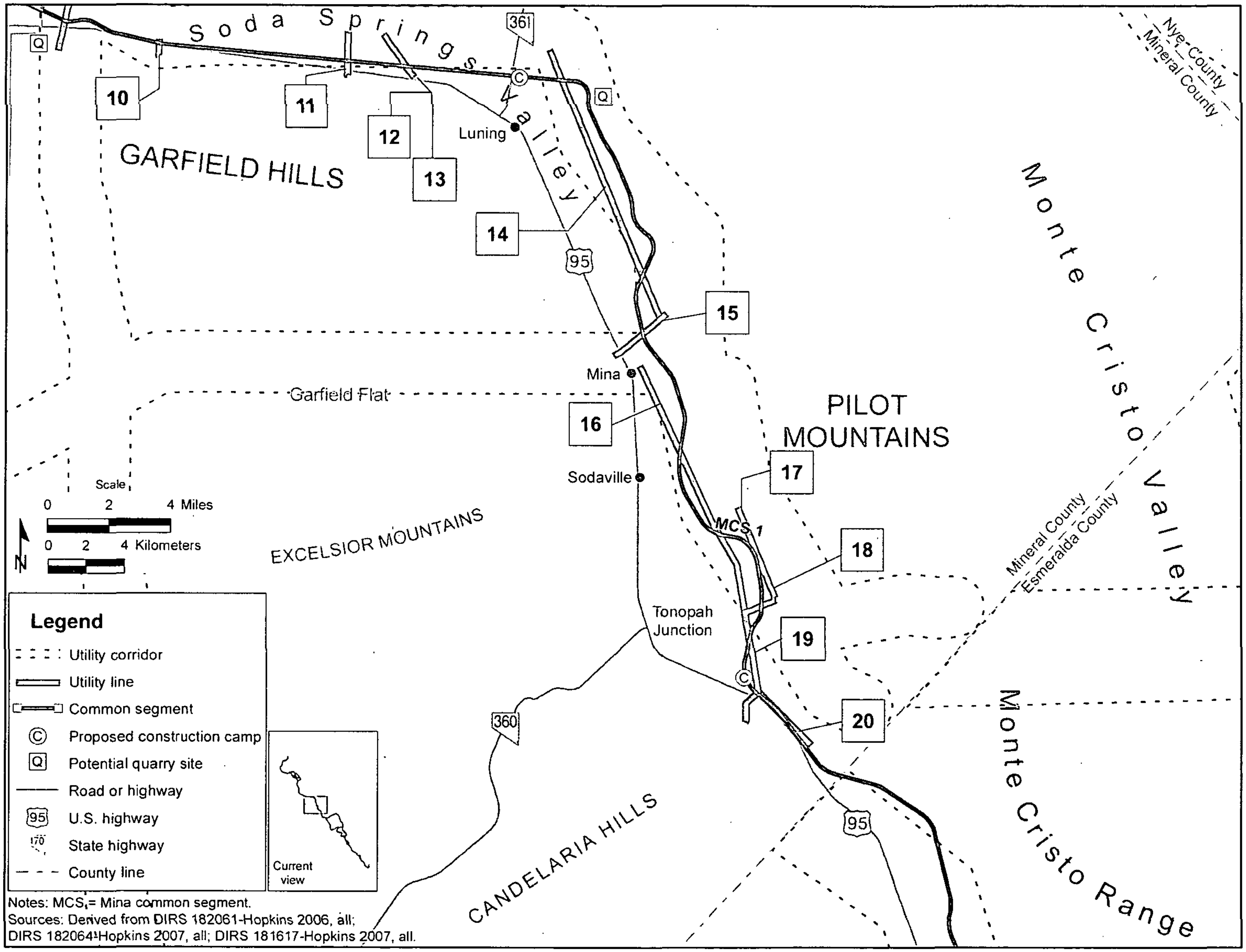


Figure 3-170. Utility corridors within map area 2.



Notes: MCS = Mina common segment.
Sources: Derived from DIRS 182061-Hopkins 2006, all; DIRS 182064-Hopkins 2007, all; DIRS 181617-Hopkins 2007, all.

Figure 3-171. Utility corridors within map area 3.

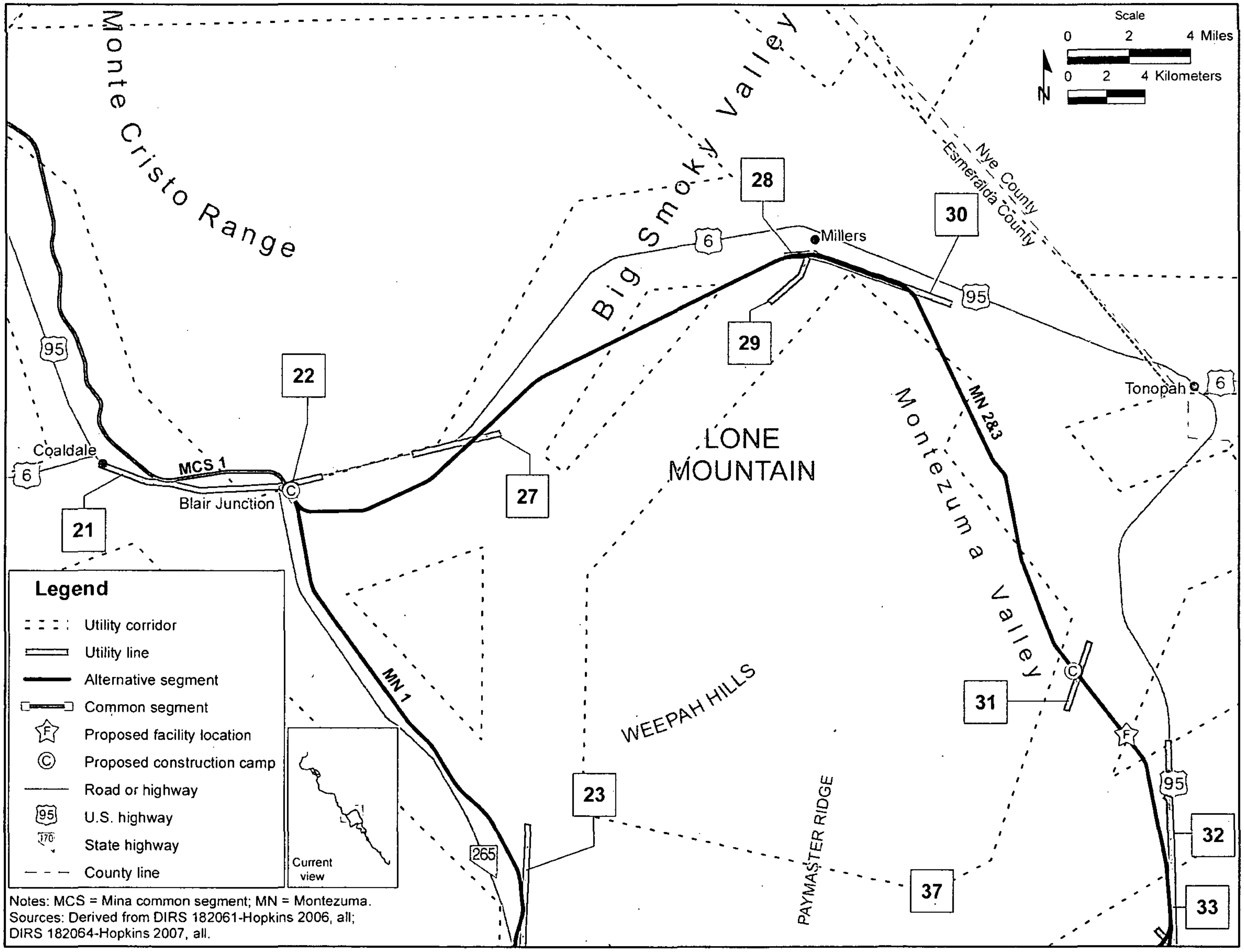


Figure 3-172. Utility corridors within map area 4.

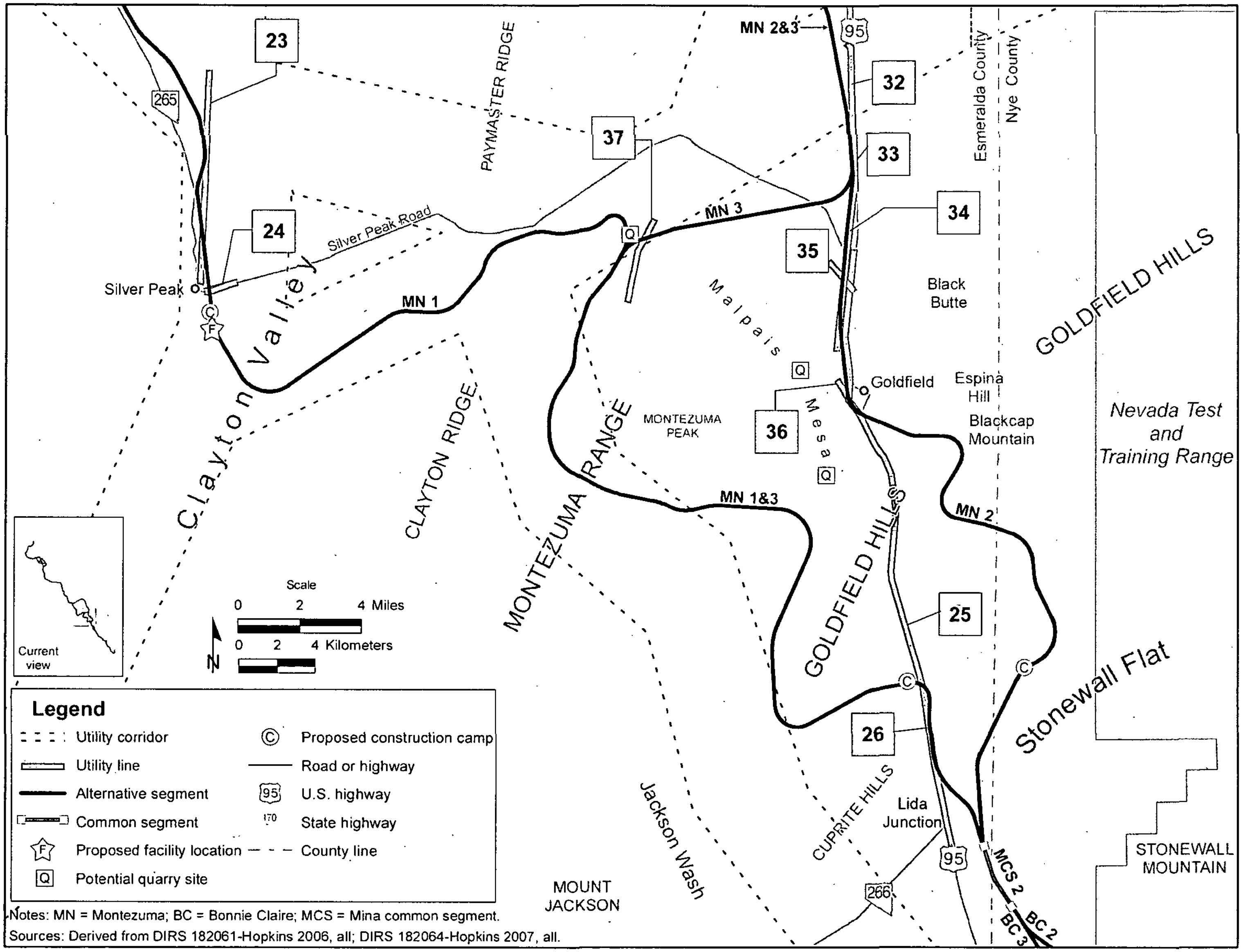


Figure 3.-173. Utility corridors within map area 5.

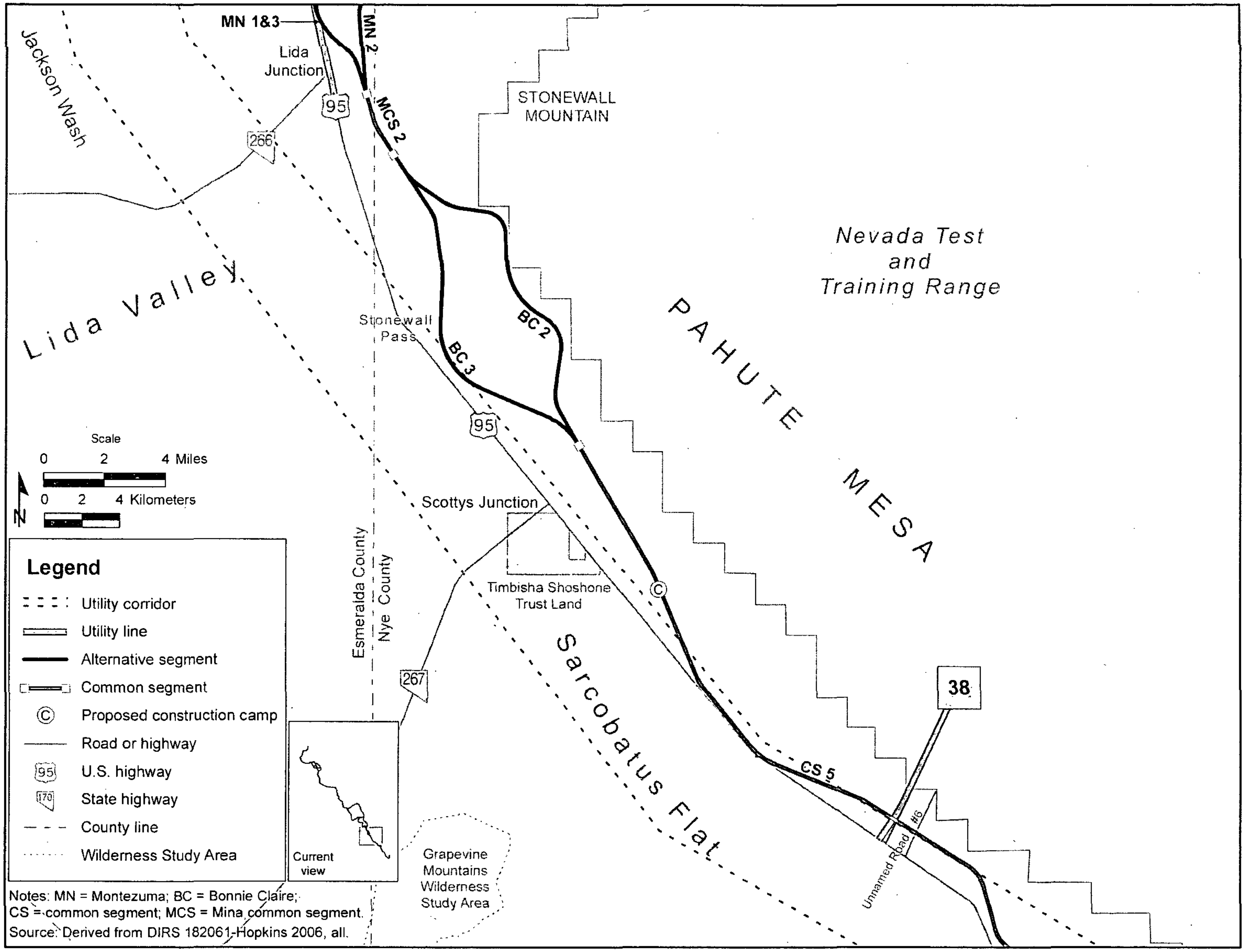


Figure 3-174. Utility corridors within map area 6.

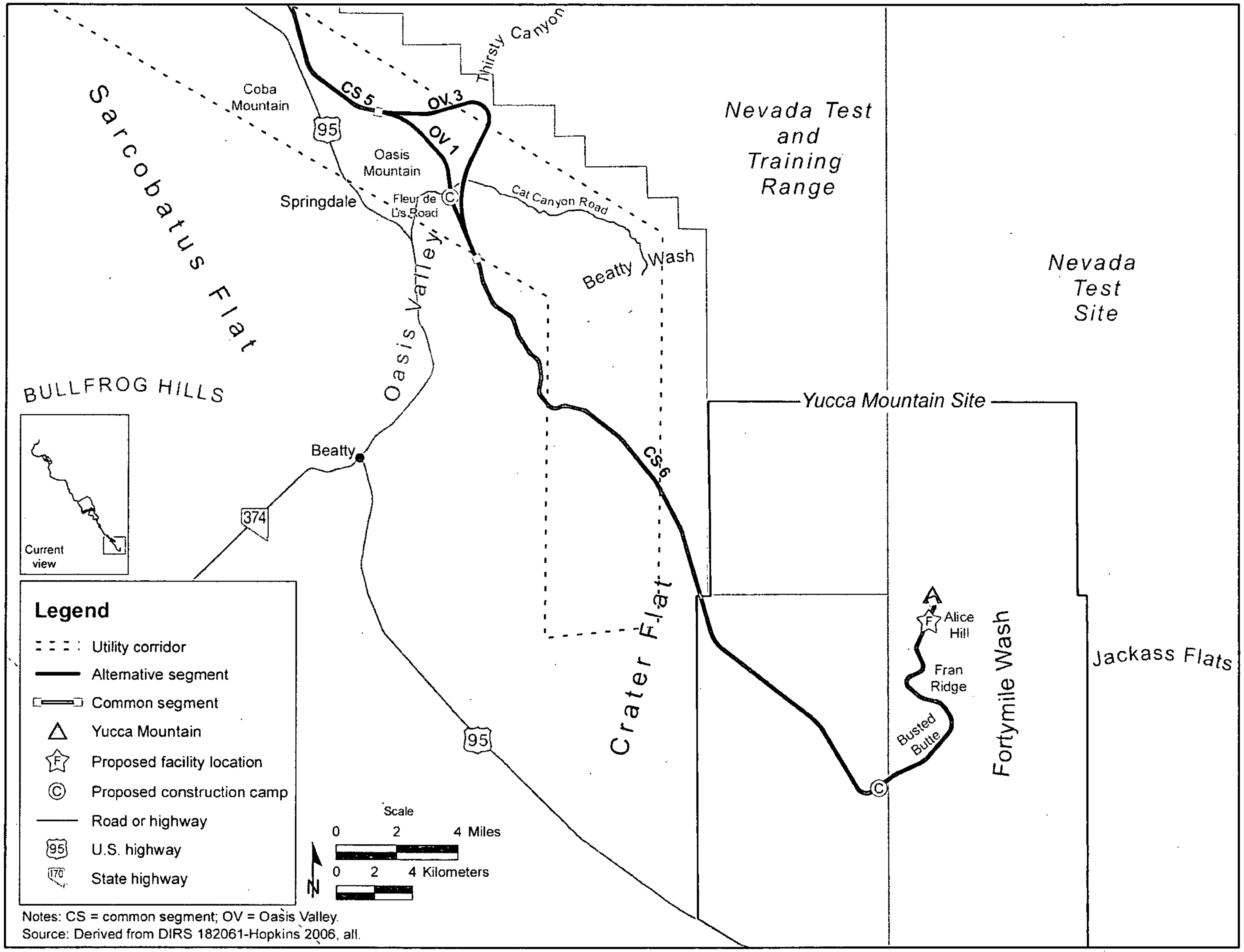


Figure 3-175. Utility corridors within map area 7.

3.3.3 AESTHETIC RESOURCES

This section describes the aesthetic (visual) setting in the region of influence along the Mina rail alignment. Section 3.3.3.1 describes the region of influence for aesthetic resources; Section 3.3.3.2 describes the methods DOE used to classify visual values; Section 3.3.3.3 describes the environmental setting and characteristics for aesthetic resources along the Mina rail alignment.

3.3.3.1 Region of Influence

The region of influence for aesthetic resources is the viewshed around all Mina rail alignment alternative segments, common segments, and proposed locations of ***rail line*** construction and operations support facilities.

BLM guidance subdivides landscapes into three ***distance zones*** based on relative visibility from travel routes or observation points. "Foreground-middleground" zone includes areas less than 5 to 8 kilometers (3 to 5 miles) away. "Background" zone includes areas visible beyond the foreground-middleground zone but usually less than 24 kilometers (15 miles) away. Areas not seen as foreground-middleground or background are in the "seldom-seen" zone (DIRS 101505-BLM 1986, Section IV). To ensure that seldom-seen views were included in this analysis, DOE used a conservative region of influence extending 40 kilometers (25 miles) on either side of the centerline of the Mina rail alignment.

Landscapes are divided into three **distance zones** based on their relative location to common viewpoints: foreground to middleground, background, and seldom seen (DIRS 101505-BLM 1986, Section IV).

Scenic quality is a measure of the visual appeal of a tract of land. Areas are rated based on key factors including landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications (DIRS 101505-BLM 1986, Section II).

Sensitivity levels are a measure of public concern for scenic quality. Areas are ranked high, medium, or low based on types of users, amount of use, public interest, adjacent land uses, and whether they are special areas (DIRS 101505-BLM 1986, Section III).

3.3.3.2 Methodology for Classifying Visual Values

Most of the lands along the Mina rail alignment are BLM-administered public lands, with the remainder owned or administered by the Walker River Paiute Tribe, the U.S. Army, or private entities. Because of the predominance of BLM-administered land, and because neither the Walker River Paiute Tribe nor the U.S. Army assign visual quality ratings to lands in their jurisdiction, DOE used BLM methodologies for evaluating visual values. The BLM considers visual resources when addressing aesthetic issues during BLM planning. These resources include natural or manmade physical features that give a landscape its character and value as an environmental factor. The BLM uses a visual resource management system to classify the aesthetic value of its lands and to set management objectives (DIRS 173052-BLM 1984, all).

The BLM classification of visual resource value, the visual resource inventory, involves assessing visual resources and assigning them to one of four visual resource management classes based on three factors: ***scenic quality***, visual sensitivity (***sensitivity levels***), and distance from travel or observation points (DIRS 101505-BLM 1986, all). The BLM uses a combination of the ratings of these three factors to assign a visual resource inventory class to a piece of land, ranging from Class I to Class IV, with Class I representing the highest visual values. Each visual resource class is subsequently associated with a management objective, defining the way the land may be developed or used. Each BLM district assigns visual resource management classes to its lands during the resource management planning process. Table 3-93 lists the BLM management objectives for visual resource classes.

Table 3-93. BLM visual resource management classes and objectives.[a]

Visual resource class	Objective	Acceptable changes to land
Class I	Preserve the existing character of the landscape.	Provides for natural ecological changes but does not preclude limited management activity. Changes to the land must be small and must not attract attention.
Class II	Retain the existing character of the landscape.	Management activities may be seen but should not attract the attention of the casual observer. Changes must repeat the basic elements of form, line, color, and texture of the predominant natural features of the characteristic landscape.
Class III	Partially retain the existing character of the landscape.	Management activities may attract attention but may not dominate the view of the casual observer. Changes should repeat the basic elements in the predominant natural features of the characteristic landscape.
Class IV	Provides for management activities that require major modifications of the existing character of the landscape.	Management activities may dominate the view and be the major focus of viewer attention. An attempt should be made to minimize the impact of activities through location, minimal disturbance, and repeating the basic elements.

a. Source: DIRS 101505-BLM 1986, Section V.B.

The BLM uses visual resource contrast ratings to assess the visual impacts of proposed projects and activities on the existing landscape (DIRS 173053-BLM 1986, all). The BLM looks at basic elements of design to determine levels of contrast created between a proposed project and the existing viewshed. Depending on the visual resource management objective for a particular location, varying levels of contrast are acceptable.

Contrast ratings are determined from locations called "key observation points," which are usually along commonly traveled routes such as highways or frequently used county roads or in communities. To identify key observation points along the Mina rail alignment, DOE considered the following factors: angle of observation, number of viewers, how long the project would be in view, relative project size, season of use, and light conditions. BLM guidance (DIRS 173053-BLM 1986, Section IIC) recommends that key observation points for linear projects, such as the proposed railroad, include the following:

- Most-critical viewpoints (for example, views from communities at road crossings)
- Typical views encountered in representative landscapes, if not covered by critical viewpoints
- Any special project or landscape features such as river crossings and substations

3.3.3.3 Visual Setting and Characteristics

3.3.3.3.1 General Setting and Characteristics

The Class IV lands in the region of influence consist of landscapes that are generally flat in form and horizontal in line, with gray and brown colors from soil and rock, and texture ranging from flat to slightly rough, depending on whether the broad flat valleys and alluvial fans include any topographic features such as hills, buttes, or eroded stream channels. Vegetation is usually small, low, and rounded in form (for example, grasses, shrubs, and small trees), horizontal in line, brown or gray-green in color, and light-to-medium in texture with irregular spacing. Structures are rare, but could include transmission towers, ranch buildings, or similar structures. Class III lands generally include more varied forms, lines, colors, and textures, including vertical lines in topography and vegetation, brighter greens in vegetation, visible blues from water, and dense texture from forested lands or rough texture in eroded rock. Some Class III areas in the Carson City BLM District will not necessarily fit this description, because the district has not inventoried most of the lands adjacent to the Mina rail alignment. The BLM manages uninventoried lands as Class III under district policy (DIRS 179571-Knight 2007, all). Class II lands are mostly in mountains that include forested areas and open rock exposures, with mixed forms including slopes and ridges; rounded lines; a wide range of rock and soil colors, and vegetation that changes color with the seasons; and variable texture that is often dense in forested areas. There are no Class I areas along the Mina rail alignment.

Sections 3.3.3.3.2.1 through 3.3.3.3.2.11 describe visual resources along and near the Mina rail alignment alternative segments and common segments. The discussions highlight resources of high visual value, identify current visual resource management classifications, ***special areas***, and key observation points.

> **Special areas** are lands where measures must be taken to protect visual values. Special areas often include designated natural areas, Wilderness Study Areas, scenic rivers, and scenic roads. Special areas are not necessarily unique or picturesque, but the management objective for a special area is to preserve its natural characteristics (DIRS 101505-BLM 1986, Section III.5).

DOE excerpted visual resource management classifications for lands along the Mina rail alignment primarily from BLM resource management plans from districts the alignment would cross (DIRS 173224- BLM 1997, all; DIRS 103079-BLM 1998, all; DIRS 179560-BLM 2001). DOE confirmed these classifications through telephone communications, electronic mail, and meetings with BLM personnel responsible for visual resource management for the Las Vegas, Carson City, and Battle Mountain Districts (DIRS 174631-Quick 2005, all; DIRS 174632-Quick 2005, all; DIRS 176988-Quick 2006, all; DIRS 179571-Knight 2007, all). The BLM Las Vegas and Carson City Districts provided Geographic Information System data from their resource management plans as a source for mapping the visual resource management classes in their districts (DIRS 103079-BLM 1998, Map 2-9). Geographic Information System data provided by the BLM Carson City District were augmented with information on default classifications from the district (DIRS 179571-Knight 2007, all). The Department based visual resource classifications for the Battle Mountain BLM District on the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all). DOE developed visual resource management classifications for non-BLM lands using BLM methodology (DIRS 173053-BLM 1986, all; DIRS 173052-BLM 1984, all), considering scenic quality ratings reported in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, pp. 3-158 and 3-159) where available. Non-BLM areas adjacent to lands managed by the Carson BLM District were analyzed as Class III unless their scenic qualities warranted more restrictive classifications.

Figure 3-176 is a map of visual resource management classifications for lands surrounding the Mina rail alignment based on the sources identified above. There are no locations where the alternative segments and common segments would cross or be close to Class I lands, and few where the alternative segments would cross or be close to Class II lands. As the figure shows, most of the lands surrounding the alternative segments and common segments are Class IV or Class III lands.

DOE selected 22 key observation points along the Mina rail alignment to evaluate the visual impacts of constructing and operating the proposed railroad. (Note: Key observation points M-1 through M-16 are unique to the Mina rail alignment. Points 31 through 36 are along the portion of the Mina rail alignment that is the same as the Caliente rail alignment and DOE has not renumbered them for the Mina analysis.) Figure 3-176 shows the locations of key observation points.

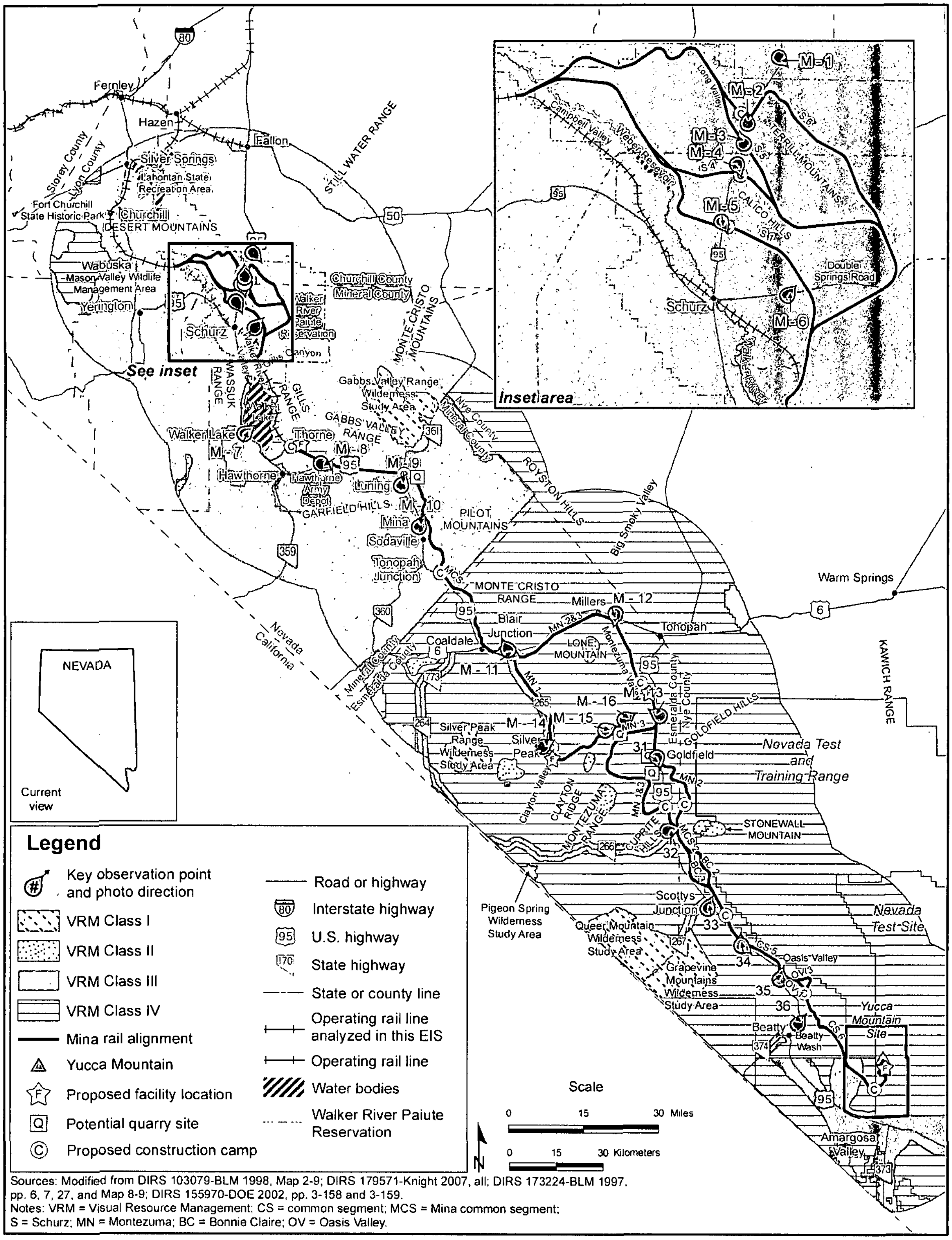


Figure 3-176. Visual resource management classifications and key observation points along the Mina rail alignment.

Appendix D, Aesthetics, contains photos taken at each key observation point. Table 3-94 lists visual resource management classes in the viewshed of each key observation point. Following BLM guidance, DOE selected most key observation points along travel routes or at use areas or potential use areas, and included critical viewpoints and typical views. Section 3.3.3.3.2 highlights areas of high visual value and other special areas, and identifies key observation points from which DOE analyzed impacts to these areas.

Table 3-94. Key observation points and visual resource management classes in the Mina rail alignment viewshed[a] (page 1 of 2).

Key observation point[b]	Location	Visual resource management classes[c]
M-1	U.S. Highway 95 looking over Rawhide Flats and the rail alignment against hills	Surrounding lands (III)
M-2 [d]	U.S. Highway 95 at intersection with county/Reservation road to Rawhide Flats, view of Schurz alternative segment 6 rail-over-road crossing	Surrounding lands (III)
M-3 [d]	U.S. Highway 95 in Long Valley, view of road-over-rail crossing of Schurz alternative segment 5	Surrounding lands (III)
M-4 [d]	U.S. Highway 95 at intersection with Weber Dam Road, view of Schurz alternative segment 4 road-over-rail crossing	Surrounding lands (III)
M-5 [d]	U.S. Highway 95, view of Schurz alternative segment 1 road-over-rail crossing	Surrounding lands (III)
M-6 [d]	Double Springs Road, view of Schurz alternative segment 1 at-grade crossing	Surrounding lands (III)
M-7	Town of Walker Lake, view across lake to Department of Defense Branchline South	Surrounding lands (II), western and eastern perimeters of Walker Lake (II)
M-8	U.S. Highway 95 just west of Hawthorne, view of potential Garfield Hills quarry facilities	Surrounding lands (III)
M-9	Town of Luning just off U.S. Highway 95, view of potential Gabbs Valley Range quarry site	Surrounding lands (III)
M-10	Town of Mina, corner of C Street and Hilda, view of Mina common segment 1	Surrounding lands (III)
M-11	Intersection State Route 265 and U.S. Highway 95 (Blair Junction), views of Mina common segment 1 toward Monte Cristo Range; south/southeast over State Route 265 to Montezuma alternative segment 1; west over Mina common segment 1	Surrounding lands (III and IV), State Route 265 (III), Monte Cristo Range (IV)
M-12	U.S. Highway 95 in Montezuma Valley, view south across Montezuma alternative segments 2 and 3 toward Lone Mountain	Surrounding lands (IV)
M-13	U.S. Highway 95, view toward Montezuma alternative segments 2 and 3 and potential Maintenance-of-Way Facility at Klondike	Surrounding lands (IV)
M-14	Main Street in Silver Peak (just past Chemetall Foote Corporation processing plant), view east over Montezuma alternative segment 1	Surrounding lands (III), State Route 265 (III)

Table 3-94. Key observation points and visual resource management classes in the Mina rail alignment viewshed[a] (page 2 of 2).

Key observation point[b]	Location	Visual resource management classes[c]
M-15	Silver Peak Road, view toward Montezuma alternative segment 1 and potential North Clayton quarry	Surrounding lands (IV)
M-16	Silver Peak Road intersection with road to Klondike, views over Montezuma alternative segments 2 and 3	Surrounding lands (IV)
31[b]	Alignment crossing U.S. Highway 95 south of Goldfield, view south-southeast over Montezuma alternative segment 2	Surrounding lands (IV)
32	U.S. Highway 95 at State Route 266, view east over Montezuma alternative segments 1, 2, and 3	Surrounding lands (IV), State Route 266 (III), Stonewall Mountain (II)
33	U.S. Highway 95 at State Route 267, view north-northeast over common segment 5	Surrounding lands (IV), State Route 267 (III)
34	U.S. Highway 95 (typical cut), view toward common segment 5 hill cuts	Surrounding lands (IV)
35	U.S. Highway 95 north of Oasis Valley (typical landscape)	Surrounding lands (IV)
36	U.S. Highway 95 and Beatty Wash access road, view northeast to construction access road	Surrounding lands (IV)

a. Appendix D contains photographs taken from each key observation point.
b. Key observation points M-1 through M-16 are unique to the Mina rail alignment. Points 31 through 36 are along the portion of the Mina rail alignment that is the same as the Caliente rail alignment and DOE has not renumbered them for the Mina analysis.
c. Sources: DIRS 155970-DOE 2002, pp. 3-158 and 3-159; DIRS 173224-BLM 1997, pp. 6, 7, and 27, and Map 8; DIRS 103079-BLM 1998, Map 2-9; DIRS 101811-DOE 1996, pp. 4-152 to 4-154; DIRS 179571-Knight 2007, all.
d. Key observation point is located on the Walker River Paiute Reservation.

3.3.3.3.2 Specific Visual Settings and Characteristics along Alternative Segments and Common Segments

3.3.3.3.2.1 Union Pacific Railroad Hazen Branchline. The Mina rail alignment would begin on an existing Union Pacific Railroad branchline near Hazen, Nevada. This existing rail segment crosses primarily Class III areas between Alternate U.S. Highway 50 and the former town site of Wabuska. The existing Union Pacific Railroad Hazen Branchline borders the boundaries of the Lahontan State Recreation Area and Fort Churchill State Historic Park, both considered Class III areas for this analysis.

Because DOE does not anticipate that it would make any modifications to this existing rail line (except during routine maintenance during the operations phase), DOE did not select key observation points along this portion of the Mina rail alignment. Figure 3-177 shows the existing line south of this segment through the Walker River Paiute Reservation as a point of reference for the appearance of an existing rail line in this general area.

3.3.3.3.2.2 Department of Defense Branchline North (Existing Rail Line from Wabuska to the Boundary of the Walker River Paiute Reservation). This existing rail line extends from the former town site of Wabuska to near the boundary of the Walker River Paiute Reservation. Along its route, the line borders the Mason Valley Wildlife Management Area. Department of Defense Branchline North passes exclusively through Class III areas.

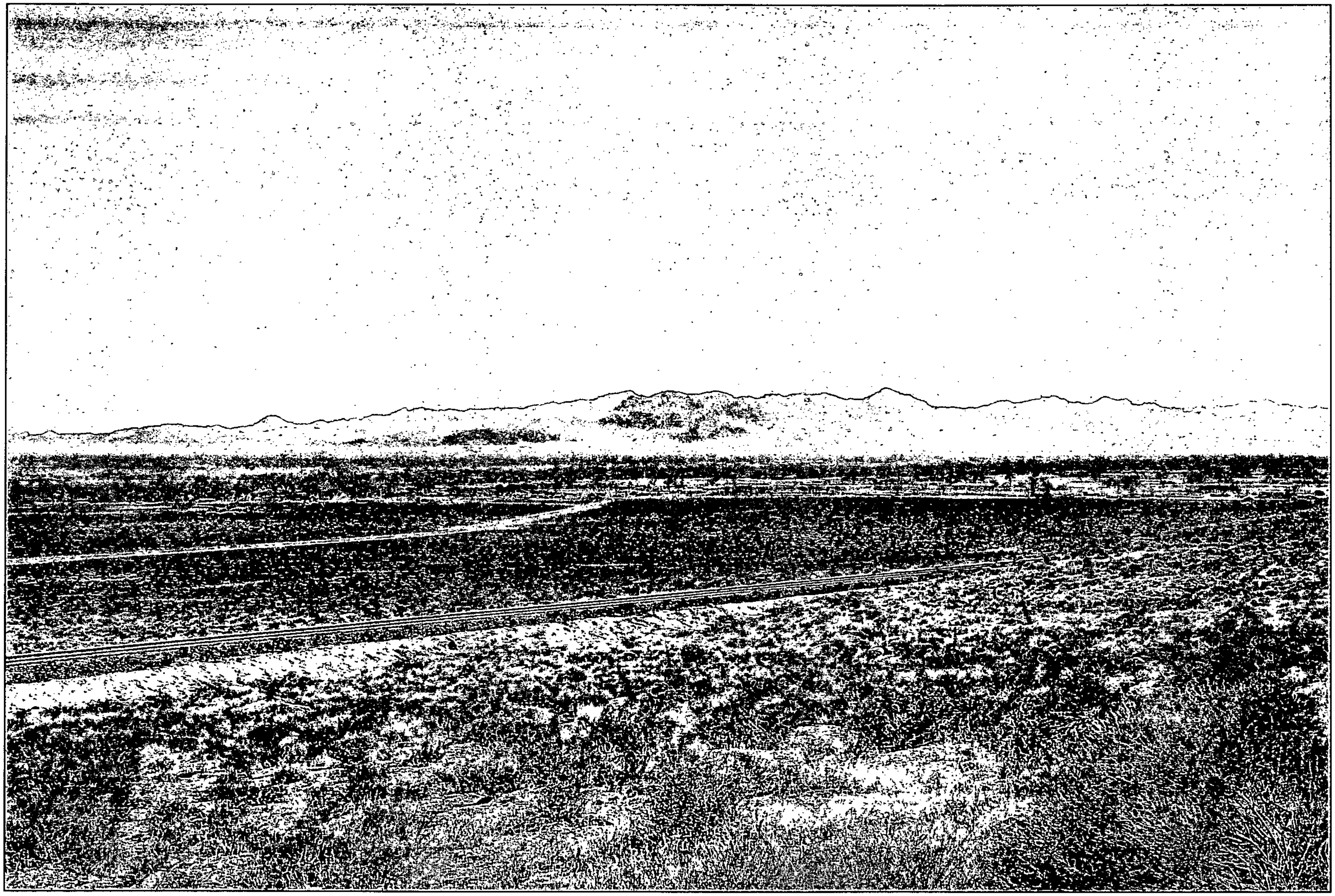


Figure 3-177. View from Alternate U.S. Highway 95 along the existing Department of Defense Branchline through Schurz on the Walker River Paiute Reservation.

Because DOE does not anticipate that it would make any modifications to this existing rail line (except during routine maintenance during the operations phase), DOE did not select key observation points along this portion of the Mina rail alignment. Figure 3-177 shows the existing line south of this segment through the Walker River Paiute Reservation as a point of reference for the appearance of an existing rail line in this general area.

3.3.3.3.2.3 Schurz Alternative Segments (Walker River Paiute Reservation). The Schurz alternative segments would cross exclusively through areas considered Class III by DOE for the purpose of this analysis, primarily on the Walker River Reservation. At present, Department of Defense Branchlines North and South are linked by a rail line that runs near the western bank of the Walker River through the Reservation and the town of Schurz. DOE would remove this existing section of rail line, leaving the railbed and structures such as bridges and culverts in place. Figure 3-177 provides a view of this section of existing rail line from Alternate U.S. Highway 95.

Each Schurz alternative segment would begin in Campbell Valley west of the Walker River and south of the Desert Mountains, but each would take a different route shortly after crossing the Walker River.

Schurz alternative segment 1 would run east of the Walker River, passing within 1 kilometer (0.6 mile) of the Weber Reservoir. The alternative segment would travel through the Walker River Valley along the southeastern edge of the Calico Hills and around the northern end of the Gillis Range.

Schurz alternative segment 4 would run east of the Walker River, passing within 1 kilometer (0.6 mile) of the Weber Reservoir. The alternative segment would pass near the Calico Hills, and would travel east between the Terrill Mountains and the Calico Hills and around the northern end of the Gillis Range.

Schurz alternative segment 5 would skirt the southern edge of the Desert Mountains before crossing into Long Valley. From there, the alternative segment would run south down Long Valley and travel east between the Terrill Mountains and the Calico Hills and around the northern end of the Gillis Range.

Schurz alternative segment 6 would pass the southern edge of the Desert Mountains before crossing into Long Valley. The alternative segment would cross the Terrill Mountains into Rawhide Flats and travel east between the Terrill Mountains and the Calico Hills and around the northern end of the Gillis Range. Each Schurz alternative segment would connect to Department of Defense Branchline South near the northern edge of the Gillis Range.

Key observation points from U.S. Highway 95 include views toward the road-over-rail crossing of Schurz alternative segment 2 (M-4), north toward the road-over-rail crossing of Schurz alternative segment 5 in Long Valley (M-3), north toward the rail-over-road crossing of Schurz alternative segment 6 in the Terrill Mountains (M-2), southeast over Schurz alternative segment 6 crossing Rawhide Flats along the base of the Terrill Mountains (M-1), and south toward the road-over-rail crossing of Schurz alternative segment 1 in the Walker River Valley (M-5). A final point, east of the town of Schurz, looks northeast from Double Springs Road toward the ***at-grade crossing*** of Schurz alternative segment 1 (M-6).

3.3.3.3.2.4 Department of Defense Branchline South (Existing Rail Line, Walker Lake Area). Department of Defense Branchline South is an existing rail line extending south toward Walker Lake east of the Walker River. It comes no closer than 0.40 kilometer (.25 mile) from the shore as it traces the eastern edge of Walker Lake and proceeds southeast toward the Hawthorne Army Depot on the outskirts of the town of Hawthorne. The area around the Walker River north of the lake and the area around the Hawthorne Army Depot south of the lake are considered Class III areas. The eastern and western shores of Walker Lake are Class II areas. The existing rail line crosses the Class II lands on the eastern shore of the lake for 18 kilometers (11 miles).

A key observation point, in the town of Walker Lake on the western shore of Walker Lake, provides a view east over the lake toward the existing line (M-7). DOE chose this point to show the appearance of the existing rail line from the more heavily traveled western shore of Walker Lake and to demonstrate the view of an existing rail line at a distance (approximately 8 kilometers [5 miles]).

3.3.3.3.2.5 Mina Common Segment 1 (Hawthorne Army Depot to Blair Junction). Mina common segment 1 would cross through Class III lands as it heads southeast from Hawthorne between the Gabbs Valley Range and the Garfield Hills, and then south on the western side of the Pilot Mountains toward the Monte Cristo Range. Common segment 1 would then pass through Class IV areas as it passed the west and southwestern sides of the Monte Cristo Range. Key observation points provide views from U.S. Highway 95 looking west toward the potential Garfield Hills quarry site (M-8), from the town of Luning looking east toward Mina common segment 1 and the potential Gabbs Range quarry site (M-9), from a residential area in the town of Mina looking east toward Mina common segment 1 (M-10), and views both west and north across Mina common segment 1 from the intersection of State Route 265 and U.S. Highway 95 (M-11).

3.3.3.3.2.6 Montezuma Alternative Segments. Each Montezuma alternative segment would begin near Blair Junction (at the intersection of State Route 265 and U.S. Highway 95).

The southwestern segment, Montezuma alternative segment 1, would first pass south through a Class III area running the length of State Route 265 to the town of Silver Peak, and then turn east through the Class IV Clayton Valley and Montezuma Range. Parts of the Clayton Ridge and Montezuma Ranges are Class II, and Montezuma alternative segment 1 would come within 2.4 kilometers (1.5 miles) of the Class II Clayton Ridge area as it crossed Clayton Valley and within 2.1 kilometers (1.3 miles) of the Class II areas in the Montezuma Range as it crossed those mountains. Montezuma alternative segment 1 would continue in Class IV areas as it traveled through the hills near the town of Goldfield to a location just south of the intersection of U.S. Highway 95 and State Route 266. The BLM manages State Route 266 west of U.S. Highway 95 as a Class III area.

Montezuma alternative segment 2 would proceed northeast through Class IV areas along the Monte Cristo Range, and would come within 4 kilometers (2.5 miles) of the Class II Lone Mountain area. Montezuma alternative segment 2 would then cross exclusively through Class IV lands as it traveled south through the Montezuma Valley west of Tonopah to the hills near the town of Goldfield, then through Stonewall Flats near the border of the Nevada Test and Training Range, and finally west of Stonewall Mountain to just south of the intersection of U.S. Highway 95 and State Route 266. Montezuma alternative segment 2 would come no closer than 6.9 kilometers (4.3 miles) to the Class II Stonewall Mountain area.

Montezuma alternative segment 3 would proceed northeast through Class IV areas along the Monte Cristo Range, and would come within 4 kilometers (2.5 miles) of the Class II Lone Mountain area. Montezuma alternative segment 2 would then cross exclusively through Class IV lands as it traveled south through the Montezuma Valley west of Tonopah. Before leaving Montezuma Valley, the alternative segment would turn west into the Class IV Montezuma Valley area and south between Clayton Ridge and the Montezuma Range. Montezuma alternative segment 3 would come within 2.1 kilometers (1.3 miles) of the Class II areas in the Montezuma Range as it crossed those mountains. Montezuma alternative segment 3 would continue in Class IV areas as it traveled through the hills near the town of Goldfield to a location just south of the intersection of U.S. Highway 95 and State Route 266. The BLM manages State Route 266 west of U.S. Highway 95 as a Class III area.

Key observation points with views over Montezuma alternative segment 1 include the intersection of U.S. 95 and State Route 265 looking south (M-11), the main street in the town of Silver Peak looking east (M-14), and Silver Peak Road looking east (M-15). Key observation points with views over Montezuma alternative segments 2 and 3 are on U.S. Highway 95 looking west toward the proposed rail segment and

Lone Mountain (M-12), U.S. Highway 95 west toward the proposed rail segment and the Maintenance-of-way Facility (M-13), and Silver Peak Road east toward the proposed rail segment (M-16). A key observation point shows where Montezuma alternative segment 2 would cross U.S. Highway 95 at the south end of the town of Goldfield (31). A key observation point provides a view from the intersection of U.S. Highway 95 and State Route 266 over Montezuma alternative segments 1, 2, and 3 toward Stonewall Mountain (32).

3.3.3.3.2.7 Mina Common Segment 2 (Stonewall Flat Area). Common segment 2 would begin west of Stonewall Mountain and south of the intersection of U.S. Highway 95 and State Route 266. Mina common segment 2 would be in Class IV land and would never pass closer than 6.9 kilometers (4.3 miles) to the Class II Stonewall Mountain area.

Note: At this point, the Mina rail alignment becomes the same as the Caliente rail alignment. Although descriptions of the remaining alternative segments and common segments are the same as for the Caliente rail alignment, DOE has repeated them here for continuity. There are no Mina common segments numbered 3 and 4; instead, DOE has retained the numbering (common segments 5 and 6) used in the description of the Caliente alternative segment.

3.3.3.3.2.8 Bonnie Claire Alternative Segments. The Bonnie Claire alternative segments would cross Class IV lands to the southwest of the Nevada Test and Training Range and past Scotty's Junction at the intersection of U.S. Highway 95 and State Route 267, which the BLM manages as a Class III area west of U.S. Highway 95. A key observation point at Scottys Junction provides a view northeast toward the alternative segments (33).

3.3.3.3.2.9 Common Segment 5 (Sarcobatus Flat Area). Common segment 5 would cross Class IV land between the Bonnie Claire area and the Oasis Valley area. There are no visual resources of concern along this common segment and, therefore, no key observation points.

3.3.3.3.2.10 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would cross Class IV areas through Oasis Valley. A key observation point (35) is located north of Springdale, looking east over the Oasis Valley, showing a typical landscape. A key observation point (34) provides a view of a typical cut.

3.3.3.3.2.11 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would pass from the Oasis Valley area, near Beatty and across Beatty Wash, through the Nevada Test Site to the Yucca Mountain Site. State Route 374, entering Beatty, is a Class III area. Common segment 6 would cross approximately 10 kilometers (6.2 miles) of Class III lands before it entered the Nevada Test Site, but the segment is more than 15 kilometers (9.3 miles) from U.S. Highway 95 in this section. Land on the Nevada Test Site is not under BLM jurisdiction. Land on the Nevada Test Site that is visible from U.S. Highway 95 and which the rail alignment would cross is considered Class IV in this evaluation. A key observation point (36) is located north of Beatty, with views from U.S. Highway 95 over the Class IV lands surrounding the access road to Beatty Wash. The viewshed within the wash is considered a contributing element to cultural resources within the wash that are important to American Indians (DIRS 174205-Kane et al. 2005, p. 17). Beatty Wash and the rail alignment through it would not be visible from the highway. Therefore, DOE did not select key observation points in this area.

3.3.4 AIR QUALITY AND CLIMATE

This section describes the present air quality and climate characteristics along the Mina rail alignment and summarizes information from ***ambient air*** monitoring and meteorological data collection in the region. Section 3.3.4.1 describes the region of influence for air quality and climate; Section 3.3.4.2 describes general air quality characteristics in the Mina rail alignment region of influence; and Section 3.3.4.3 describes the climate characteristics in the Mina rail alignment region of influence.

3.3.4.1 Region of Influence

The region of influence of air quality and climate along the Mina rail alignment includes a small portion of Churchill County near Hazen, Lyon, Mineral (including the Walker River Paiute Reservation), Esmeralda, and Nye Counties. Historic data on pollutant emissions inventories and compliance status for the State of Nevada are calculated at the county level, and these data provide a basis for determining existing air quality in the region of influence and for use in analyzing potential impacts to air quality (see Section 4.3.4).

However, air-emissions fixed-point sources such as quarries and linear sources such as operating railroads can subject certain locations (known as receptors; for example, population centers) to higher localized levels of pollutants than a regional analysis would suggest. Therefore, DOE also selected more focused study locations within the region of influence in which to assess air quality impacts on specific receptors. These locations are the population centers near the Mina rail alignment (Schurz, Hawthorne, Mina, and Silver Peak) and two potential quarry sites northeast of Luning (Gabbs Valley Range) and southwest of Goldfield (Malpais Mesa).

3.3.4.2 Existing Air Quality

Air quality is determined by measuring concentrations of certain pollutants in the atmosphere. The U.S. Environmental Protection Agency designates an area as being ***in attainment*** for a particular pollutant if ***ambient*** concentrations of that pollutant are below the National ***Ambient Air Quality Standards***. The pollutants regulated under the State of Nevada and National Ambient Air Quality Standards are ***ozone***, ***carbon monoxide***, ***nitrogen dioxide***, ***sulfur dioxide***, ***particulate matter*** (***PM_{10}*** and ***$PM_{2.5}$***), and lead. Collectively, these pollutants are referred to as ***criteria air pollutants***. Table 3-95 lists the National Ambient Air Quality Standards for both the primary public health standard and the secondary public welfare standards in comparison to State of Nevada Ambient Air Quality Standards.

Areas in violation of one or more of these standards are classified as ***nonattainment areas***. If there is not enough air quality data to determine the status of a remote or sparsely populated area, then the U.S. Environmental Protection Agency lists the area as unclassifiable. However, for regulatory purposes, unclassifiable areas are considered to be in attainment. All portions of the Mina rail alignment would be within areas classified as in attainment for all National Ambient Air Quality Standards.

The most representative air quality data for the northern portion of the Mina rail alignment (Churchill, Lyon, and Mineral Counties and the Walker River Paiute Reservation) consists of historical monitoring data collected at three locations: Schurz for particulate matter; the Fort Churchill Power Plant (near Wabuska) for carbon monoxide, nitrogen dioxide, and sulfur dioxide (DIRS 182287-Hoelscher 2007, all); and Fallon for ozone (DIRS 179933-State of Nevada 2007, all). The Schurz data are recent ambient air quality data collected and reported on the Tribal Environmental Exchange Network; the Fort Churchill Power Plant data was collected in preparation for a Prevention of Significant Deterioration

Table 3-95. State of Nevada and National Ambient Air Quality Standards[a] (page 1 of 2).

Pollutant[b]	Averaging time over which pollutant is measured	Nevada standards concentration[b]	National primary standards[b]	National secondary standards[b]	Notes regarding the air quality standard
Ozone	1 hour	0.12 ppm (235 μg/m^3)	None	None	Not to be exceeded where the general public has access.
	8 hours	None	0.08 ppm (195 μg/m^3)	Same as primary	The 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations must not be exceeded.
Ozone, Lake Tahoe Basin	1 hour	0.10 ppm (195 μg/m^3)	None	None	Not to be exceeded where the general public has access.
Carbon monoxide	8 hours	9 ppm (10,500 μg/m^3) for elevations less than 1,500 meters[c] above mean sea level 6 ppm (7,000 μg/m^3) for elevations greater than 1,500 meters above mean sea level	9 ppm (10,500 μg/m^3) at any elevation	None	Not to be exceeded more than once per year.
Carbon monoxide (at any elevation)	1 hour	35 ppm (40,500 μg/m^3)	35 ppm (40,500 μg/m^3)		
Nitrogen dioxide	Annual arithmetic mean	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	Same as primary	Not to be exceeded.
Sulfur dioxide	Annual arithmetic mean	0.03 ppm (80 μg/m^3)	0.03 ppm (80 μg/m^3)	None	Not to be exceeded.
	24 hours	0.14 ppm (365 μg/m^3)	0.14 ppm (365 μg/m^3)		Not to be exceeded more than once per year.
	3 hours	0.5 ppm (1,300 μg/m^3)	None	0.5 ppm (1,300 μg/m^3)	
Particulate matter as PM_{10}	Annual arithmetic mean	50 μg/m^3	None[d]	None[d]	The 3-year average of the weighted annual mean concentration at each monitor within an area.
	24 hours	150 μg/m^3	150 μg/m^3		Not to be exceeded more than once per year.[e]

Table 3-95. State of Nevada and National Ambient Air Quality Standards[a] (page 2 of 2).

Pollutant[b]	Averaging time over which pollutant is measured	Nevada standards concentration[b]	National primary standards[b]	National secondary standards[b]	Notes regarding the air quality standard
Particulate matter as $PM_{2.5}$	Annual arithmetic mean	None	15 $\mu g/m^3$	Same as primary	The 3-year average of the weighted annual mean concentration from single or multiple community-oriented monitors.
	24 hours	35 $\mu g/m^3$	35 $\mu g/m^3$		The 3-year average of the 98th percentile of 24-hr concentrations at each population-oriented monitor within an area.[f]
Lead[g]	Quarterly arithmetic mean	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	Same as primary	Not to be exceeded.
Hydrogen sulfide[g]	1 hour	0.08 ppm (112 $\mu g/m^3$)	None	None	Not to be exceeded.

a. Sources: Nevada Administrative Code Section 445B.22097 and 40 CFR 50.4 through 50.11.
b. PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers; ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter.
c. To convert meters to feet, multiply by 3.2808.
d. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006).
e. The 24-hour state standard is attained when the expected number of days per calendar year with a 24-hour average concentration above the standard is equal to or less than 1. The expected number of days per calendar year is based on an average of the number of exceedances per year for the last 3 years.
f. The 24-hour state standard is attained when the second highest of a 3-year rolling average of the 24-hour concentration at each monitor is less than the standard.
g. The proposed railroad would not emit lead or hydrogen; they are included here for completeness.

Permit Application for the Sierra Pacific Power Company during the late 1990s; and the nearest representative ozone data were data collected from Fallon by the Nevada Department of Environmental Protection. While the Fort Churchill air quality data are somewhat outdated, the little development or population growth in the region since that time strongly suggests that the Fort Churchill air quality data remains representative of the region in the vicinity of the Mina rail alignment. Additional air quality data are available, such as carbon monoxide from Minden and particulate matter from Fernley and Gardnerville, but these locations are more than 50 kilometers (30 miles), 18 kilometers (11 miles), and 50 kilometers, respectively, from the Mina rail alignment at its closest and are influenced by local emissions sources not representative of the region near the rail alignment.

The only gas-phase monitoring study made in the southern portion (Esmeralda and Nye Counties) of the Mina rail alignment is a special study at Yucca Mountain covering a 4-year period from October 1991 to September 1995 (DIRS 102877-CRWMS M&O 1999, all). The limited amount of air quality data reflects choices made by national and state agencies to focus monitoring resources either on population centers or pristine areas such as national parks. Additional data on particulate matter are available based on monitoring in the vicinity of Yucca Mountain from 1989 to 1997 (DIRS 102877-CRWMS M&O 1999, all; DIRS 102876-CRWMS M&O 1997, all; DIRS 147777-SAIC 1992, all; DIRS 147780-SAIC 1992, all), from three sites from 1998 to 2001 (DIRS 173738-DOE 2002, p. 42), and from two sites from 2002 through 2005 (DIRS 168842-DOE 2003, p. 42; DIRS 173740-DOE 2004, p. 36; DIRS 176801-Wills 2005, p. 38; DIRS 179948-DOE 2006, p. 40). While these data sets pertain to locations more than 110 kilometers (70 miles) from the Goldfield area, DOE believes they are representative of the ambient air quality along the southern portion of the Mina rail alignment, because no large emission sources or metropolitan areas are located in the region that would otherwise affect air quality. However, local natural sources of particulate matter, such as barren land or dry lake beds (such as Sarcobatus Flat), could generate higher localized concentrations of particulate matter.

In the vicinity of the southern portion of the Mina rail alignment, the closest location (other than the Yucca Mountain Site) for which there are recent air quality data is Pahrump, Nevada. However, Pahrump, which is in the extreme southern tip of Nye County, is 65 kilometers (40 miles) southeast of the Mina rail alignment and only monitors particulate matter. In recent years there have been exceedances of the National Ambient Air Quality Standards for particulate matter in Pahrump because there has been substantial construction activity and population growth in the Pahrump Valley. In September 2003, Pahrump entered into a Memorandum of Understanding (DIRS 178128-Nevada Division of Environmental Protection 2003, p. 5) with the U.S. Environmental Protection Agency, the State of Nevada, and Nye County to develop an air quality improvement plan, with quantified emission-reduction measures so that the emission reduction strategies will be adequate to ensure the area stays in attainment of the particulate matter standards and with the objective that the area would be in attainment by 2009. Pahrump has a background monitoring site intended to represent natural background concentrations of the northern Mojave Desert; however, some disturbed land in the vicinity of the monitor makes the site only representative of the local background in the Pahrump Valley. Because of Pahrump's distance from the Mina rail alignment and heavy construction activity and population growth, its air quality is not representative of the area of the Mina rail alignment.

Along the northern portion of the Mina rail alignment (Churchill, Lyon, and Mineral Counties, and the Walker River Paiute Reservation), the most representative air quality data was collected at three locations depending on the air pollutant. Particulate matter data for Schurz are available for the period 2004 to 2006 (DIRS 180073-Tribal Environmental Exchange Network 2007, all). Sierra Pacific Power Company collected data at the Fort Churchill Power Plant from January 1996 through May 1998; these data contain information on sulfur dioxide, nitrogen dioxide, and carbon monoxide (DIRS 182287-Hoelscher 2007, all). The nearest representative ozone information is data the Nevada Department of Environmental Protection collected at Fallon, Nevada, from 2000 through 2003 (DIRS 179933-State of Nevada 2007). Figure 3-178 shows meteorological and air quality monitoring station locations along the Mina rail alignment.

The Fort Churchill Power Plant data and the Nevada Bureau of Air Quality Planning data were designed to comply with the U.S. Environmental Protection Agency's *On-Site Meteorological Program Guidance for Regulatory Modeling Applications* (DIRS 101822-EPA 1987, all) and *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)* (DIRS 108989-EPA 1987, all).

DOE collected data from the Tribal Environmental Exchange Network. The data includes hourly meteorological and air quality monitoring data that starts in May 2003. Hourly air quality monitoring data includes PM_{10} and $PM_{2.5}$, using a method equivalent to the U.S. Environmental Protection Agency's integrated filter reference method, for continuous monitoring of PM_{10} and $PM_{2.5}$. DOE collected, processed, and conducted some limited quality assurance reviews on the meteorological and hourly air quality values to characterize the background PM_{10} and $PM_{2.5}$ concentration for the Walker River Paiute Reservation. To verify and assure the quality of the monitoring values, DOE performed statistical checks for reasonableness in the monitored values. Additionally, DOE prepared statistics on the rate of change to identify periods with possible equipment malfunction and remove data with extreme change in hourly concentrations.

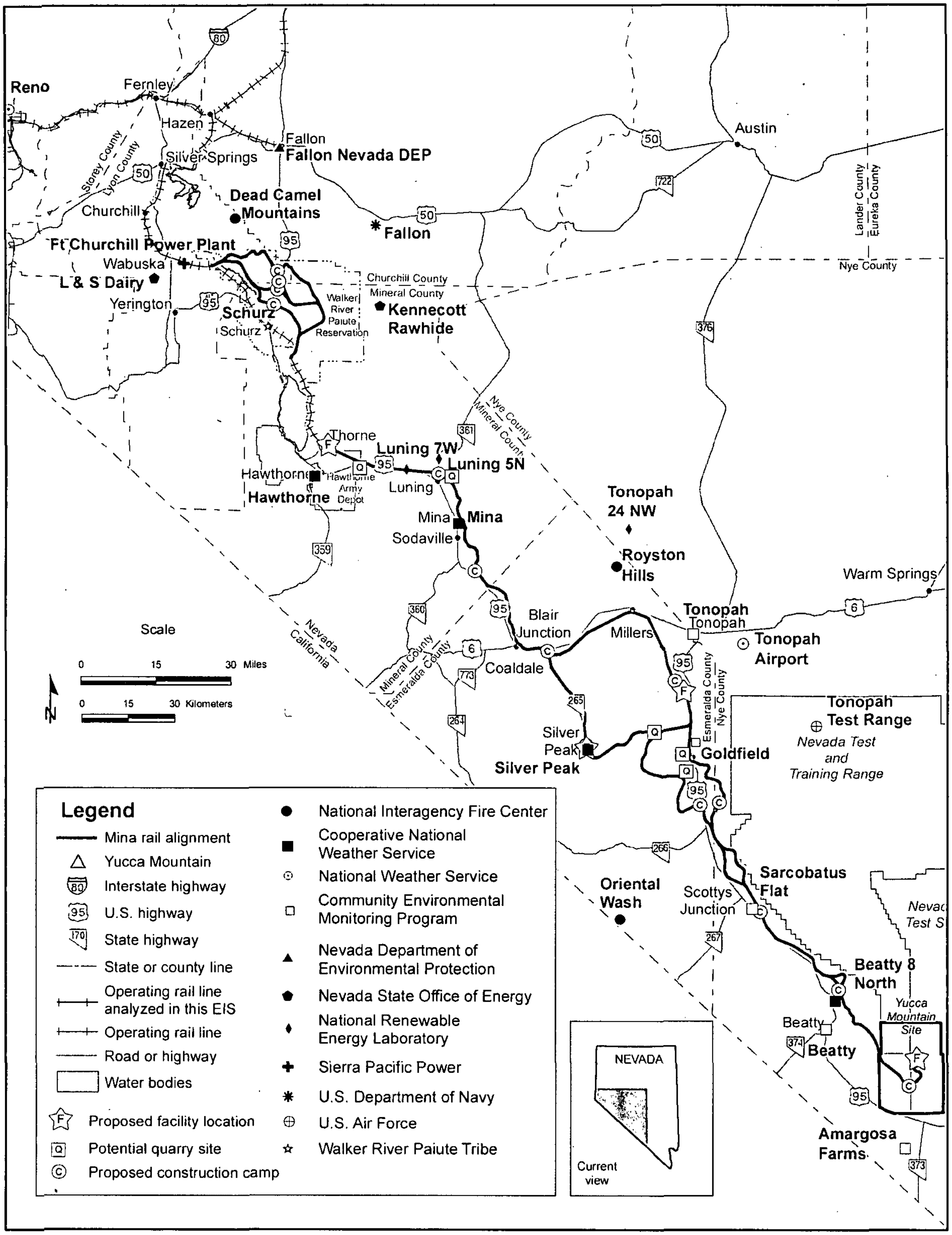


Figure 3-178. Meteorological and air monitoring stations along the Mina rail alignment.

DOE then screened the PM_{10} and $PM_{2.5}$ data for cases when the $PM_{2.5}$ was reported to be higher than the PM_{10} concentration. If the PM_{10} concentration was within three standard deviations of the mean hourly PM_{10} concentration, then the PM_{10} concentration was assumed correct and the $PM_{2.5}$ concentration set to missing; otherwise the PM_{10} was set to missing. After screening, DOE summarized both the PM_{10} and $PM_{2.5}$ concentrations for the daily and annual averages from the available dataset. To determine annual values, the Department determined quarterly averages of PM_{10} and $PM_{2.5}$ for those periods in which the hourly PM_{10} and $PM_{2.5}$ measurements, respectively, met a completeness criterion of at least 75 percent (DIRS 179932-EPA 1999, pp. 5 to 16).

Tables 3-96 through 3-98 summarize the particulate-matter air quality monitoring at Schurz, the air quality monitoring at Fort Churchill Power Plant, and the ambient ozone monitoring at Fallon, Nevada, respectively. These represent the best available information on the air quality along the northern portion of the Mina rail alignment. The second highest 24-hour and annual PM_{10} measurements were 99 and 23 micrograms per cubic meter, respectively. These measurements, made at Schurz in 2005, are approximately 66 and 46 percent of the national and state regulatory standard of 150 and 50 micrograms per cubic meter. Ambient concentrations of carbon monoxide, nitrogen dioxide, and sulfur dioxide measured at Fort Churchill were also well below the ambient air quality standards with their maximum percentages at 16, 8, and 18 percent of their respective national and state regulatory standards. For ozone there has been no exceedance of the 1- or 8-hour standard. The highest percentage was for the 8-hour ozone standard (0.08 parts per million), at 88 percent.

No ambient monitoring data were available for lead. However, DOE expects concentrations of lead to be far below the regulatory standard because there are no industrial sources in the region of influence (or near enough to transport this ***contaminant*** into the region of influence), and lead-based gasoline, previously the principal source of lead in the air, has been phased out.

Along the southern portion of the Mina rail alignment, the most representative data are from the DOE Environmental Safety and Health Department, which began air quality monitoring in the Yucca Mountain vicinity in 1989. The air quality network originally consisted of Sites YMP1 and YMP5; DOE added sites YMP6 and YMP9 in 1992.

Table 3-96. Maximum observed ambient air quality concentration at Schurz, Nevada (2004 to 2006) compared to the Nevada and National Ambient Air Quality Standards for particulate matter.[a,b]

Pollutant[c]	Averaging time	2004	2005	2006	High	Nevada and National Ambient Air Quality Standards
PM_{10}	24-hour highest	NA[d]	136	73	136	None
	24-hour second highest	NA	99	70	99	150
	Annual average	NA	23	11	23	50[e]
$PM_{2.5}$	24-hour 98th percentile	12	24	11	24[f]	35
	Annual average	3.4	3.9	5.4	5.4	15

a. Source: DIRS 180073-Tribal Environmental Exchange Network 2007, all.
b. Concentrations are shown in micrograms per standard cubic meter.
c. PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers.
d. NA = not applicable.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 Federal *FR* 60853, October 17, 2006). The Nevada state standard remains in effect and is reported here.
f. For comparison to the air quality standard, the three-year average is 16 micrograms per cubic meter.

Table 3-97. Fort Churchill maximum observed ambient gaseous air quality concentration in comparison to the Nevada Standards for Air Quality and the National Ambient Air Quality Standards (in parts per million by volume).[a]

Pollutant	Nevada and NAAQS[b]	(1/10/96 to 12/31/96)	(1/1/97 to 12/31/97)	(1/1/98 to 03/1/98)	(4/1/98 to 5/11/98)
Carbon monoxide	35 (1 hour)	1.1	1.8	0.8	0.5
	9[c] (8 hour)	1.0	1.4	0.7	0.4
Nitrogen dioxide	0.053 (annual)	0.004	0.004	0.002	NA[d]
Sulfur dioxide	0.50 (3 hour)	0.072	0.020	0.005	0.004
	0.14 (24 hour)	0.025	0.019	0.003	0.003
	0.03 (annual)	0.002	0.002	0.002	NA

a. Source: DIRS 182287-Hoelscher 2007, all.
b. NAAQS = National Ambient Air Quality Standards.
c. Nevada Standards for Air Quality: less than 5,000 feet above mean sea level.
d. NA = not applicable.

Table 3-98. Fallon, Nevada, highest 1-hour and fourth highest 8-hour observed ozone concentration in comparison to the Nevada Standards for Air Quality and the National Ambient Air Quality Standards (in parts per million by volume).[a]

Pollutant	Nevada and NAAQS[b]	2000	2001	2002	2003
Ozone	0.12 (1 hour)	0.080	0.070	0.070	0.080
	0.08 (8 hour)	0.070	0.059	0.058	0.067

a. Source: DIRS 179933-State of Nevada 2007.
b. NAAQS = National Ambient Air Quality Standards; Nevada, federal standard is for 8-hour; state standard is for 1-hour.

DOE designed the air quality and meteorological monitoring program to comply with the U.S. Environmental Protection Agency's *On-Site Meteorological Program Guidance for Regulatory Modeling Applications* (DIRS 101822-EPA 1987, all) and *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)* (DIRS 108989-EPA 1987, all), and with U.S. Nuclear Regulatory Commission meteorological monitoring guidance (ANSI/ANS-2.5-1984, *Standard for Determining Meteorological Information at Nuclear Power Sites* and Regulatory Guide 1.23, Rev. 0, *Onsite Meteorological Programs*).

DOE monitored the criteria gaseous pollutants of carbon monoxide, nitrogen dioxide, ozone, and sulfur dioxide at YMP1 from October 1991 through September 1995. DOE also monitored the concentration of PM_{10} at YMP1; the ambient air quality monitoring program included sampling of PM_{10} every sixth day, based on the U.S. Environmental Protection Agency's representative schedule of sampling.

YMP5, the second site measuring PM_{10}, represented background conditions away from site activities at Yucca Mountain. Measurements at YMP5 began in April 1989 and continued until 2002.

In October 1992, DOE added two sites to measure PM_{10}:

- YMP6, along the western border of the Nevada Test Site where the Test Site meets the U.S. Air Force land in upper Yucca Wash, measured particulate matter that might be transported from Midway Valley toward the northwest through Yucca Wash (discontinued in September 1999)
- YMP9, at Gate 510 on the southern border of the Nevada Test Site, north of Amargosa Valley

Tables 3-99 and 3-100 summarize the results of the particulate-matter air quality monitoring programs. More information on the results of the sampling program is available in *Environmental Baseline File for Meteorology and Air Quality* (DIRS 102877-CRWMS M&O 1999, all); *Meteorological Monitoring Program Particulate Matter Ambient Air Quality Monitoring Report January through December 1996* (DIRS 102876-CRWMS M&O 1997, all); *Particular Matter Ambient Air Quality Data Report for 1989 and 1990* (DIRS 147777-SAIC 1992, all); and *Particular Matter Ambient Air Quality Data Report for 1991* (DIRS 147780-SAIC 1992, all).

Between 1989 and 1997, the highest 24-hour PM_{10} measurement was 67 micrograms per cubic meter. This measurement, made at Site YMP5 in 1995, is approximately 45 percent of the regulatory standard of 150 micrograms per cubic meter (40 CFR 50.4 through 50.11). The second-highest value at any site, which is the regulatory level for an exceedance of the air quality standard, was 49 micrograms per cubic meter at Site YMP1 in 1990, which is 33 percent of the standard (the second-highest value would be used to determine whether there was a violation of the PM_{10} standard).

The annual averages were between 6 and 13 micrograms per cubic meter (Site YMP9 [1998] and Site YMP5 [1989], respectively), which is less than 30 percent of the Nevada annual standard (50 micrograms per cubic meter).

Table 3-100 lists the annual highest and second-highest 24-hour concentrations, and the annual average PM_{10} concentration for the period 1998 to 2005 for YMP1, YMP5, and YMP9, and shows the measured levels of ambient particulate matter were well below the federal and Nevada particulate-matter standards.

Table 3-101 lists YMP1 results for monitoring of gaseous criteria pollutants (carbon monoxide, nitrogen dioxide, ozone, and sulfur dioxide) for each year of the 4-year monitoring period (1991 to 1995); for comparison, the National Ambient Air Quality Standards are also shown.

Ambient concentrations of carbon monoxide and sulfur dioxide were below the threshold of reliable detection of the instrument. Nitrogen dioxide occasionally registered values of a few hundredths of parts per million by volume, typically associated with nearby vehicle activity. The number of hours per operating quarter with measurements above the threshold was between 1 hour and 161 hours, which occurred from October through December 1993. The results listed in Table 3-101 are expressed in the units of the applicable standard (annual average of nitrogen dioxide), and the listed values are based on the threshold of reliable detection for that instrument.

DOE believes these measurements of particulate matter, carbon monoxide, nitrogen dioxide, and sulfur dioxide are representative of the air quality along the southern portion of the Mina rail alignment (Esmeralda County and south) because the region of influence has no large emission sources or metropolitan areas that would otherwise affect its air quality. However, in areas close to barren land or dry lake beds, there could be higher particulate-matter concentrations.

Ozone was the only gaseous criteria pollutant to routinely register ambient levels above the instrument threshold. Ozone levels never exceeded the regulatory limit for the 1-hour average standard (0.12 parts per million by volume). The highest 1-hour average was 0.096 parts per million. Note that the 1-hour average standard was withdrawn in 2005, and has now been replaced with an 8-hour average standard (0.08 parts per million). Ozone is formed in the atmosphere under the presence of sunlight, nitrogen oxides, and ***volatile organic compounds***. Ozone typically has the highest concentrations during warm weather because strong sunlight and high temperatures are more conducive to higher ambient concentrations. Approximately 90 percent of the warm-season hours had concentrations between 0.020 and 0.060 parts per million; only 44 hours had concentrations in excess of 0.080 parts per million.

Table 3-99. Summary of PM_{10} concentrations at sites in the vicinity of Yucca Mountain (1989 to 1997).[a,b,c]

Sampler	Averaging time	1989	1990	1991	1992	1993	1994	1995	1996	1997	High
Site YMP1	24-hour highest	41	62	33	30	30	39	21	60	31	62
	Second highest	27	49	25	24	22	26	20	23	21	49
	Annual average	12	12	10	12	10	10	10	10	9	12
Site YMP5	24-hour highest	40	51	45	49	21	42	67	57	26	67
	Second highest	38	43	33	27	20	23	21	35	19	43
	Annual average	13	10	10	12	9	9	10	10	9	13
Site YMP6	24-hour highest	NA	NA	NA	NA	21	25	14	32	59	59
	Second highest	NA	NA	NA	NA	21	20	13	21	18	21
	Annual average	NA	NA	NA	NA	9	7	7	9	8	9
Site YMP9	24-hour highest	NA	NA	NA	31	21	39	15	57	29	57
	Second highest	NA	NA	NA	31	21	19	14	28	19	31
	Annual average	NA	NA	NA	NA	9	8	7	10	8	10

a. Sources: DIRS 102877-CRWMS M&O 1999, p.13; DIRS 102876-CRWMS M&O 1997, p.13; DIRS 147777-SAIC 1992, p.13; DIRS 147780-SAIC 1992, p.13.
b. Concentrations are shown in micrograms per standard cubic meter ($\mu g/m^3$).
c. PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; NA = samples were not taken during the corresponding monitoring period.

Table 3-100. Summary of PM_{10} concentrations at sites in the vicinity of Yucca Mountain (1998 to 2005).[a,b,c]

Sampler	Averaging time	1998	1999	2000	2001	2002	2003	2004	2005	High
Site YMP1	24-hour highest	30	18	38	23	52	33	24	32	52
	Second highest	17	34	34	19	37	17	19	29	37
	Annual average	8	8	11	8	10	8	8	9	11
Site YMP5	24-hour highest	26	24	45	27	NA	NA	NA	NA	45
	Second highest	18	21	39	25	NA	NA	NA	NA	39
	Annual average	7	8	12	10	NA	NA	NA	NA	12
Site YMP9	24-hour highest	22	18	36	22	43	39	27	26	43
	Second highest	20	17	33	19	39	38	21	26	39
	Annual average	6	8	11	9	10	11	9	9	11

a. Sources: DIRS 173738-DOE 2002, p. 42; DIRS 168842-DOE 2003, p. 44; DIRS 173740-DOE 2004, p. 36; DIRS 176996-DOE, 2005, p. 38; DIRS 179948-DOE 2006, p. 40.
b. Concentrations are shown in micrograms per standard cubic meter ($\mu g/m^3$).
c. PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; NA = samples were not taken during the corresponding monitoring period.

Table 3-101. Site YMP1 maximum observed ambient gaseous air quality concentration in comparison to the Nevada Standards for Air Quality and the National Ambient Air Quality Standards (in parts per million by volume).[a]

Pollutant	Nevada and NAAQS[b]	Year 1 (10/91 to 9/92)	Year 2 (10/92 to 9/93)	Year 3 (10/93 to 9/94)	Year 4 (10/94 to 9/95)
Carbon monoxide	35 (1 hour)	0.2	0.2	0.2	0.2
	9[c] (8 hour)	0.2	0.2	0.2	0.2
Nitrogen dioxide	0.053 (annual)	0.0020	0.0020	0.0021	0.0021
Ozone[d] (for Nevada ambient air quality only)	0.12 (1 hour) 0.08 (8 hour)	0.096 (1 hour)	0.093 (1 hour)	0.081 (1 hour)	0.083 (1 hour)
Sulfur dioxide	0.50 (3 hour)	0.002	0.002	0.002	0.002
	0.14 (24 hour)	0.002	0.002	0.002	0.002
	0.03 (annual)	0.002	0.002	0.002	0.002

a. Source: DIRS 102877-CRWMS M&O 1999, p.14; 40 CFR 50.4 through 50.11.
b. NAAQS = National Ambient Air Quality Standards.
c. Nevada Standards for Air Quality: less than 5,000 feet above mean sea level.
d. The 1-hour ozone standard of 0.12 parts per million, in place during the listed years, was phased out in 2005 and replaced with an 8-hour ozone standard of 0.08 parts per million.

Available data for Death Valley National Park (for 1995 to 2004), 50 kilometers (30 miles) to the west of the southern portion of the Mina rail alignment, reported a highest 1-hour average concentration of 0.095 parts per million (DIRS 176115-EPA 2005, all), which is similar to the ozone values measured at Yucca Mountain. Ozone concentrations to the east are anticipated to be even lower because of their greater distance from emission sources.

Again, no ambient monitoring data were available along the southern portion of the rail alignment for lead. However, DOE expects concentrations of lead to be far below the regulatory standard because there are no industrial sources in the region of influence (or near enough to transport this contaminant into the region of influence), and lead-based gasoline, previously the principal source of lead in the air, has been phased out.

No ambient monitoring data were available for $PM_{2.5}$ and PM_{10}, but $PM_{2.5}$ can be estimated from measurements of ambient PM_{10}. In the region of influence, nearly all PM_{10} would be generated from the resuspension of surface-level soil and mineral materials. A U.S. Department of Agriculture study on wind erosion in the western United States found that over all soils, the fraction of PM_{10} as $PM_{2.5}$ was about 15 percent, ranging from 10 to 30 percent (DIRS 173838-Hagen 2001, p. 1). To be conservative, DOE applied the upper end of this range (30 percent) to the ambient PM_{10} data collected at Yucca Mountain (Sites YMP1, YMP5, and YMP9), and the resulting data indicated the highest expected 24-hour concentration of $PM_{2.5}$ would be 16 micrograms per cubic meter, and the highest expected annual average concentration would be 4 micrograms per cubic meter. These figures are 46 and 26 percent of the standards for $PM_{2.5}$. Table 3-102 summarizes these results and indicates that $PM_{2.5}$ would be well below the National Ambient Air Quality Standards at all locations along the Mina rail alignment.

3.3.4.3 Climate

The Mina rail alignment would cross desert and ***semi-desert*** areas that generally have abundant hours of cloud-free days, low annual precipitation, and large daily ranges in temperature.

Table 3-102. Maximum observed ambient air quality concentration at sites in the vicinity of Yucca Mountain (1998 to 2003) compared to the National Ambient Air Quality Standards for particulate matter.[a,b,c]

Sampler	Nevada and NAAQS[d]	1998	1999	2000	2001	2002	2003	2004	2005	High
PM_{10}	24 hour: 150	30	24	45	27	52	39	27	32	52
	Annual: 50[e]	8	8	12	10	10	11	9	9	12
Estimated[f] $PM_{2.5}$	24 hour: 35	9	7	14	8	16	12	8	10	16
	Annual: 15	2	2	4	3	3	3	3	3	4

a. Sources: DIRS 173738-DOE 2002, p. 42; DIRS 168842-DOE 2003, p. 44; DIRS 173740-DOE 2004, p. 36; DIRS 176996-DOE, 2005, p. 38; DIRS 179948-DOE 2006, p. 40; and 40 CFR 50.4 through 50.11.
b. PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers.
c. Concentrations are shown in micrograms per standard cubic meter.
d. NAAQS = National Ambient Air Quality Standards.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18th, 2006 (71 Federal *FR* 60853, October 17, 2006).
f. Estimated based on upper-end range of PM_{10} data assuming 30 percent of PM_{10} is $PM_{2.5}$ (DIRS 173838-Hagen 2001, p 1).

To characterize the existing climate, DOE collected meteorological data from 41 meteorological monitoring stations within the Mina rail alignment region of influence (see Figure 3-178 and Table 3-103).

The following eight groups operated these stations:

- National Oceanic and Atmospheric Administration
- Community Environmental Monitoring Program
- DOE Environment, Safety and Health Programs Department Network
- Tribal Environmental Exchange Network
- National Renewable Energy Laboratories
- Nevada State Office of Energy
- National Interagency Fire Center - Remote Automated Weather Station
- U.S. Air Force

The Meteorological Data Acquisition Network is a network of meteorological stations operated by the National Oceanic and Atmospheric Administration, Air Resources Laboratory/Special Operations and Research Division. The Community Environmental Monitoring Program is a joint effort between the DOE Nevada Operations Office, the University of Nevada Desert Research Institute, and the Community College System of Nevada, and is a network of monitoring stations in communities surrounding the Nevada Test Site that check the ***environment*** for ***radioactivity*** and check a variety of meteorological parameters. The Walker River Paiute Reservation station is part of a national network of meteorological stations operated by each tribe and is reported through the Tribal Environmental Exchange Network. The National Renewable Energy Laboratories supports the collection of wind data operated by the Desert Research Institute for potential site locations for wind energy development. The Nevada State Office of Energy operates a similar program for the collection of wind monitoring data on potential site locations for wind energy development. The Remote Automated Weather Station operated by the National Interagency Fire Center is a network of meteorological stations that monitor weather data that assists land management agencies with a variety of efforts primarily directed at rating fire danger. The U.S. Air Force has historically operated a meteorological station from time to time on the Nevada Test and Training Range at the Tonopah Test Range and archives this data with the Air Force Combat Climatology Center.

Table 3-103. Meteorological stations in the Mina rail alignment air quality and climate region of influence[a,b] (page 1 of 2).

Station name	Elevation (in meters)[c]	Source	Wind data
Reno	1,341	WRCC	Yes
Fallon	1,199	WRCC	Yes
Dead Camel Mtn	1,369	RAWS	Yes
L & S Dairy	1,323	NSOE	Yes
Kennecott Rawhide	1,555	NSOE	Yes
Schurz	1,280	TREX	Yes
Hawthorne	1,286	WRCC	NA
Luning 7W	1,355	NREL	Yes
Luning 5N	1,524	NREL	Yes
Mina	1,386	WRCC	NA
Tonopah 24NW	1,535	NREL	Yes
Royston Hills	1,555	RAWS	Yes
Tonopah	1,836	CEMP	Yes
Tonopah Airport	1,655	WRCC	NA
Silverpeak	1,298	WRCC	NA
Goldfield	1,734	CEMP	Yes
Tonopah Test Range	1,691	Air Force	Yes
Sarcobatus Flat	1,226	CEMP	Yes
Oriental Wash	1,250	RAWS	Yes
Beatty 8 North	1,082	WRCC	NA
Beatty	1,007	CEMP	Yes
Amargosa Farms	746	CEMP	Yes
Mercury	1,009	WRCC	Yes
07	1,663	MEDA	NA
14	1,432	MEDA	NA
18	1,533	MEDA	NA
21	1,512	MEDA	NA
24	1,505	MEDA	NA
25	835	MEDA	NA
26	1,133	MEDA	NA
27	1,370	MEDA	NA
42	880	MEDA	NA
NTS 60 (YMP1)	1,136	DOE	NA
Gate 510 (YMP9)	838	DOE	NA
Fortymile Wash (YMP5)	952	DOE	NA
Knothead Gap (YMP8)	1,130	DOE	NA
Sever Wash (YMP7)	1,080	DOE	NA
Yucca Mountain (YMP2)	1,478	DOE	NA
Coyote Wash (YMP3)	1,278	DOE	NA

Table 3-103. Meteorological stations in the Mina rail alignment air quality and climate region of influence[a,b] (page 2 of 2).

Station Name	Elevation (in meters)[c]	Source	Wind data
Alice Hill (YMP4)	1,234	DOE	NA
WT-6 (YMP6)	1,315	DOE	NA

a. Sources: DIRS 165987-WRCC 2002; DIRS 180073-Tribal Council Exchange Network 2007, all.
b. CEMP = Community Environmental Monitoring Program; DOE = DOE Environment, Safety and Health Programs Department Network; MEDA = Meteorological Data Acquisition Network; NREL = National Renewable Energy Laboratory; RAWS = Remote Automated Weather Station, NSOE = Nevada State Office of Energy; NA = not available; NTS = Nevada Test Site; WRCC = Western Regional Climate Center; YMP = Yucca Mountain Project, TREX = Tribal Environmental Exchange Network.
c. To convert meters to feet, multiply by 3.2808.

DOE acquired data not directly available through these programs through the Western Regional Climate Center (DIRS 165987-WRCC 2002, all), which maintains historical climate databases for most of the climate stations and operational National and Military Weather Service stations throughout the western United States, including a network of stations that collect daily climate observations.

Table 3-103 lists the stations and their respective elevations in the Mina rail alignment air quality and climate region of influence. All stations collected temperature and precipitation data, and Table 3-103 also identifies those stations that collected wind speed and direction data. The range of elevations over which weather data were collected is approximately the same as the elevation range of the Mina rail alignment – from 747 meters (2,450 feet) at the Amargosa Farms Station to 1,836 meters (6,023 feet) at Tonopah.

The Mina rail alignment would cross a variety of topographic features, ranging from mountain passes to sage-covered deserts. The alignment elevations range from 1,280 meters (4,200 feet) near Schurz in Mineral County to 1,860 meters (6,090 feet) at Goldfield Summit in Esmeralda County and back down to 1,080 meters (3,540 feet) near the end of the Mina Rail Alignment at Yucca Mountain. These elevation changes drive a wide variation in temperature and precipitation.

From north to south, the Mina rail alignment would lie within and be exposed to the climatic conditions of Churchill, Lyon, Mineral (including the Walker River Paiute Reservation, the bulk of which lies within Mineral County), Esmeralda, and Nye Counties, as described in Sections 3.3.4.3.1 through 3.3.4.3.5. The climate discussion that follows is based on the climatic data collected from the sites listed in Table 3-103.

3.3.4.3.1 Churchill County

A small portion of the Mina rail alignment would cross through western Churchill County, at an elevation of approximately 1,200 meters (4,000 feet). Annual average temperature in this portion of Churchill County is approximately 13° Celsius (55° Fahrenheit). Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer. Daily temperature variations are smaller during the winter. Summertime mean maximum temperatures are approximately 33° Celsius (92° Fahrenheit), and are accompanied by low relative humidity (commonly less than 10 percent). Winter mean minimum temperatures are approximately minus 5° Celsius (23° Fahrenheit) in December and January.

Precipitation occurs about equally throughout the year although slightly more occurs during the winter (November through March). Average annual precipitation is less than 130 millimeters (5 inches), but daily precipitation levels can be as high as 25 millimeters (1 inch), and historical maximums have exceeded 50 millimeters (2 inches) per day. Occasional summer thunderstorms can produce heavy rains that can cause flash floods. From November through April, precipitation might fall as snow. Mean average total snowfall is about 150 millimeters (6 inches).

Local topography influences winds in western Churchill County along the Mina rail alignment. Wind speeds are highest in the spring and occasionally generate dust storms. Annual average wind speed is 2.8 meters per second (6.3 miles per hour), with calm conditions (wind speeds of less than 0.58 meter per second [1.3 miles per hour]) occurring about 20 percent of the time.

3.3.4.3.2 Lyon County

The Mina rail alignment would cross through Lyon County from just west of the Lahontan Dam around Silver Springs and then past Wabuska and the Fort Churchill siding. The area lies to the east of the moisture-trapping Sierra Nevada Mountains. Mina rail alignment elevations through the county would range from about 1,200 meters (3,900 feet) to about 1,300 meters (4,300 feet). This area experiences abundant hours of cloud-free days, low annual precipitation (less than 150 millimeters [6 inches] per year), and large diurnal ranges in temperature.

Within Lyon County, the mean annual temperature along the Mina rail alignment is approximately 13° Celsius (55° Fahrenheit) north of Wabuska; south of Wabuska, temperatures are moderated due to cold air drainage along the Walker River, with a mean annual air temperature of 10° Celsius (50° Fahrenheit). Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer. Summertime mean maximum temperatures are approximately 41° Celsius (105° Fahrenheit); while in the vicinity of the Walker River they average approximately 34° Celsius (93° Fahrenheit). Winter mean minimum temperatures are approximately minus 12° Celsius (10° Fahrenheit) north of Wabuska, while in the vicinity of the Walker River they average approximately minus 8.9° Celsius (16° Fahrenheit). Annual precipitation in Lyon County averages less than 150 millimeters (6 inches) per year, with higher amounts found at higher elevations and lower amounts at lower elevations. During the summer, occasional thunderstorms can produce heavy rains and cause flash floods. Daily precipitation levels have occasionally exceeded 25 millimeters (1 inch), but generally are much less. Precipitation from November through April might fall as snow, particularly at higher elevations. Snowfall averages are around 76 to 180 millimeters (3 to 7 inches).

Local topography in Lyon County strongly influences winds along the Mina rail alignment. Local winds are generally channeled by topography, with prevailing wind direction oriented along valley axes. Highest wind speeds occur in the spring, and occasionally generate dust storms. Annual average wind speeds are around 2.3 meters per second (5.1 miles per hour), with calm conditions occurring more than 30 percent of the time, mostly during the night.

3.3.4.3.3 Mineral County and the Walker River Paiute Reservation

The Mina rail alignment would cross through Mineral County and the Walker River Paiute Reservation from just east of the Ft. Churchill Siding and then around Schurz and Walker Lake to Redlich Summit. The area lies to the east of the moisture-trapping Sierra Nevada Mountains. Elevations of the alignment through the county and reservation would range from about 1,300 meters (4,300 feet) to about 1,500 meters (5,000 feet). This area experiences abundant hours of cloud-free days, low annual precipitation (less than 250 millimeters [10 inches] per year), and large diurnal ranges in temperature.

Within Mineral County and the Walker River Paiute Reservation, the mean annual temperature along the Mina rail alignment in the vicinity of the Walker River is approximately 11° Celsius (52° Fahrenheit); south of Walker Lake the mean air temperature is slightly warmer at 13° Celsius (55° Fahrenheit). This is due to the absence of the nighttime cold air drainage winds along the Walker River. Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer. Summertime mean maximum temperatures are approximately 34° Celsius (93° Fahrenheit) at northerly locations and around 36° Celsius (96° Fahrenheit) at southerly locations, and are accompanied by low relative humidity (commonly less than 10 percent). Winter mean minimum temperatures are approximately minus 8° Celsius (17° Fahrenheit) in the vicinity of Walker River and minus 6° Celsius (22° Fahrenheit) in the southern portion of the county.

Annual precipitation in Mineral County and the Walker River Paiute Reservation averages less than 130 millimeters (5 inches) per year, with higher amounts at higher elevations and lower amounts at lower elevations. During the summer, occasional thunderstorms can produce heavy rains and cause flash floods. Daily precipitation levels have occasionally exceeded 50 millimeters (2 inches), but generally are much less than 25 millimeters (1 inch) of rain. Precipitation from November through April might fall as snow, particularly at higher elevations. Snowfall averages are around 76 to 180 millimeters (3 to 7 inches).

Local topography in Mineral County and the Walker River Paiute Reservation strongly influences winds along the Mina rail alignment. Local winds are generally channeled by topography, with prevailing wind direction oriented along valley axes. Highest wind speeds occur in the spring and occasionally generate dust storms. Annual average wind speeds at the Schurz station on the Walker River Paiute Reservation, which are representative of the Mina rail alignment in the vicinity of Walker River, are around 1.7 meters per second (3.9 miles per hour); slightly more than 20 percent of the time the area experiences calm conditions. Farther south wind speeds are higher, with an annual average wind speed of 3.6 meters per second (8.1 miles per hour); slightly more than 4 percent of the time the area experiences calm conditions.

3.3.4.3.4 Esmeralda County

The Mina rail alignment would cross through Esmeralda County from Redlich Pass to Lida Junction and would be east of the highest peaks of the Sierra Nevada and White Mountain ranges. Elevations of the alignment through the county would range from about 1,300 meters (4,300 feet) to around 1,700 meters (5,500 feet). This area experiences abundant hours of cloud-free days, low annual precipitation (less than 250 millimeters [10 inches] per year), and large daily ranges in temperature.

Within Esmeralda County, the mean annual temperature along the Mina rail alignment is approximately 10° Celsius (50° Fahrenheit). Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer months. Summertime mean maximum temperatures are approximately 32° Celsius (90° Fahrenheit) at higher elevations and around 37° Celsius (98° Fahrenheit) at lower elevations, and are accompanied by low relative humidity (commonly less than 10 percent). Winter mean minimum temperatures are approximately minus 7° Celsius (20° Fahrenheit) in December and January.

Annual precipitation in Esmeralda County averages less than 180 millimeters (7 inches) per year, with higher amounts found at higher elevations and lower amounts at lower elevations. During the summer, occasional thunderstorms can produce heavy rains and cause flash floods. Daily precipitation levels have occasionally exceeded 50 millimeters (2 inches), but generally are less than 25 millimeters (1 inch) of rain. Precipitation from October through April might fall as snow, particularly at higher elevations. Snowfall averages are around 380 millimeters (15 inches) at higher elevations.

Local topography in Esmeralda County strongly influences winds along the Mina rail alignment. Local winds are generally channeled by topography, with prevailing wind direction oriented along valley axes. Highest wind speeds occur in the spring, and occasionally generate dust storms. Annual average wind speeds at the Goldfield station are around 2.7 meters per second (6 miles per hour); slightly more than 5 percent of the time the area experiences calm conditions.

3.3.4.3.5 Nye County

Through southern Nye County, the Mina rail alignment would lie to the east of the Grapevine and Funeral Mountains as well as the southern Sierra Nevada Mountains, a large mountain ***barrier*** that prevents much of the moist Pacific Ocean air from reaching the area. The result is that most of the area is largely desert. The Mina rail alignment through Nye County principally drops in elevation starting from approximately 1,400 meters (4,700 feet) at Stonewall Pass to 1,100 meters (3,500 feet) near the end of the Mina rail alignment at Yucca Mountain, and presents a wide variation in temperature and precipitation. In general, the climatic features can be described as abundant hours of cloud-free days, low annual precipitation (less than 250 millimeters [10 inches] per year), and large daily ranges in temperature.

In Nye County, the mean annual temperature along the Mina rail alignment ranges from approximately 16° Celsius (61° Fahrenheit) at lower elevations to approximately 13° Celsius (56° Fahrenheit) at the highest elevations. Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer months. Daily temperature variations are smaller during winter months, and less pronounced at higher elevations. At the lowest elevations along the Mina rail alignment, summertime maximum temperatures frequently exceed 38° Celsius (100° Fahrenheit), and are accompanied by low relative humidity (commonly less than 10 percent).

Annual precipitation averages less than 250 millimeters (10 inches) per year at all locations across southern Nye County, with most precipitation occurring during the winter months. Along the Mina rail alignment, precipitation is lowest from the Sarcobatus Flat station to the Beatty station, averaging just 76 to 100 millimeters (3 to 4 inches) per year because of the ***rain shadow*** effects from the Sierra Nevada and Amargosa Mountain Ranges. At higher elevations, a secondary peak in rainfall (associated with increased thunderstorm activity) occurs during the late summer months; at lower elevations, this precipitation often evaporates before reaching the ground. The thunderstorms occasionally produce heavy rains that can cause flash floods. Daily precipitation levels can be high, and historical maximums have reached 61 millimeters (2.4 inches) at the Sarcobatus Flat station, with a number of locations exceeding 41 millimeters (1.6 inches).

From November through April, precipitation in southern Nye County along the Mina rail alignment might fall as snow. Mean average snowfall is about 50 to 130 millimeters (2 to 5 inches).

Local topography in southern Nye County strongly influences winds along the Mina rail alignment. Local winds are generally channeled by topography, with prevailing wind direction oriented along valley axes. Wind speeds are highest in the spring, and occasionally generate dust storms at playas. The extreme highest wind speeds are along ridgetops. Winds of more than 40 meters per second (90 miles per hour) have been recorded along ridgetops at the Nevada Test Site station. Annual average wind speeds are much lower, with annual average speeds of 2.4 meters per second (5.4 miles per hour) at Sarcobatus Flat and 2.2 meters per second (4.9 miles per hour) at Beatty. Through southern Nye County, calm conditions are most frequent at Sarcobatus Flat station, and characterize wind conditions in the area about 7 percent of the time.

3.3.5 SURFACE-WATER RESOURCES

This section describes surface-water resources along the Mina rail alignment. Surface-water resources include streams, washes, playas, ponds, wetlands, floodplains, and springs. Section 3.3.5.1 describes the region of influence for surface-water resources along the Mina rail alignment; Section 3.3.5.2 is a general overview of surface-water features along the rail alignment; and Section 3.3.5.3 describes specific surface-water features for the alternative segments and common segments. Section 3.3.5.2.3 and 3.3.5.2.4 describe wetlands and floodplains, respectively, from a regulatory perspective; Section 3.3.7, Biological Resources, describes wetlands from a habitat perspective. Appendix F (Floodplain and Wetlands Assessment) addresses compliance with Executive Orders 11988, *Floodplain Management*, and 11990, *Protection of Wetlands*, in more detail.

3.3.5.1 Region of Influence

The Mina rail alignment region of influence for surface-water resources is limited in most cases to the nominal width of the construction right-of-way. Because of the types of land-disturbing activities that would take place during rail line construction, the construction right-of-way would be susceptible to erosion and changes in surface-water flow patterns. Spills (of, for example, fuel, paint, or lubricants) during railroad construction and operations could also affect this area.

In some cases, the region of influence for surface water extends beyond the construction right-of-way. In places where surface-water flow patterns (including floodwaters) could be modified or surface-water drainage could carry eroded soil, sediment, or spills downstream, the region of influence extends beyond the construction right-of-way. Within the region of influence, there could be impacts to floodwaters such that they would back up on the upstream side of the rail line, while there could be impacts to water quality if potential pollutants travel downstream during a storm event without precipitating out (soils from erosion) or becoming too dilute (petroleum-based lubricants or fuels) to detect. For purposes of analysis, DOE screened the area within 1.6 kilometers (1 mile) of the centerline of the rail alignment for surface-water resources that could be indirectly affected.

Surface-Water Terms

An **ephemeral stream** or ephemeral drainage has a channel bed above the normal water table and only flows in direct response to precipitation or snowmelt within its drainage basin.

An **intermittent stream** or intermittent drainage has a channel bed that fluctuates above or below the normal water table along its length, and might or might not have flow within it during any particular time or at any particular location. The presence of flow within the channel is determined by its channel elevation in relation to the water table, precipitation events, or snowmelt within its drainage basin.

A **wash** or drainage in the western United States generally refers to the dry streambed of an intermittent or ephemeral stream. In this Rail Alignment EIS, wash is used interchangeably with intermittent and ephemeral streams.

A **perennial stream** or perennial drainage receives groundwater into its channel and its stream bed is normally below the water table. During years with normal precipitation, a perennial stream will have constant flow.

A **playa** is normally a dry lake bed that can contain water in response to seasonally high runoff.

Evapotranspiration is a combination of processes through which water is transferred to the atmosphere from evaporation from open water and bare soil, and transpiration from vegetation.

3.3.5.2 General Environmental Setting and Characteristics

Important characteristics of hydrologic systems in the region of influence include ***ephemeral streams*** and playas. Ephemeral surface-water features can be dry over multiple seasons or even years during droughts, but can have multiple periods of flow or standing water during wet periods, as during the winter of 2004-2005. Central and southern Nevada are characterized by low precipitation and high annual ***evapotranspiration*** rates typical of desert climates, as described in Section 3.3.4, Air Quality and Climate. Because of the arid climate and the terrain (that is, north-south trending, parallel mountain ranges with broad, intervening valleys) in this area, surface water generally evaporates before it can flow out of the drainage basin. Typically, surface drainage in this area remains within its topographically defined water basin; that is, surface water generally flows to low areas such as lakes, flats, or playas.

Surface water systems are typically defined in terms of watersheds (or basins). For water planning and management purposes, the State of Nevada is divided into discrete hydrologic units delineated by 14 major hydrographic regions that are subdivided into 256 hydrographic areas (DIRS 103406-Nevada Division of Water Planning 1992, p. all). In this Rail Alignment EIS, watersheds (or basins) are referred to as hydrographic regions. A region is defined as a geographic area drained by a single major stream or an area consisting of a drainage system comprised of streams and often natural or manmade lakes.

Overall, most surface-water features described in this section are ***ephemeral drainage*** features that intermittently contain flowing water. Walker River and some of its tributaries near the beginning of the Mina rail alignment are the exceptions, where surface-water flow is perennial. This section describes surface-water features in terms of the hydrographic regions in which they are located. Figure 3-179 shows the hydrographic basins within Nevada and the boundaries for the four hydrographic regions the Mina rail alignment would cross. Most of the existing Union Pacific Railroad Hazen Branchline would be within the Carson River Basin, while a small portion of this line, the existing Department of Defense Branchlines (North, through Schurz, and South), and a small portion of Mina common segment 1 would be within the Walker River Basin. The majority of the rail alignment (most of Mina common segment 1, the Montezuma alternative segments, Mina common segment 2, the Bonnie Claire alternative segments, and Mina common segment 5) would be within the Central Region. The Oasis Valley alternative segments and Mina common segment 6 would be in the Death Valley Basin.

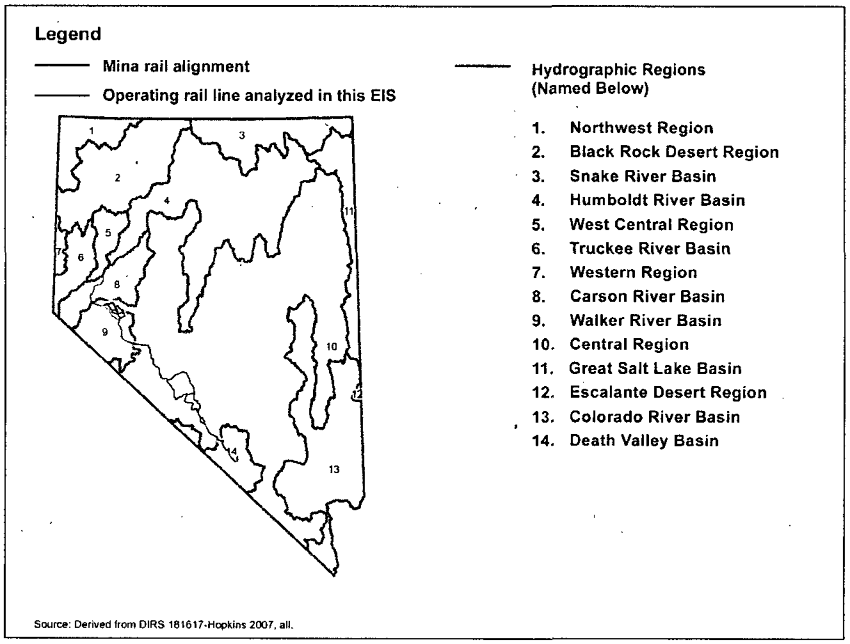


Figure 3-179. Nevada hydrographic areas crossed by the Mina rail alignment.

3.3.5.2.1 Surface Drainage Features (Streams and Playas)

As described in Section 3.3.1, Physical Setting, the Mina rail alignment would pass through numerous valleys and over or around numerous mountain ranges. The need for relatively gentle curves and gradients sets physical limitations on the design of the rail line that would require the alignment to follow valley floors that go around mountain ranges, or parallel the mountain ranges in transition zones to change elevation gradually (DIRS 176165-Nevada Rail Partners 2006, Appendix B). Within the valley floors, the rail alignment could parallel predominant drainage channels and cross through or near flats and playas. Some streams within low areas are braided channels where stream flow is divided among multiple channels, which the rail alignment could cross in several locations. Near or within mountain ranges, the rail alignment typically would be perpendicular to the predominant drainage direction. Therefore, the Mina rail alignment would encounter a wide variety of surface drainage features.

> **Notable drainage channels,** as referenced in the text and shown on figures in Section 3.3.5.3, were determined by choosing those channels with a stream order of 2 or greater based on Strahler's ordering system, with the National Hydrography Dataset as a base map.

Drainage features have been classified using Strahler's stream order system (DIRS 176728-Goudie et al. 1981, pp. 50 and 51), which is a method of classifying stream segments based on the number of upstream tributaries. Stream order ranks the size and potential power of streams. Orders range from small streams with no branches (1st Order) up to streams the size of the Mississippi River, which is a 10th Order stream. As two 1st Orders come together, they form a 2nd Order stream. Two 2nd Order streams converging form a 3rd Order stream. Streams of lower order joining a higher order stream do not change the order of the higher order stream.

DOE used stream order to define ***notable drainage channels*** and as a method to select the number of ***ephemeral washes*** shown on figures in Section 3.3.5.3. To improve the readability of these figures and provide a means to prioritize the drainage features, these figures depict only rivers, streams, and washes the rail alignment would cross that are 2nd Order streams or higher. Figures in Section 3.3.5.3 do not show all the washes and drainages the rail alignment would cross, but provide enough information to support the analysis of potential impacts to surface-water resources. Section 4.3.5 identifies the estimated number of drainage channels the rail alignment would cross by alternative segment and common segment.

3.3.5.2.1.1 Surface-Water Quality. Because of the ephemeral nature of surface water in the southwestern part of Nevada, water-quality data for the region of influence are limited. The State of Nevada does not formally monitor surface water in the Mina rail alignment region of influence.

Water-quality data for the state of Nevada are available through the Nevada District of the U.S. Geological Survey and the Nevada Division of Environmental Protection. Surface water samples are collected from several major river basins in the state and then analyzed for physical and chemical parameters. The routine water-quality monitoring network includes the following river/basin systems: Walker River, Humboldt River, Colorado River, Lake Tahoe Tributaries, Snake River, Truckee River, Carson River, and Steamboat Creek. The Carson River and Walker River Basins are the only basin systems in the Nevada Division of Environmental Protection's monitoring system relevant to the region of influence for the Mina rail alignment (DIRS 176306-NDEP 2005, all).

In accordance with federal regulations, each state is required to submit a report on overall water-quality conditions to the U.S. Environmental Protection Agency every 2 years. According to the Nevada Division of Environmental Protection report for 2005 (DIRS 176306-NDEP 2005, all), agriculture and grazing have the greatest impacts on Nevada's waters, mainly because of ***nonpoint source pollution*** (such as irrigation, grazing, and flow-regulation practices). Flow reductions have a great impact on streams, limiting dilution of salts, minerals, and pollutants. Temperature, ***pH***, dissolved oxygen, nutrients, and suspended solids are the main pollutants of concern in the state. Agricultural sources generate large sediment and nutrient loads. Surface-water quality in Nevada varies greatly from location to location and from month to month with changes in flow. In general, concentrations of dissolved solids are higher in the southern part of the state than in the northern part, depending largely on water discharge (DIRS 176316-Bostic et al. 2004, all). Because of dilution by precipitation or snowmelt, dissolved solids concentrations are usually highest during periods of low stream flow and lowest during periods of high stream flow.

According to the Nevada Division of Environmental Protection Agency 305(b) report, the Walker River experienced improvement in pH, nitrates, and phosphates during the 2004 reporting cycle (DIRS 176306-NDEP 2005, p. 2). The report cited temperature as a continuing problem in the system and total dissolved solids as a continuing problem for the lower reach, including Walker Lake. Near Wabuska, the Walker River is listed as an impaired stream and the types of pollutants affecting the water vary throughout the stream reach. Typical pollutants consist of total phosphorus, total iron, pH, and suspended solids (DIRS 180120-NDEP 2005, Appendix A and p. A-9). Walker Lake became at-risk because of upstream agricultural diversions; upstream diversions have caused Walker Lake to decline, thereby causing the total dissolved solids concentrations to increase (DIRS 176325-USGS 2004, all). Because of its high salt content, Walker Lake is listed as an impaired waterbody (DIRS 176306-NDEP 2005, p. 99).

No site-specific water chemistry data are available for the rest of the stream channels or washes the Mina rail alignment would cross. No other streams the alignment would cross are known to be impaired. DOE previously collected and analyzed surface-water samples for chemical characteristics in the Yucca Mountain region. These analytical data are provided in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 3-40).

3.3.5.2.1.2 Stream Flow. The U.S. Geological Survey has stream-gaging stations (many of which have been discontinued) throughout Nevada. Stream-flow data from these monitoring stations are available through the Geological Survey Nevada District. Table 3-104 lists the range of peak discharges for typical or major streams along the Mina rail alignment. DOE cross-referenced peak discharge measurements at and near the Nevada Test Site with a Geological Survey fact sheet that discusses significant flooding events in the Amargosa River drainage basin in 1995 and 1998 (DIRS 159895-Tanko and Glancy 2001, Table 2).

Most of the drainage channels the Mina rail alignment would cross typically flow only during significant (heavy) rainfall events, which generally occur only a few times a year. In many years, most of the streams listed in Table 3-104 have little or no flow. From late spring to early fall, precipitation patterns are dominated by convective, short-duration, and high-intensity thunderstorms. From late fall to early spring, precipitation patterns are dominated by long-duration, low-intensity, general storm events with both rain and snow possible throughout the area. These two types of precipitation events result in runoff that differs between smaller watersheds (up to 520 square kilometers [200 square miles]) and larger watersheds (greater than 520 square kilometers). For smaller watersheds, the summer thunderstorm events dominate the peak runoff rates, which occur in the tributary channels and washes. However, as watershed size increases, the general storm events eventually dominate the peak rates of runoff. In addition, for all watersheds, the volume of runoff will generally be greater for the general (winter) storm events than for the thunderstorm (summer) events (DIRS 180885-Parsons Brinckerhoff 2007, p. 12).

Generally, stream discharge in Nevada is low in late summer, and then increases through the autumn and winter until the snow melts in the spring. Maximum discharge for the year normally can be expected in May and June, although rain or snow has caused floods from November through March (DIRS 176308-Stockman et. al. 2003, p. 2). As shown in Table 3-104, the more significant peak-flow scenarios relevant to the Mina rail alignment occur within the Carson River, Walker River, and Upper Amargosa hydrologic units. The highest peak flows for Nevada's hydrographic regions generally occur during late winter due to snowmelt and late summer due to intense precipitation.

Table 3-104. U.S. Geological Survey annual peak flow measurements for selected sites in streams of hydrographic basins and areas along the Mina rail alignment[a] (page 1 of 2).

Hydrologic unit (gaging station number)	Drainage area (square kilometers)[b]	Annual peak flow range (cubic meters per second)[c]	Typical peak flow month(s)	Years of record (number of counts)
Areas along the alignment				
Carson River Basin (existing Union Pacific Railroad Hazen Branchline and Department of Defense Branchlines North, through Schurz, and South)				
Carson River Basin near Fort Churchill (10312000)	3,400	1.0 to 31	January through June	1912-2006 (95)
Walker River Basin (Schurz alternative segments)				
Walker River near Wabuska (10301500)	6,700	1.1 to 93	May through June	1903-2005 (86)
Walker River near Mason (10300600)	6,200	9.2 to 79	May through June	1974-1984 (11)
Reese River Canyon near Schurz (10302010)	36	0 to 53	May through June	1963-1991 (22)
Walker River at Schurz (10302000)	7,400	1.7 to 72	May through June	1914-1933 (20)
Walker River above Weber Reservoir near Schurz (10301600)	7,000	2.2 to 57	May through June	1977-2006 (17)
Ralston-Stone Cabin Valleys (Mina common segment 2)				
Ralston Valley tributary near Tonopah (10249140)	0.52	0 to 1.4	July and August	1961-1981 (21)
Cactus-Sarcobatus Flats (Mina common segment 2; Mina common segments 4 and 5)				
Stonewall Flat tributary near Goldfield (10248970)	1.3	0 to 4.3	June through August	1963-1984 (20)
Areas in the Nevada Test Site				
Upper Amargosa (Oasis Valley alternative segments 1 and 3; Mina common segment 6)				
Pah Canyon Wash above Fortymile Wash Confluence (102512495)	16	2.6	February	1998 (1)
Unnamed Tributary to Fortymile Wash north of Delirium Canyon (102512496)	2.9	5.1	February	1998 (1)
Delirium Canyon Wash above Fortymile Wash Confluence (102512497)	6.2	3.4	February	1998 (1)
Unnamed Tributary to Fortymile Wash south of Delirium Canyon (102512499)	2.1	2.0	February	1998 (1)
Fortymile Wash at Narrows (10251250)	670	0 to 85	March	1982-1998 (8)
Yucca Wash near Mouth (10251252)	44	0 to 27	February and March	1982-1998 (10)
Pagany Wash near the Prow (102512531)	1.3	0.57 to 1.7	February and March	1995-1998 (2)
Pagany Wash #1 near Well UZ (4102512533)	2.1	0.48 to 1.7	February and March	1993-1998 (2)
Drillhole Wash above UZ (1102512535)	1.8	0 to 0.85	March	1994-1998 (3)

Table 3-104. U.S. Geological Survey annual peak flow measurements for selected sites in streams of hydrographic basins and areas along the Mina rail alignment[a] (page 2 of 2).

Hydrologic unit (gaging station number)	Drainage area (square kilometers)[b]	Annual peak flow range (cubic meters per second)[c]	Typical peak flow month(s)	Years of record (number of counts)
Areas in the Nevada Test Site (continued)				
Upper Amargosa (Oasis Valley alternative segments 1 and 3; Mina common segment 6)				
Wren Wash at Yucca Mountain (1025125356)	0.52	0 to 0.85	March	1994-1998 (3)
Split Wash below Quac Canyon Wash (102512537)	0.78	0 to 0.37	February	1994-1998 (3)
Split Wash at Antler Ridge (1025125372)	6.2	0 to 0.06	February	1994-1998 (3)
Drillhole Wash at Mouth (10251254)	42	0 to 22	July	1982-1998 (10)
Fortymile Wash near Well J (1310251255)	790	0 to 85	March through July	1984-1998 (7)
Dune Wash near Busted Butte (10251256)	18	0 to 0.40	August	1982-1995 (9)
Topopah Wash at Little Skull Mountain (10251260)	270	0 to 42	August	1984-1998 (8)
Beatty Wash near Beatty (10251215)	250	0 to 25	July through March	1989-1998 (5)
Amargosa River at Beatty (10251217)	1,200	0.03 to 28	March through August	1994-2004 (10)
Fortymile Wash near Amargosa Valley (10251258)	820	0 to 94	February through July	1969-2004 (23)
Topopah Wash at Highway 95 near Amargosa Valley (10251261)	390	0.57	February	1998 (1)

a. Sources: DIRS 176325-USGS 2006, all; DIRS 159895-Tanko and Glancy 2001, Table 2.
b. To convert square kilometers to square miles, multiply by 0.3861.
c. To convert cubic meters per second to cubic feet per second, multiply by 35.3.

The Carson River originates from the Sierra Nevada Mountains in California and flows generally northeast into Nevada where it passes through Carson City and terminates in the Carson Sink. Between Carson City and Fallon, the river is impounded by the Lahontan Dam and forms the Lahontan Reservoir, water from which is distributed throughout the Fallon area for agricultural, wildlife, and fisheries purposes (DIRS 103406-Nevada Division of Water Planning 1992, all).

The Walker River, with its headwaters in California, flows into Nevada through the Walker River Paiute Reservation before terminating at Walker Lake. Waters of the Walker River are predominantly used for agricultural purposes (DIRS 103406-Nevada Division of Water Planning 1992, all). Walker Lake is fed by the Walker River from the north and is a perennial, natural terminal lake. The lake became at-risk because of upstream diversions for irrigation purposes; between 1882 and 1994, upstream diversions caused Walker Lake to decline about 40 meters (140 feet) (DIRS 176325-USGS 2004, all), which has resulted in high salt concentration.

The washes that drain the Yucca Mountain Site discharge into the Amargosa River. This ephemeral drainage typically sees very low runoff rates due to minimal precipitation in its basin and, therefore, is usually dry (DIRS 159895-Tanko and Glancy 2001, p. 1). Precipitation is least along the Mina rail alignment in this area, from Sarcobatus Flat to Beatty, averaging just 75 to 100 millimeters (3.0 to 3.9 inches) per year. Most of the annual precipitation typically occurs in late spring to early fall. Fortymile Wash and Topopah Wash are significant tributaries draining the Nevada Test Site area into the Amargosa River, with maximum peak flows of 94 cubic meters (3,300 cubic feet) per second and 42 cubic meters (1,500 cubic feet) per second, respectively, during late winter to late summer (see Table 3-104). Section 3.3.5.2.4 describes two significant flooding events (March 1995 and February 1998) in the Amargosa River drainage basin on and near the Nevada Test Site.

3.3.5.2.2 Waters of the United States

Some of the surface-water features along the Mina rail alignment, such as ephemeral drainages, streams, ponds, and lakes, are considered waters of the United States, especially if there is an interstate connection to commerce. Section 404 of the Clean Water Act (33 U.S.C 1344) and implementing regulations (33 CFR Part 323) require the U.S. Army Corps of Engineers to regulate discharges of dredge or fill material into waters of the United States. Discharges of dredge or fill material essentially include all land-disturbing activities accomplished via the use of mechanized equipment. The placement of structures, such as bridge embankments, bridge piers and abutments, and culverts, would be activities potentially discharging fill materials into waters of the United States. Chapter 6 of this Rail Alignment EIS discusses compliance with Section 404 of the Clean Water Act in more detail.

> The term **waters of the United States** is defined in 33 CFR 328.3a. The U.S. Army Corps of Engineers and the Environmental Protection Agency regulate the placement of dredged or fill material into these waters. The definition incorporates channels with ephemeral and intermittent flow that exhibit specific physical features, including channel shape and surrounding vegetation that would provide indications of an ***ordinary high water mark.***
>
> **Ordinary high water mark** means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas (33 CFR 328.3e).

DOE surveyed all drainages within 400 meters (0.25 mile) of the Mina rail alignment that are within interstate hydrologic basins to determine if those drainages could be classified as waters of the United States (DIRS 180889-PBS&J 2007, p. 1). This survey also identified and delineated wetlands along the Mina rail alignment. The alignment-specific discussions in Section 3.3.5.3 detail the results of the survey. Subsequent to DOE surveys performed along the rail alignment, the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers released new guidance to be used when making determinations of waters of the United States subject to jurisdiction under the Clean Water Act. This guidance provides criteria for making these determinations for adjacent wetlands and non-navigable tributaries of waters of the United States, particularly in relation to ephemeral waters. As a result of this guidance, it is likely that many of the drainages along the rail alignment would not be considered waters of the United States (see Section 4.2.5.2.1.4 for further discussion).

The U.S. Army Corps of Engineers is ultimately responsible for determining whether drainages and wetlands along the rail alignment are regulated under Section 404; therefore, all conclusions in this analysis about the classification of washes and wetlands as waters of the United States are tentative. If DOE pursued the Mina rail alignment for construction of the proposed railroad, the Department would request that the U.S. Army Corps of Engineers determine the limits of jurisdiction under Section 404 along the alignment before beginning construction.

3.3.5.2.3 Wetlands

Generally, wetlands are lands where saturation with water is the dominant factor that determines how soil develops and the types of plant and animal communities living in the soil and on its surface (DIRS 178724-Cowardin et al. 1979, p. 11). Wetlands can support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants and promote the development of characteristic wetland (***hydric***) ***soils***.

According to the U. S. Environmental Protection Agency and the U. S. Army Corps of Engineers, the regulatory definition of a Section 404 jurisdictional wetland is (33 CFR 328.3b) "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." The U.S. Department of Agriculture Natural Resources Conservation Service and U. S. Fish and Wildlife Service define wetlands somewhat differently, but all four agencies include three basic elements for identifying wetlands: ***hydrology***, soils, and vegetation. Wetland communities are recognized as providing many valuable functions that improve the human environment. Wetlands that have surface-water connections to or are adjacent to (bordering, contiguous, neighboring) other waters of the United States are regulated under Section 404 of the Clean Water Act. Wetlands that are isolated – that is, they have no permanent or temporary surface-water connections to interstate water bodies or are not considered adjacent – are not typically regulated under Section 404 unless the use of these isolated wetlands could affect interstate commerce.

Surveys in support of this Rail Alignment EIS have identified wetlands along the Mina rail alignment (DIRS 180889-PBS&J 2007, all). Tables in Section 3.3.5.3 list wetlands identified during these surveys. Appendix F discusses wetlands along the Mina rail alignment in more detail, and Section 3.3.7, Biological Resources, discusses wetlands from a habitat perspective.

3.3.5.2.4 Floodplains

The presence of floodplains in the Mina rail alignment region of influence largely depends on the meteorology and hydrology of the area. Much of the rail alignment would be in areas that are subject to intense rainfall over a short duration (1 to 3 hours), which typically occurs in late spring to early fall. Precipitation in late fall to early spring is dominated by low-intensity rainfall or snow over a long duration (2 to 4 days). In both cases, precipitation has the potential to produce flooding (DIRS 180885-Parsons Brinckerhoff 2007, pp. 12 to 14). Evapotranspiration rates throughout the region of influence are high; therefore, most of the rainfall from summer storms is lost relatively quickly unless a storm is intense enough to produce runoff, or unless there are more storms before the water evaporates (DIRS 180885-Parsons Brinckerhoff 2007, p. 18). Evapotranspiration rates are lower during the winter, and water from precipitation or melting snow has a better chance of resulting in streamflow, thereby increasing the chances of flooding. Much of the runoff quickly infiltrates into rock fractures or into the dry soils, some is carried down alluvial fans in arroyos, and some drains onto dry lakebeds where it might stand for weeks as a lake (DIRS 180885-Parsons Brinckerhoff 2007, p. 17).

Although flow in most washes is rare, the area is subject to flash flooding from intense summer thunderstorms and sustained winter precipitation. When it occurs, intense flooding can include mud and debris flows in addition to water runoff. Thunderstorms in the area can be local and intense, creating runoff in one wash while an adjacent wash receives little or no rain. In rare cases, however, storm and runoff conditions can be extensive enough to result in flow being present throughout the drainage systems. For example, conditions recorded during March 1995 and February 1998 at the Amargosa River and its tributaries indicated that the channels all flowed simultaneously along its primary stream channels to Death Valley. The 1995 event was the first documented case of this flow condition. During the 1995 event, the peak flow near the location where the existing Yucca Mountain access road crosses Fortymile

Wash was approximately 100 cubic meters (3,500 cubic feet) per second (DIRS 180885-Parsons Brinckerhoff 2007, p. 18).

In accordance with the requirements of 10 CFR Part 1022, DOE reviewed available authoritative information to determine whether the Mina rail alignment would be located in wetlands or floodplains. The results of that effort (DIRS 180885-Parsons Brinckerhoff 2007, p. 9) indicated that the only flood map or flood studies available for the areas of the Mina rail alignment were those completed by the Federal Emergency Management Agency in the form of Flood Insurance Rate Maps. Furthermore, and consistent with the remoteness of the project area, DOE found that Federal Emergency Management Agency maps cover only about 20 percent of the rail alignment (see Appendix F, Table F-2). At present, there are no Federal Emergency Management Agency flood maps for areas northeast of Silver Springs, and the Agency has not mapped flood-prone areas east and west of where U.S. Highways 50 and 95 intersect, including a large portion of Lahontan Reservoir. Most of the mapped flood-prone areas are between Carson River and Wabuska. Federal Emergency Management Agency flood maps encompassing Department of Defense Branchline North indicate areas most prone to possible flooding correspond to emergent wetlands shown in the National Wetlands Inventory. The Federal Emergency Management Agency flood map shows no ***100-year flood***-prone areas next to the Walker River or any of its tributaries. There are limited flood-map data covering the southern-most section of Walker Lake and most of the area between Mina common segment 2 and the Yucca Mountain Site (DIRS 180119-Parsons Brinckerhoff 2003, all). DOE completed flood studies for several washes on the eastern slope of Yucca Mountain in support of the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Figure 3-12 and pp. 3-37 to 3-39).

In accordance with 10 CFR Part 1022, DOE prepared a floodplain and wetland assessment (see Appendix F) for the Mina rail alignment. Appendix F provides a detailed discussion of the floodplains and wetlands the Mina rail alignment would cross, including figures of the relevant floodplains identified on Federal Emergency Management Agency maps and those identified near the ***repository*** site.

3.3.5.2.5 Springs

With the exception of surface water bodies such as perennial streams and reservoirs, springs are the only other natural source of perennial surface water throughout the Mina rail alignment region of influence. Typically, these springs flow year round. The springs often infiltrate naturally into the ground or undergo evapotranspiration, or are captured near the source for local use (such as irrigation). DOE used the U.S. Geological Survey Geographic Names Information System, the National Hydrologic Dataset, and several DOE field studies completed in support of this Rail Alignment EIS to identify springs along the Mina rail alignment (DIRS 180889-PBS&J 2007, all; DIRS 180885-Parsons Brinckerhoff 2007, all).

3.3.5.3 Surface-Water Features along Alternative Segments and Common Segments

DOE compiled this information using the National Wetland Inventory database, a U.S. Geological Survey dataset of hydrologic features known as the National Hydrological Dataset, a dataset from the U.S. Environmental Protection Agency Geographic Names Information System (DIRS 176979-MO0605GISGNISN.000), and DOE wetland surveys conducted in support of this Rail Alignment EIS (DIRS 180889-PBS&J 2007, all). Specific hydrologic features are divided into two categories: those within 150 meters (500 feet) of the rail alignment centerline and those between 150 meters and 1.6 kilometers (1 mile) from the rail alignment centerline. Both of these categories fall within the region of influence for surface-water resources. The first category is also within the nominal width of the rail line construction right-of-way.

Sections 3.3.5.3.1 through 3.3.5.3.12 describe surface water-resources for each Mina rail alignment alternative segment and common segment moving along the rail line from north to south (from Hazen, Nevada, to Yucca Mountain). Tables in these sections provide summaries of surface-water features identified along the Mina rail alignment region of influence. Figures in these sections show the proposed rail line location as it crosses Nevada's physiographic features. A key for these map areas is provided in Chapter 2, Figure 2-12.

3.3.5.3.1 Union Pacific Railroad Hazen Branchline (Hazen to Wabuska)

There would be no new construction and therefore no new land disturbance within or near the region of influence along this portion of the Mina rail alignment. Therefore, DOE has not characterized the surface-water features in this area.

3.3.5.3.2 Department of Defense Branchline North (Wabuska to the boundary of the Walker River Paiute Reservation)

Except for a new siding inside the existing rail line right-of-way, there would be no new construction or land disturbance along Department of Defense Branchline North within the region of influence (see Figure 3-180). Construction of this siding would not affect current drainage patterns. Therefore, DOE has not characterized surface-water features along this portion of the Mina rail alignment.

3.3.5.3.3 Department of Defense Branchline through Schurz

As part of the Mina Implementing Alternative, DOE would remove track, timber ties, and ballast, and grade the ballast section to a smooth surface along this branchline. This removal activity would not involve land disturbance outside the existing rail line right-of-way because these actions would be performed using equipment designed to move along the track. Therefore, DOE has not characterized surface-water features in this area.

3.3.5.3.4 Schurz Alternative Segments

3.3.5.3.4.1 Schurz Alternative Segment 1. From the northern end of Campbell Valley, Schurz alternative segment 1 would cross Walker River and two tributaries of the Walker River as it enters Sunshine Flat. The alternative segment would pass to the west of Painted Mesa, and east of Weber Reservoir and the northern end of the Wassuk Range before crossing U.S. Highway 95. It would then pass south of Calico Hills, enter an unnamed valley, and travel west of the Agai Pah Hills and the Gillis Range before ending near Gillis Canyon (see Table 3-105 and Figure 3-180). Construction camp 18A would be adjacent to Schurz alternative segment 1 approximately 75 meters (250 feet) east of its junction with U.S. Highway 95 (DIRS 180875-Nevada Rail Partners 2007, p. F-4). The construction camp would not overlie any surface-water features. There are no potential quarry sites along Schurz alternative segment 1.

Schurz alternative segment 1 would run northeast from Campbell Valley, where it would cross the Walker River and two tributaries to Walker River that receive their drainage from the Desert Mountains and later combine into one stream. The Walker River is a perennial stream that flows through Weber Reservoir and conveys surface water to a terminal basin called Walker Lake. Schurz alternative segment 1 would lie entirely within the Walker Hydrographic sub-basin, which has a total drainage area of approximately 2,600 square kilometers (1,000 square miles) (DIRS 180885-Parsons Brinckerhoff 2007, p. 20). The U.S. Geological Survey gaging station closest to Schurz alternative segment 1 is at the Walker River above Weber Reservoir near the community of Schurz. At this station, the river has a drainage area of approximately 7,000 square kilometers (2,700 square miles) (see Table 3-104). Schurz alternative segment 1 would continue eastward and then head south into Sunshine Flat, which receives drainage from the Desert Mountains and Painted Mesa.

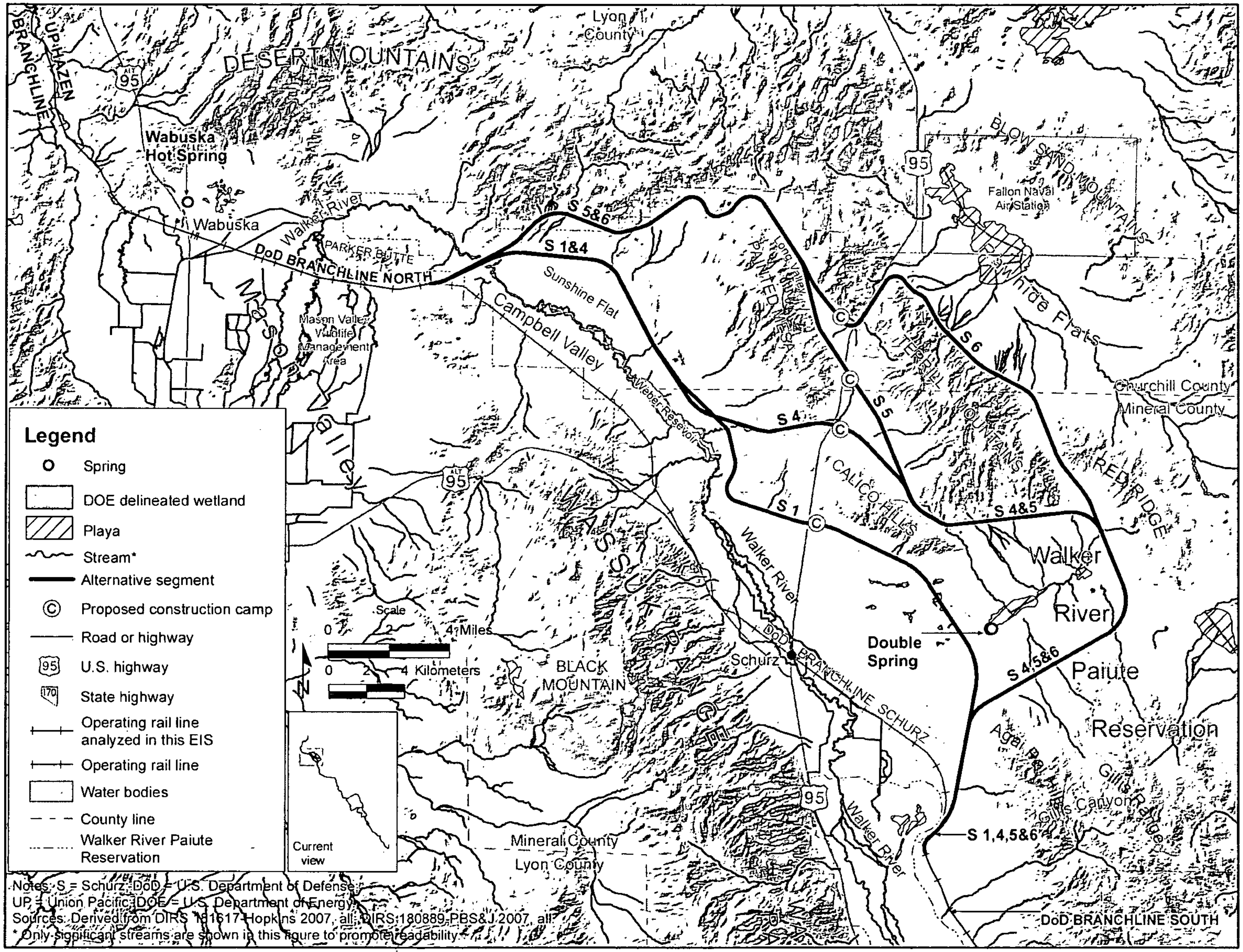


Figure 3-180. Surface drainage within map area 1.

Table 3-105. Hydrologic features potentially relevant to the Schurz alternative segments[a] (page 1 of 2).

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[b] of the centerline of the rail alignment
Schurz alternative segment 1		
Drainage from the Desert Mountain Range, Painted Mesa, and Calico Hills to Sunshine Flat. Drainage from Calico Hills, Terrill Mountains, and Red Ridge into an unnamed valley. Drainage from the Agai Pah Hills into the Schurz 1 region of influence. Surface runoff would generally drain west and toward the Walker River.	Segment would cross Walker River and 20 unnamed washes (some of these washes are tributaries to Walker River). Segment would enter Sunshine Flat. Segment would cross through two unnamed playas and pass within 80 meters west of two other unnamed playas. Segment would cross over two DOE-delineated wetlands and pass within two other wetlands 110 meters north and 40 meters south of the alignment, respectively.	Weber Reservoir 1 kilometer west. Set of unnamed playas, within 1.6 kilometers west and 1.4 kilometers east of the alignment in the unnamed valley. Set of unnamed playas, west of the alignment and adjacent to Walker River (identified as wetlands in the National Wetland Inventory). Double Spring 1.5 kilometers east. Unnamed spring 1.4 kilometers east.
Schurz alternative segment 4		
Drainage from the Desert Mountain Range, Painted Mesa, and Calico Hills to Sunshine Flat. Drainage from Calico Hills, Terrill Mountains, and Red Ridge into an unnamed valley. Drainage from the Agai Pah Hills west toward Schurz 4.	Segment would cross Walker River and 41 unnamed washes (some of these washes are tributaries to Walker River). Segment would enter Sunshine Flat. Segment would cross through two unnamed playas and pass within 80 meters west of two other unnamed playas. Segment would cross over two DOE-delineated wetlands and pass within two other wetlands 110 meters north and 40 meters south of the alignment, respectively.	Weber Reservoir 0.85 kilometer west. Two unnamed playas, within 1.3 kilometers west and 1.5 kilometers west of the alignment in the unnamed valley. Set of unnamed playas, west of the alignment and adjacent to Walker River (identified as wetlands in the National Wetland Inventory).
Schurz alternative segment 5		
Drainage from the Desert Mountain Range, Painted Mesa, and Terrill Mountains to Long Valley. The alignment would include the entire drainage basin of Long Valley. Drainage from Calico Hills, Terrill Mountains, and Red Ridge into an unnamed valley. Drainage from the Agai Pah Hills west towards the rail alignment.	Segment would cross Walker River and 60 unnamed washes (some of these washes are tributaries to Walker River). Segment would cross over two DOE-delineated wetlands and pass within two other wetlands 7 meters north and 150 meters south of the alignment, respectively.	Two unnamed playas, within 1.3 kilometers west and 1.5 kilometers west of the alignment in the unnamed valley. Set of unnamed playas, west of the alignment and adjacent to Walker River (identified as wetlands in the National Wetland Inventory).

Table 3-105. Hydrologic features potentially relevant to the Schurz alternative segments[a] (page 2 of 2).

General hydrographic features/drainage	Hydrologic features within 150 meters of the centerline of the rail alignment[b]	Hydrologic features between 150 meters and 1.6 kilometers[b] of the centerline of the rail alignment
Schurz alternative segment 6		
Drainage from the Desert Mountain Range, Painted Mesa, and Terrill Mountains to Long Valley. The alignment would include the entire drainage basin of Long Valley. Drainage from Terrill Mountains to Rawhide Flat. Drainage from Calico Hills, Terrill Mountains, and Red Ridge into an unnamed valley. Drainage from the Agai Pah Hills west towards the rail alignment.	Segment would cross Walker River and 66 unnamed washes (some of these washes are tributaries to Walker River). Segment would enter Rawhide Flat. Segment would cross over two DOE-delineated wetlands and pass within two other wetlands 7 meters north and 150 meters south of the alignment, respectively.	Two unnamed playas, within 1.3 kilometers west and 1.5 kilometers west of the alignment in the unnamed valley. Set of unnamed playas, west of the alignment and adjacent to Walker River (identified as wetlands in the National Wetland Inventory).

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 51-53, and 58-59.
b. To convert meters to feet, multiply by 3.2808; to convert kilometers to miles, multiply by 0.62137.

The segment would pass within 1 kilometer (0.6 mile) to the east of Weber Reservoir and cross numerous tributaries to the Walker River. There are no water-quality data available for this area; however, there are regional data for the Walker River Basin (DIRS 180064-USGS 2005, all). Schurz alternative segment 1 would then turn southeast along the southwest edge of the Calico Hills and enter an unnamed valley that receives its drainage from the Calico Hills, Terrill Mountains, Red Ridge, and Gillis Range. After passing the Calico Hills, Schurz alternative segment 1 would cross through two unnamed playas and bypass several other unnamed playas situated east and west of the segment in the unnamed valley. For most of the year, these playas and ponds would be dry; however, runoff from ephemeral washes draining the Calico Hills, Terrill Mountains, and Gillis Range would be conveyed into and toward these low-lying areas. During periods of intense precipitation, the size of the watershed and the number of ephemeral washes could provide enough runoff to create localized flooding. There is another set of playas at the southern end of Schurz alternative segment 1 adjacent to the Walker River. Additional surface runoff from ephemeral washes would drain from the Agai Pah Hills into the Schurz alternative segment 1 region of influence. Surface runoff would generally drain west toward Walker River.

The Walker River Basin is considered an interstate basin because it receives drainage from outside Nevada. During a survey of the washes along the Mina rail alignment in support of this Rail Alignment EIS, DOE identified the Walker River and three other washes that Schurz alternative segment 1 would cross as waters of the United States, as regulated under Section 404 of the Clean Water Act. There are another four washes, also classified as waters of the United States, within 0.40 kilometer (0.25 mile) of the Schurz alternative segment 1, but the segment would not cross those washes (DIRS 180889-PBS&J 2007, p. 7, Table 2, and Figure 3A).

The National Wetland Inventory dataset indicates that wetlands border the Walker River. During field investigations in support of this Rail Alignment EIS, DOE confirmed the presence of these wetlands along the Walker River. Schurz alternative segment 1 would cross the Walker River and two DOE-delineated wetlands. There are two other wetlands (one north and one south of the alternative segment) adjacent to the Walker River (DIRS 180889-PBS&J 2007, Figure 4). Additionally, as the alternative segment continued south past Weber Reservoir, it would pass within approximately 1.6 kilometers (1 mile) of a small group of wetlands along the Walker River. The National Wetlands Inventory dataset identifies the playas at the southern end of Schurz alternative segment 1 and adjacent to

the Walker River as wetlands; however, DOE field surveys in support of this Rail Alignment EIS confirmed that there are no wetlands in this area. Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Schurz alternative segment 1; however, the segment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with Schurz alternative segment 1.

There are two springs within the Schurz alternative segment 1 region of influence – Double Spring and an unnamed spring. Double Spring and the unnamed spring are approximately 1.5 kilometers (0.93 mile) and 1.4 kilometers (0.88 mile) east of the alternative segment, respectively.

3.3.5.3.4.2 Schurz Alternative Segment 4. From the northern end of Campbell Valley, Schurz alternative segment 4 would cross Walker River and two tributaries of the Walker River as it enters Sunshine Flat. The alternative segment would pass to the west of Painted Mesa, and east of Weber Reservoir and the northern end of the Wassuk Range before crossing U.S. Highway 95. It would then pass south of Calico Hills, enter an unnamed valley, and travel west of the Agai Pah Hills and the Gillis Range before ending near Gillis Canyon (see Table 3-105 and Figure 3-180). Construction camp 18A would be adjacent to Schurz alternative segment 4 approximately 75 meters (250 feet) east of its junction with U.S. Highway 95 (DIRS 180875-Nevada Rail Partners 2007, p. F-4). The construction camp would not overlie any surface-water features. There are no potential quarry sites along Schurz alternative segment 4.

Schurz alternative segment 4 would run northeast from Campbell Valley, where it would cross the Walker River and two tributaries to Walker River that receive their drainage from the Desert Mountains and later combine into one stream. The Walker River is a perennial stream that flows through Weber Reservoir and conveys surface water to a terminal basin called Walker Lake. Schurz alternative segment 4 would lie entirely within the Walker Hydrographic sub-basin, which has a total drainage area of approximately 2,600 square kilometers (1,000 square miles) (DIRS 180885-Parsons Brinckerhoff 2007, p. 20). The U.S. Geological Survey gaging station closest to Schurz alternative segment 4 is at the Walker River above Weber Reservoir near the community of Schurz. At this station, the river has a drainage area of approximately 7,000 square kilometers (2,700 square miles) (see Table 3-104). Schurz alternative segment 4 would continue eastward and then head south into Sunshine Flat, which receives drainage from the Desert Mountains and Painted Mesa. The segment would pass within 0.85 kilometer (0.53 mile) to the east of Weber Reservoir and cross numerous tributaries to the Walker River. There are no water-quality data available for this area; however, there are regional data for the Walker River Basin (DIRS 180064-USGS 2005, all). Schurz alternative segment 4 would proceed east and follow along a tributary to the Walker River, crossing it several times. After passing through a valley between Painted Mesa and Calico Hills and then turning southeast, the alternative segment would turn toward the east and pass the southern edge of the Terrill Mountains and proceed into an unnamed valley that receives its drainage from the Calico Hills, Terrill Mountains, Red Ridge, and Gillis Range. In this valley, Schurz alternative segment 4 would pass two unnamed playas that would be west of the segment. For most of the year, these playas would be dry; however, runoff from unnamed ephemeral washes draining the Terrill Mountains, Red Ridge, and Gillis Range would be conveyed toward these low-lying areas. During periods of intense precipitation, the size of the watershed and the number of ephemeral washes could provide enough runoff to create localized flooding. There is another set of playas at the southern end of Schurz alternative segment 4 adjacent to the Walker River. Additional surface runoff from ephemeral washes would drain from the Agai Pah Hills into the Schurz alternative segment 4 region of influence. Surface runoff would generally drain west toward Walker River.

The Walker River Basin is considered an interstate basin because it receives drainage from outside Nevada. During a survey of the washes along the Mina rail alignment in support of this Rail Alignment EIS, DOE identified the Walker River and five washes that Schurz alternative segment 4 would cross as waters of the United States, as regulated under Section 404 of the Clean Water Act. There are another two washes, also classified as waters of the United States, within 0.40 kilometer (0.25 mile) of the Schurz alternative segment 4, but the segment would not cross those washes (DIRS 180889-PBS&J 2007, p. 3, Table 2, and Figure 3A). The National Wetland Inventory dataset indicates that emergent wetlands border the Walker River. During field investigations in support of this Rail Alignment EIS, DOE confirmed the presence of emergent wetlands along the Walker River. Schurz alternative segment 4 would cross the Walker River and two DOE-delineated wetlands. There are two other wetlands (one north and one south of the alternative segment) adjacent to the Walker River (DIRS 180889-PBS&J 2007, Figure 4). Additionally, as the alternative segment continued south past Weber Reservoir, it would pass within approximately 1.6 kilometers (1 mile) of a small group of wetlands along the Walker River. The National Wetlands Inventory dataset identifies the playas at the southern end of Schurz alternative segment 4 and adjacent to the Walker River as wetlands; however, DOE field surveys in support of this Rail Alignment EIS confirmed that there are no wetlands in this area. Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Schurz alternative segment 4; however, the segment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with Schurz alternative segment 4.

There are no springs identified within 1.6 kilometers (1 mile) of Schurz alternative segment 4.

3.3.5.3.4.3 Schurz Alternative Segment 5. From the northern end of Campbell Valley, Schurz alternative segment 5 would cross the Walker River, travel along the southern edge of the Desert Mountains, and then travel southeast through Long Valley between Painted Mesa and the Terrill Mountains. The segment would then cross U.S. Highway 95 as it continued around the southern edge of the Terrill Mountains, past the western edge of Red Ridge, through an unnamed valley, and past the western edge of the Agai Pah Hills before ending near Gillis Canyon (see Table 3-105 and Figure 3-180). Construction camp 18C would be adjacent to Schurz alternative segment 5 approximately 295 meters (970 feet) southeast of its junction with U.S. Highway 95 (DIRS 180875-Nevada Rail Partners 2007, p. F-4). The construction camp would not overlie any surface-water features. There are no potential quarry sites along Schurz alternative segment 5.

Schurz alternative segment 5 would run northeast from Campbell Valley, where it would cross the Walker River and several tributaries to Walker River that receive their drainage from the Desert Mountains and later combine into one stream. The Walker River is a perennial stream that flows through Weber Reservoir and conveys surface water to a terminal basin called Walker Lake. Schurz alternative segment 5 would lie entirely within the Walker Hydrographic sub-basin, which has a total drainage area of approximately 2,600 square kilometers (1,000 square miles) (DIRS 180885-Parsons Brinckerhoff 2007, p. 20). The U.S. Geological Survey gaging station closest to Schurz alternative segment 5 is at the Walker River above Weber Reservoir near the community of Schurz. At this station, the river has a drainage area of approximately 7,000 square kilometers (2,700 square miles) (see Table 3-104). As the alternative segment continued east, it would travel along the southern edge of the Desert Mountains, crossing several ephemeral washes draining the Desert Mountains and flowing toward Sunshine Flat. After rounding the northern edge of Painted Mesa, Schurz alternative segment 5 would travel southeast through Long Valley and over U.S. Highway 95. Long Valley receives its drainage from Painted Mesa, the Terrill Mountains, and Calico Hills. As the segment turned toward the east and passed the southern edge of the Terrill Mountains, it would proceed into an unnamed valley which receives its drainage from the Calico Hills, Terrill Mountains, Red Ridge, and Gillis Range. In this valley, Schurz 5 would pass two unnamed playas situated west of the rail alignment. For most of the year, these playas would be dry; however, runoff from unnamed ephemeral washes draining the Terrill Mountains, Red Ridge, and Gillis Range would be conveyed toward these low-lying areas. During periods of intense precipitation, the size of the watershed and the number of ephemeral washes could provide enough runoff to create localized flooding. There is another set of playas at the southern end of Schurz alternative segment 5 adjacent to the Walker River. Additional surface runoff from ephemeral washes would drain from the Agai Pah Hills into the Schurz alternative segment 5 region of influence. Surface runoff would generally drain west toward Walker River.

The Walker River Basin is considered an interstate basin because it receives drainage from outside Nevada. During a survey of the washes along the Mina rail alignment in support of this Rail Alignment EIS, DOE identified the Walker River as the only water of the United States, as regulated under Section 404 of the Clean Water Act, crossed by this alternative segment (DIRS 180889-PBS&J 2007, p. 3, Table 2, and Figure 3A).

The National Wetland Inventory dataset indicates that emergent wetlands border the Walker River. During field investigations in support of this Rail Alignment EIS, DOE confirmed the presence of emergent wetlands along the Walker River. Schurz alternative segment 5 would cross the Walker River and two DOE-delineated wetlands. There are two other wetlands (one north and one south of the alternative segment) adjacent to the Walker River (DIRS 180889-PBS&J 2007, Figure 4). Additionally, as the alternative segment continued south past Weber Reservoir, it would pass within approximately 1.6 kilometers (1 mile) of a small group of wetlands along the Walker River. The National Wetlands Inventory dataset identifies the playas at the southern end of Schurz alternative segment 5 and adjacent to Walker River as wetlands; however, DOE field surveys in support of this Rail Alignment EIS confirmed that there are no wetlands in this area. Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Schurz alternative segment 5; however, the segment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with Schurz alternative segment 5.

There are no springs identified within 1.6 kilometers (1 mile) of Schurz alternative segment 5.

3.3.5.3.4.4 Schurz Alternative Segment 6. From the northern end of Campbell Valley, Schurz alternative segment 6 would cross the Walker River, travel along the southern edge of the Desert Mountains, and then travel southeast through Long Valley between Painted Mesa and the Terrill Mountains. The segment would then cross U.S. Highway 95 as it continued around the southern edge of the Terrill Mountains, past the western edge of Red Ridge, through an unnamed valley, and past the western edge of the Agai Pah Hills before ending near Gillis Canyon (see Table 3-105 and Figure 3-180). Construction camp 18D would be adjacent to Schurz alternative segment 6 approximately 640 meters (2,100 feet) west of its junction with U.S. Highway 95 (DIRS 180875-Nevada Rail Partners 2007, p. F-1). A small ephemeral stream would run through the footprint for construction camp 18D. There are no potential quarry sites along Schurz alternative segment 6.

Schurz alternative segment 6 would run northeast from Campbell Valley, where it would cross the Walker River and several tributaries to Walker River that receive their drainage from the Desert Mountains and later combine into one stream. The Walker River is a perennial stream that flows through Weber Reservoir and conveys surface water to a terminal basin called Walker Lake. Schurz alternative segment

6 would lie entirely within the Walker Hydrographic sub-basin, which has a total drainage area of approximately 2,600 square kilometers (1,000 square miles) (DIRS 180885-Parsons Brinckerhoff 2007, p. 20). The U.S. Geological Survey gaging station closest to Schurz alternative segment 6 is at the Walker River above Weber Reservoir near the community of Schurz. At this station, the river has a drainage area of approximately 7,000 square kilometers (2,700 square miles) (see Table 3-104). As the alternative segment continued east, it would travel along the southern edge of the Desert Mountains, crossing several ephemeral washes draining the Desert Mountains and flowing toward Sunshine Flat. After rounding the northern edge of Painted Mesa, Schurz 6 would travel southeast through Long Valley and over U.S. Highway 95. Long Valley receives its drainage from Painted Mesa, the Terrill Mountains, and Calico Hills. After crossing U.S. Highway 95, the alternative segment 6 would turn to the northeast and pass through a gap in the Terrill Mountains, round the northern edge of the Terrill Mountains, and enter Rawhide Flats. Near the area of the alternative segment, Rawhide Flats receives its drainage from numerous ephemeral washes from the Terrill Mountains. After passing between the Terrill Mountains and Red Ridge, Schurz alternative segment 6 would enter an unnamed valley that receives its drainage from the Calico Hills, Terrill Mountains, Red Ridge, and Gillis Range. In this valley, Schurz alternative segment 6 would pass two unnamed playas west of the rail alignment. For most of the year, these playas would be dry; however, runoff from unnamed ephemeral washes draining the Terrill Mountains, Red Ridge, and Gillis Range would be conveyed toward these low-lying areas. During periods of intense precipitation, the size of the watershed and the number of ephemeral washes could provide enough runoff to create localized flooding. There is another set of playas at the southern end of Schurz alternative segment 6 adjacent to the Walker River. Additional surface runoff from ephemeral washes would drain from the Agai Pah Hills into the Schurz alternative segment 6 region of influence. Surface runoff would generally drain west toward Walker River.

The Walker River Basin is considered an interstate basin because it receives drainage from outside Nevada. During a survey of the washes along the Mina rail alignment in support of this Rail Alignment EIS, DOE identified the Walker River, which Schurz alternative segment 6 would cross, as a water of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180889-PBS&J 2007, p. 3, Table 2 and Figure 3A).

The National Wetland Inventory dataset indicates that emergent wetlands border the Walker River. During field investigations in support of this Rail Alignment EIS, DOE confirmed the presence of emergent wetlands along the Walker River. Schurz alternative segment 6 would cross the Walker River and two DOE-delineated wetlands. There are two other wetlands (one north and one south of the alternative segment) adjacent to the Walker River (DIRS 180889-PBS&J 2007, Figure 4). Additionally, as the alternative segment continued south past Weber Reservoir, it would pass within approximately 1.6 kilometers (1 mile) of a small group of wetlands along the Walker River. The National Wetlands Inventory dataset identifies the playas at the southern end of Schurz alternative segment 6 and adjacent to the Walker River as wetlands; however, DOE field surveys in support of this Rail Alignment EIS confirmed that there are no wetlands in this area. Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Schurz alternative segment 6; however, the segment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with Schurz alternative segment 6.

There are no springs identified within 1.6 kilometers (1 mile) of Schurz alternative segment 6.

3.3.5.3.5 Department of Defense Branchline South (Boundary of Walker River Paiute Reservation to Thorne)

Except for a new siding inside the existing rail line right-of-way and construction camp 17 (which would be on the Hawthorne Army Depot), there would be no new construction along Department of Defense Branchline South. Neither the siding nor the construction camp would overlie any surface-water features. No additional road construction would be required (see Figure 3-181). Therefore, DOE has not characterized surface-water features along this portion of the Mina rail alignment.

3.3.5.3.6 Mina Common Segment 1 (Gillis Canyon to Blair Junction)

Beginning east of Thorne, Nevada, Mina common segment 1 would travel south of the Gillis Range through Walker Lake Valley and Soda Springs Valley, with the Gabbs Valley Range to the north and east and Garfield Hills to the west. This common segment would continue to travel south through Soda Springs Valley and Alkali Flat and pass to the east of Rhodes Salt Marsh between the Excelsior Mountains and Pilot Mountains. Mina common segment 1 would then travel to the east of Columbus Salt Marsh between the Candelaria Hills and the Monte Cristo Range before ending near Blair Junction. The common segment would parallel U.S. Highway 95 (see Table 3-106 and Figures 3-181 and 3-182). There are three ***construction camps*** associated with Mina common segment 1. Construction camp 16 would be adjacent to the rail alignment, 40 meters (131 feet) southeast of the junction of Mina common segment 1 with State Route 361. Two ephemeral washes that receive drainage from Gabbs Valley Range would run through the footprint for construction camp 16. Construction camp 15 would be adjacent to and west of the rail alignment, east of Tonopah Junction and Rhodes Salt Marsh. The construction camp would not overlie any surface-water features. Construction camp 14 would be adjacent to and east of the rail alignment at Blair Junction. Two ephemeral washes that receive drainage from the Monte Cristo Range would run through the footprint for construction camp 14. There are two potential quarry sites along Mina common segment 1. The first (Garfield Hills) would be approximately 2.23 kilometers (1.4 miles) south of the rail alignment near Hawthorne. Ephemeral washes draining down from the Garfield Hills would pass within 20 meters (66 feet) of the quarry. The second potential quarry site (Gabbs Range) would be approximately 0.77 kilometer (0.48 mile) east of the rail alignment, near Luning. Ephemeral washes draining down from Gabbs Valley Range into Soda Springs Valley would cross through the Gabbs Range quarry site.

Mina common segment 1 would begin in Walker Lake Valley, which receives its drainage from the Wassuk Range and Garfield Hills to the south and numerous canyons (including Ryan Canyon, Sheeps Head Canyon, and Montreal Canyon) and ephemeral washes draining Gillis Range to the north. The segment would pass to the north of a playa. As Mina common segment 1 continued through Walker Lake Valley, it would pass two playas (one of which receives drainage from Sheeps Head Canyon in the Gillis Range and ephemeral washes from Garfield Hills) and cross one playa. As the segment entered Soda Springs Valley, it would cross over a large playa that receives drainage from numerous ephemeral washes from the Gillis Range to the north and Garfield Hills to the south and pass by a smaller playa to the north that receives drainage from Gillis Range. Intermittent surface water would flow into Soda Springs Valley from unnamed washes draining ravines and side canyons of mountainous areas bordering Mina common segment 1.

Continuing south through Soda Springs Valley, the segment would pass east of two large playas in Alkali Flat. The first playa, just east of Luning, receives flow from Black Dyke Mountain to the west and numerous ephemeral washes draining Gabbs Valley Range. Drainage from Cinnabar Canyon, Dunlap Canyon, Mac Canyon, Water Canyon, and other washes in the Pilot Mountains to the east and Douglas Canyon and other washes in the Excelsior Mountains to the west flow into or toward the second playa.

As Mina common segment 1 would leave Soda Springs Valley, it would pass to the east of Rhodes Salt Marsh. This playa receives drainage from Long Canyon and numerous unnamed ephemeral washes from the Pilot Mountains to the east. Additional drainage from Candelaria Hills and the Excelsior Mountains flows toward the playa. The segment would follow a ridgeline of the Monte Cristo Range and pass east of Columbus Salt Marsh. Several ephemeral washes drain downslope from the headwaters of the Monte Cristo Range and flow west into Columbus Salt Marsh, at which point the drainages develop a braided drainage pattern. After passing around the southern end of the Monte Cristo Range, Mina common segment 1 would turn south as it crossed over U.S. Highway 95 and end at the northern edge of Big Smoky Valley. There are no streamflow or water-quality data available for the streams and washes Mina common segment 1 would cross.

The first approximately 15 kilometers (9 miles) of common segment 1 would be within the Walker River Basin, which is an interstate drainage system. DOE field investigations determined that none of the washes along this portion of common segment 1 have characteristics of waters of the United States. The 2 playas crossed in this basin have no hydrologic connection to tributaries of Walker Lake or other drainages in that basin. The remainder of Mina common segment 1 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along this portion of common segment 1 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water (DIRS 180889-PBS&J 2007, all).

Table 3-106. Hydrologic features potentially relevant to Mina common segment 1.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[b] of the centerline of the rail alignment
Drainage from Wassuk Range, Garfield Hills, and numerous canyons (including Ryan Canyon, Sheeps Head Canyon, and Montreal Canyon) and ephemeral washes draining Gillis Range into Walker Lake Valley. Drainage from unnamed washes draining ravines and side canyons of mountainous areas into Soda Springs Valley. Drainage from Black Dyke Mountain, numerous ephemeral washes draining Gabbs Valley Range, Cinnabar Canyon, Dunlap Canyon, Mac Canyon, Water Canyon, and other washes in the Pilot Mountains, and Douglas Canyon and other washes in the Excelsior Mountains. Drainage from Long Canyon, numerous unnamed ephemeral washes from the Pilot Mountains, Candelaria Hills, and Excelsior Mountains into or towards Rhodes Salt Marsh. Drainage from Monte Cristo Range into Columbus Salt Marsh.	Segment would cross 141 unnamed washes. Segment would cross Alkali Flat. Segment would cross through two unnamed playas (one of which is identified as a wetland in the National Wetland Inventory) and pass within 150 meters of another unnamed playa (which is identified as a wetland in the National Wetland Inventory).	Alignment would pass within 1.6 kilometers of 6 unnamed playas (some of which are identified as wetlands in the National Wetland Inventory). Kinkaid Spring 0.23 kilometer north. Unnamed spring 0.54 kilometer east.

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 51-53, and 58-59.

b. To convert meters to feet, multiply by 3.2808; to convert kilometers to miles, multiply by 0.62137.

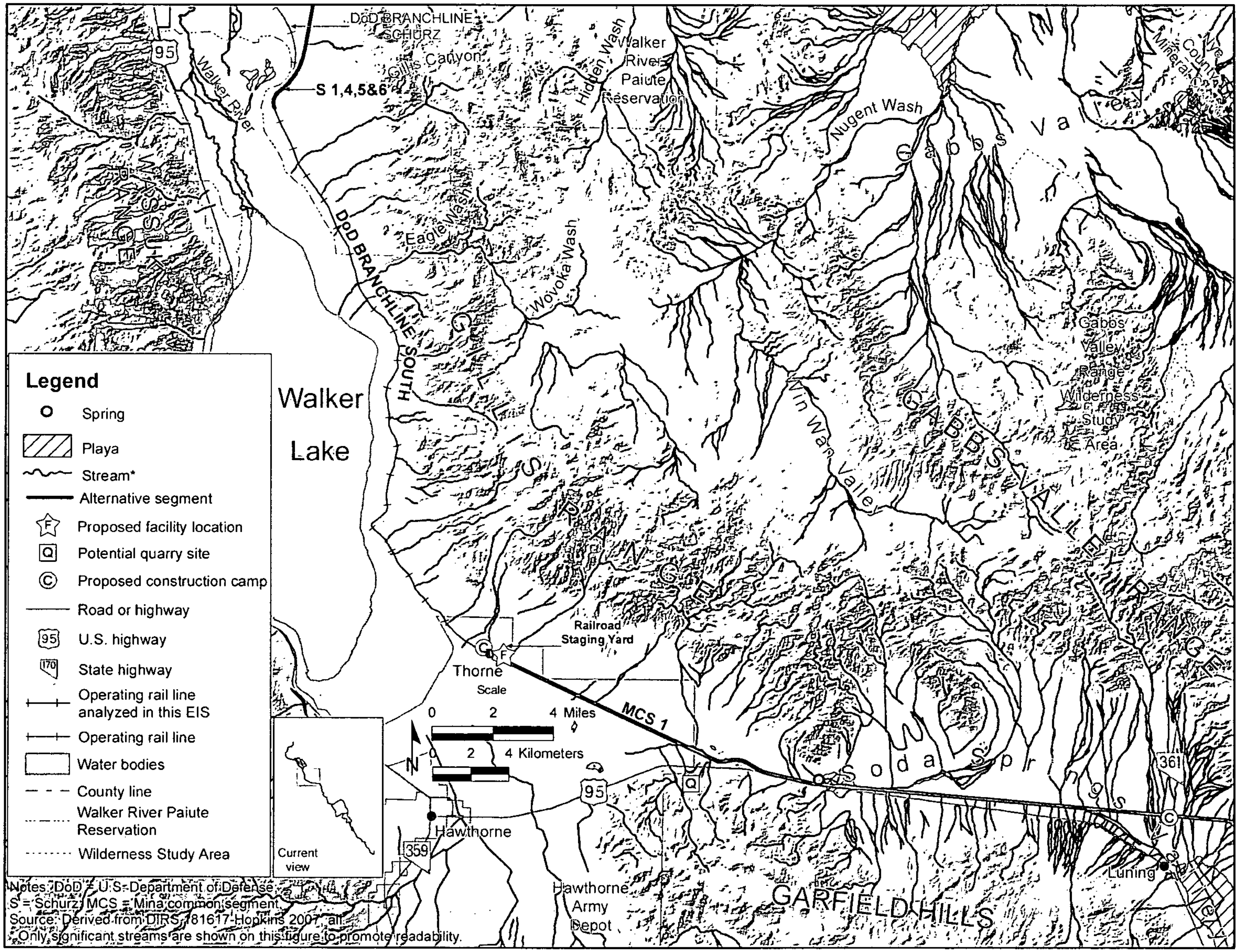


Figure 3-181. Surface drainage within map area 2.

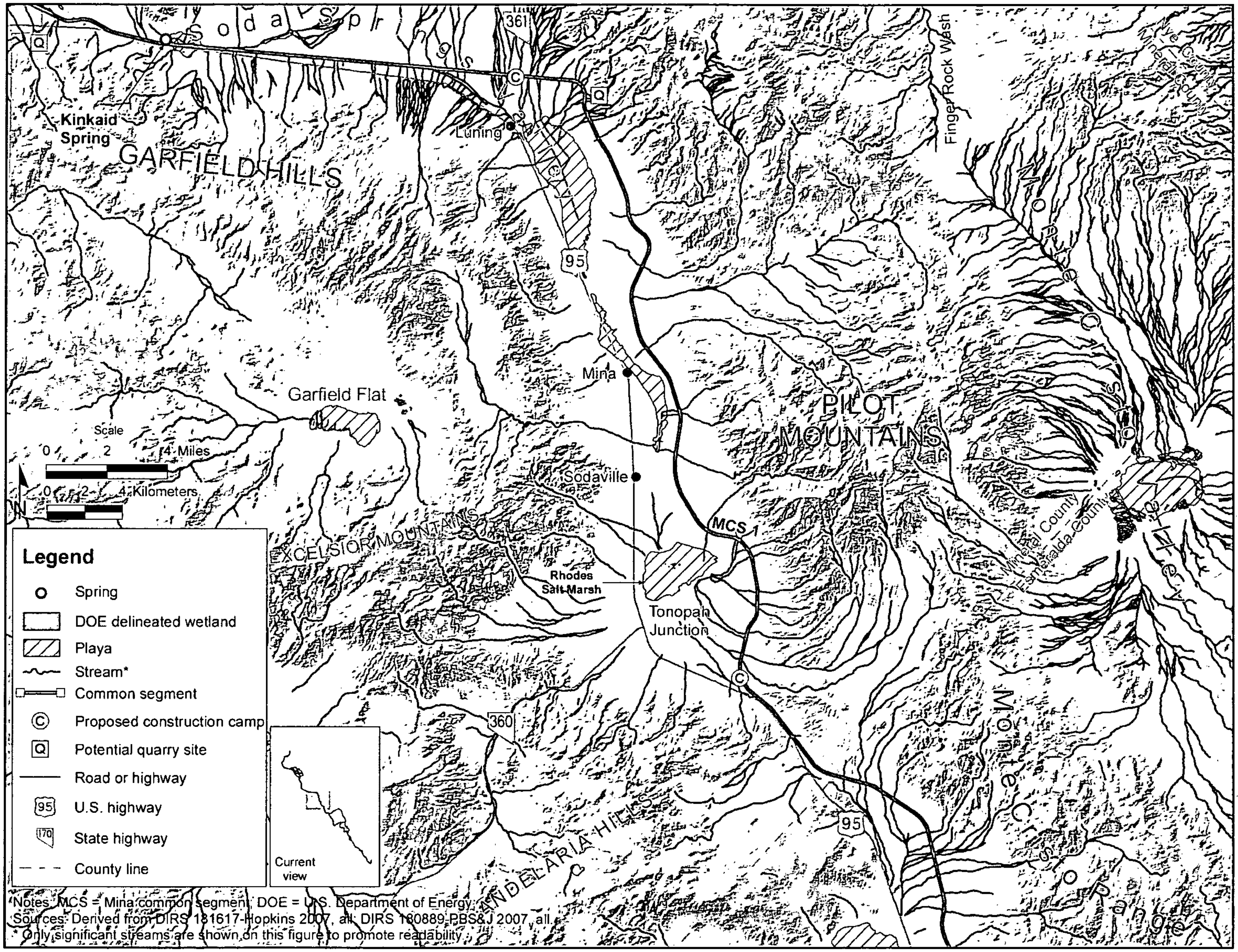


Figure 3-182. Surface drainage within map area 3.

The National Wetland Inventory dataset identifies the playas in Soda Springs Valley and Alkali Flat as wetlands; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in these areas (DIRS 180889-PBS&J 2007, Figure 5B). Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Mina common segment 1; however, the rail alignment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with the rail alignment.

There are two springs within the Mina common segment 1 region of influence – Kinkaid Spring and an unnamed spring. Kinkaid Spring is approximately 0.23 kilometer (0.14 mile) north of the common segment just west of the large playa in Soda Springs Valley (DIRS 180889-PBS&J 2007, p. 9). The unnamed spring is approximately 0.54 kilometer (0.34 mile) east of the common segment in the foothills of the Monte Cristo Range.

3.3.5.3.7 Montezuma Alternative Segments

3.3.5.3.7.1 Montezuma Alternative Segment 1. Montezuma alternative segment 1 would parallel State Route 265 as it traveled south from Big Smoky Valley past the Silver Peak Range and Mineral Ridge to the west and the Weepah Hills to the east. After entering Clayton Valley, the alternative segment would travel past Angel Island, Paymaster Ridge, Clayton Ridge, the Montezuma Range, Goldfield Hills, Cuprite Hills, Stonewall Flat, and Stonewall Mountain before ending near Lida Junction (see Table 3-107 and Figures 3-183 and 3-184). Construction camp 13A would be adjacent to Montezuma 1 just south of the community of Silver Peak. The construction camp would not overlie any surface-water features. Construction camp 9A would be adjacent to Montezuma alternative segment 1 approximately 290 meters (950 feet) northwest of where the rail segment would cross U.S. Highway 95. A small ephemeral wash draining downslope of Garfield Hills would run through the extreme southwest corner of the footprint for this construction camp (DIRS 180875-Nevada Rail Partners 2007, p. F-11). A potential quarry site, North Clayton, would be located along Montezuma alternative segment 1 near the Montezuma Range. The quarry would not overlie any surface-water features.

From Big Smoky Valley, Montezuma alternative segment 1 would travel south, paralleling State Route 265 to Silver Peak, and along the way, cross over numerous ephemeral washes flowing into Big Smoky Valley. Big Smoky Valley receives drainage from numerous ephemeral washes flowing downslope of the Monte Cristo Range to the north to join drainage from the Silver Peak Range and Mineral Ridge to the west and south via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes, and drainage from Weepah Hills to the east. Although Big Smoky Valley is an extensive topographic feature, Montezuma alternative segment 1 would only cross through the extreme western part. Once past Silver Peak, Montezuma alternative segment 1 would enter Clayton Valley, which receives drainage from the Silver Peak Range, Mineral Ridge, Palmetto Mountains, Clayton Ridge, Paymaster Range, and Weepah Hills via Lida Wash and unnamed washes. In Clayton Valley, the alternative segment would pass between Angel Island and Clayton Ridge, where it would cross numerous ephemeral washes flowing down from Clayton Ridge. As Montezuma alternative segment 1 passed through the gap between Paymaster Ridge and Clayton Ridge and rounded the southern portion of Clayton Ridge, it would cross over ephemeral washes flowing down from Paymaster Ridge, Clayton Ridge, and the Montezuma Range via Nevada Canyon and unnamed washes. After passing through a gap in the Montezuma Range, the segment would cross over Jackson Wash into an unnamed valley. Drainage from numerous ephemeral washes flows downslope of the Montezuma Range and the Goldfield Hills into this valley. Montezuma alternative segment 1 would skirt the western foothills of the Goldfield Hills, round the southern edge, cross over China Wash, and pass between the Goldfield Hills and the Cuprite Hills, crossing over several washes flowing down from both hills. Montezuma alternative segment 1 would pass between a gap in the Cuprite Hills and end near Lida Junction. There are no streamflow or water-quality data available for the streams and washes Montezuma alternative segment 1 would cross.

Montezuma alternative segment 1 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Montezuma 1 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water.

Table 3-107. Hydrologic features potentially relevant to the Montezuma alternative segments.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[b] of the centerline of the rail alignment
Montezuma alternative segment 1		
Drainage from Monte Cristo Range, Silver Peak Range, Mineral Ridge, and Weepah Hills via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes to Big Smoky Valley. Drainage from Silver Peak Range, Mineral Ridge, Palmetto Mountains, Clayton Ridge, Paymaster Range, and Weepah Hills via Lida Wash and unnamed washes into Clayton Valley. Drainage from Paymaster Ridge, Clayton Ridge, and Montezuma Range via Nevada Canyon and unnamed washes. Drainage from numerous ephemeral washes flows downslope of the Montezuma Range and Goldfield Hills into an unnamed valley.	Segment would cross Jackson Wash, China Wash, and 185 unnamed washes.	Hot Spring 0.53 kilometer west.
Montezuma alternative segment 2		
Drainage from Monte Cristo Range, Silver Peak Range, Mineral Ridge, and Weepah Hills via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes to Big Smoky Valley. Drainage from Lone Mountain, General Thomas Hills, and San Antonio Mountains flows into Montezuma Valley. Drainage from Malpais Mesa, Goldfield Hills, Montezuma Range, and Chispa Hills flow into Alkali Lake Playa and Stonewall Flat.	Segment would cross Big Wash and 84 unnamed washes. Segment would cross Stonewall Flat.	Slaughterhouse Spring 0.92 kilometer west. Rabbit Spring 0.20 kilometer west.
Montezuma alternative segment 3		
Drainage from Monte Cristo Range, Silver Peak Range, Mineral Ridge, and Weepah Hills via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes to Big Smoky Valley. Drainage from Lone Mountain, General Thomas Hills, and San Antonio Mountains flows into Montezuma Valley. Drainage from numerous ephemeral washes flows down slope of the Montezuma Range and the Goldfield Hills into an unnamed valley..	Segment would cross Big Wash and 147 unnamed washes.	

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 52-53, 58-59.

b. To convert meters to feet, multiply by 3.2808; to convert kilometers to miles, multiply by 0.62137.

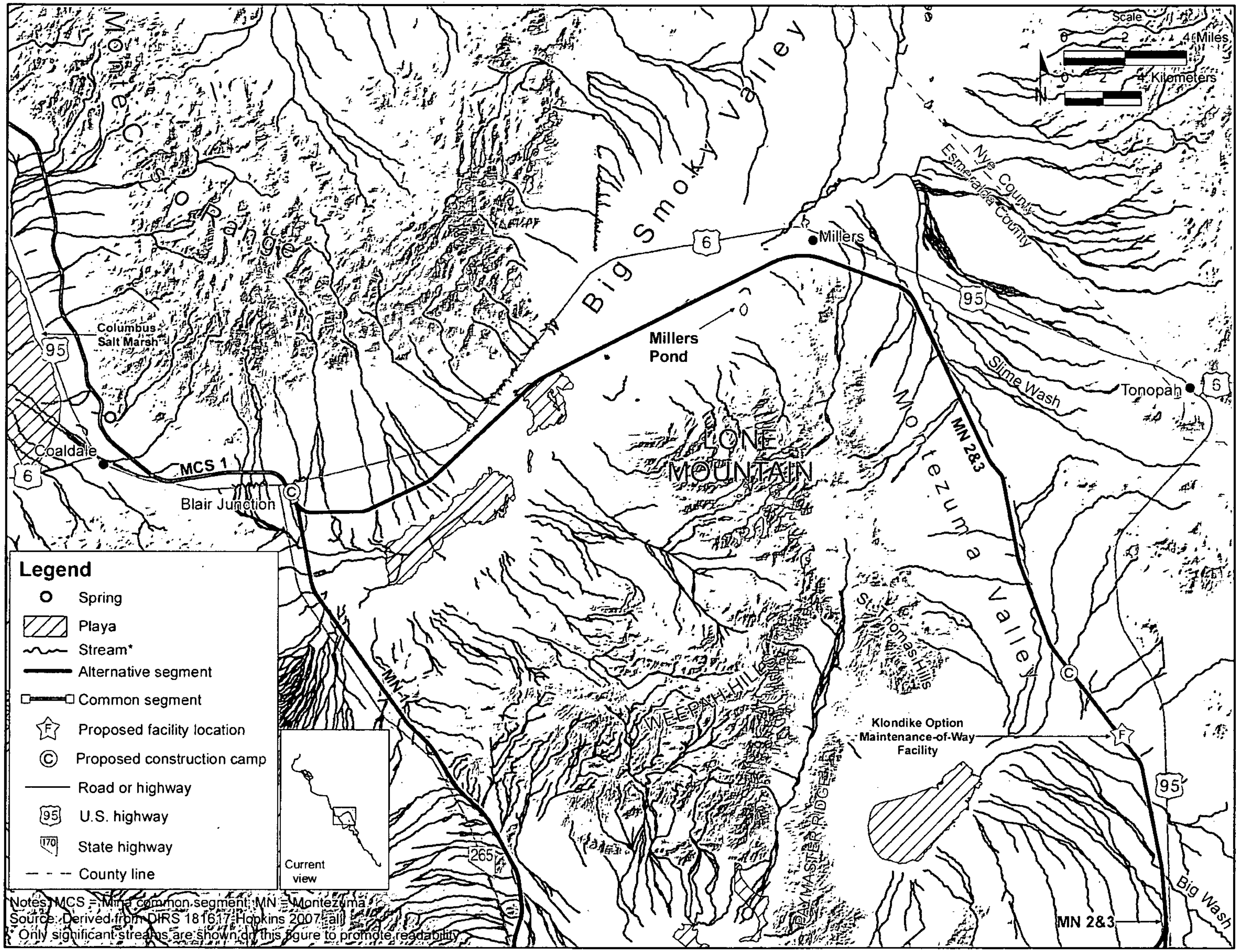


Figure -183. Surface drainage within map area 4.

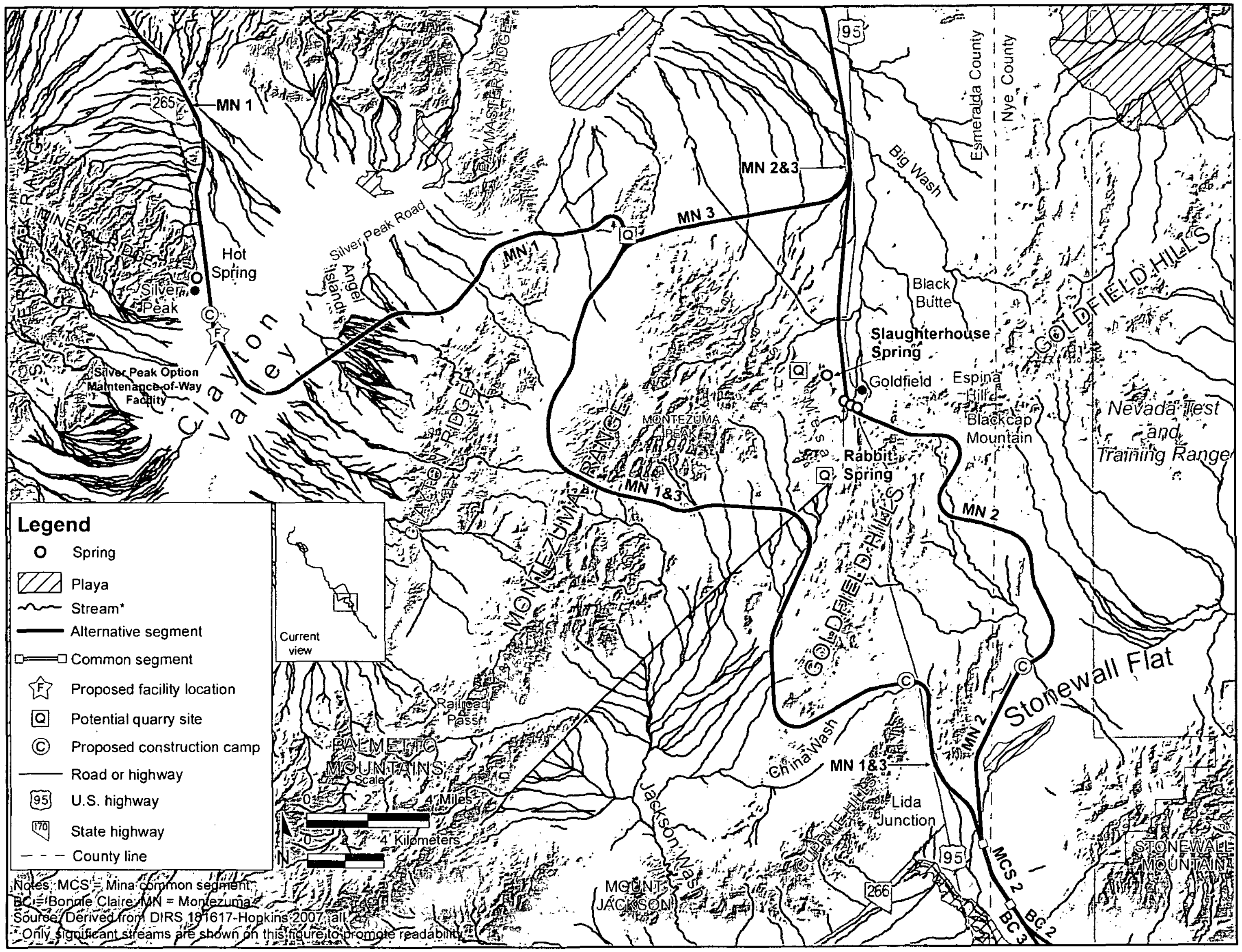


Figure 3-184. Surface drainage within map area 5.

The National Wetland Inventory dataset identifies a pond in the private, diked area near Silver Peak as a wetland; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in these areas (DIRS 180889-PBS&J 2007, all). Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Montezuma 1; however, the rail alignment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with the rail alignment.

Hot Spring is within the region of influence for Montezuma alternative segment 1, approximately 0.53 meter (0.33 mile) west of the alternative segment near the Silver Peak.

3.3.5.3.7.2 Montezuma Alternative Segment 2. Montezuma alternative segment 2 would parallel U.S. Highway 95 as it traveled east from Big Smoky Valley past Lone Mountain. After passing Millers, the segment would head south and enter Montezuma Valley. It would pass Tonopah, General Thomas Hills, and Klondike and parallel U.S. Highway 95 for a short time before crossing it near Malpais Mesa, Goldfield Hills, and Goldfield. Montezuma alternative segment 2 would end near Stonewall Flat (see Table 3-107 and Figures 3-183 and 3-184). Construction camp 9 would be adjacent to Montezuma alternative segment 2 just north of Stonewall Flat. The construction camp would not overlie any surface-water features. Construction camp 13B would be adjacent to Montezuma alternative segment 1 in Montezuma Valley. A small ephemeral wash draining hills near Hasbrouck Peak into Montezuma Valley would run through the footprint for the construction camp (DIRS 180875-Nevada Rail Partners 2007, p. F-10). Two potential quarry sites, ES-7 and Malpais Mesa South, would be along the Montezuma alternative segment 2 in Malpais Mesa near Goldfield. Neither quarry would overlie any surface-water features.

Montezuma alternative segment 2 would parallel State Route 6 as it traveled east along the southern edge of the Monte Cristo Range and into Big Smoky Valley. Big Smoky Valley receives drainage from numerous ephemeral washes flowing downslope of the Monte Cristo Range to the north to join drainage from the Silver Peak Range and Mineral Ridge to the west and south via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes, and drainage from Weepah Hills to the east. Montezuma alternative segment 2 would cross several ephemeral washes flowing down from the Monte Cristo Range, pass a few small playas, and cross a large playa twice. These playas are actually part of a larger playa in Big Smoky Valley. The segment would pass within 0.42 kilometer (0.26 mile) of a smaller playa in Big Smoky Valley. After crossing private property known as Millers, the segment would pass approximately 1.3 kilometers (0.81 mile) north of a tailings pond located on the same property. The pond, approximately 0.17 square kilometer (0.07 square mile) in size, appears to receive a portion of its hydrology as seasonal runoff from Lone Mountain. No water-quality data are available for Millers tailings pond.

In the Millers area, there is a small playa identified as a dry lake, which would be approximately 1.5 kilometers (0.93 mile) north of Montezuma alternative segment 2. As the segment passed Millers, it would turn south, proceed past Slime Wash to the east, and enter Montezuma Valley. Montezuma Valley receives drainage from numerous ephemeral washes flowing downslope of Lone Mountain and General Thomas Hills to the west and San Antonio Mountains to the east. As the Montezuma alternative segment 2 continued south through Montezuma Valley, it would pass to the west of a set of three small playas. A few small ephemeral washes originating near Mt. Butte to the east and Lone Mountain to the west might convey seasonal waters toward these playas. Just north of Goldfield, the Montezuma alternative segment 2 would cross Big Wash. Once in Goldfield, the rail segment would pass to the west of a number of small playas that receive drainage from Goldfield Hills to the south. At the extreme southern end of the Montezuma alternative segment 2, near Ralston, the segment would pass to the west of a large playa named Stonewall Flat, which is northwest of Stonewall Mountain. Runoff from Stonewall Flat drains downslope into Lida Valley where it might remain as surface water for brief periods. The estimated runoff entering Stonewall Flat is 490,000 cubic meters (17.3 million cubic feet) per year (DIRS 101811-DOE 1996, Section 4.2.5.1). It is likely that ephemeral washes would convey seasonal runoff from Stonewall Mountain into the playa. Montezuma alternative segment 2 would end shortly after passing Stonewall Flat. There are no streamflow or water-quality data available for the streams and washes Montezuma 2 would cross.

Montezuma alternative segment 2 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Montezuma 2 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water.

The National Wetland Inventory dataset identifies the large playas in Big Smoky Valley and Stonewall Flat as wetlands; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in this area (DIRS 180889-PBS&J 2007, all). Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Montezuma alternative segment 2; however, the segment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with the rail alignment.

Slaughterhouse Spring and Rabbit Spring are located approximately 0.92 kilometer (0.57 mile) and 0.20 kilometer (0.12 mile), respectively, west of the rail alignment near the town of Goldfield. All three springs are within the Mina rail alignment region of influence but would be outside the construction right-of-way.

3.3.5.3.7.3 Montezuma Alternative Segment 3. Montezuma alternative segment 3 would parallel State Route 6 as it traveled east from Big Smoky Valley past Lone Mountain. After passing Millers, the segment would head south and enter Montezuma Valley. It would pass Tonopah, General Thomas Hills, and Klondike and parallel U.S. Highway 95 for a short time before turning west at the Montezuma Range, just north of Malpais Mesa. The segment would travel past Clayton Ridge, the Montezuma Range, Goldfield Hills, Cuprite Hills, Stonewall Flat, and Stonewall Mountain before ending near Lida Junction (see Table 3-107 and Figures 3-183 and 3-184). Construction camp 13B would be adjacent to Montezuma alternative segment 3 in Montezuma Valley. A small ephemeral wash draining hills near Hasbrouck Peak into Montezuma Valley would run through the footprint for the construction camp (DIRS 180875-Nevada Rail Partners 2007, p. F-10). Construction camp 9A would be adjacent to Montezuma 3 approximately 280 meters (920 feet) west of where the rail alignment would cross U.S. Highway 95 (DIRS 180875-Nevada Rail Partners 2007, p. F-11). A small ephemeral wash draining downslope of Garfield Hills would run through the extreme southwest corner of the construction camp. There are no potential quarry sites along Montezuma 3.

Montezuma alternative segment 3 would parallel State Route 6 as it traveled east along the southern edge of the Monte Cristo Range and into Big Smoky Valley. Big Smoky Valley receives drainage from numerous ephemeral washes flowing downslope of the Monte Cristo Range to the north to join drainage from the Silver Peak Range and Mineral Ridge to the west and south via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes, and drainage from Weepah Hills to the east. The segment would cross several ephemeral washes flowing down from the Monte Cristo Range, pass a few small playas, and cross a large playa twice. These playas are actually part of a larger playa in Big Smoky Valley. Montezuma alternative segment 3 would pass within 0.42 kilometer (0.26 mile) of a smaller playa in Big Smoky Valley. After reaching

Millers, the segment would pass approximately 1.3 kilometers (0.81 mile) north of Millers Pond. The pond, approximately 0.17 square kilometer (0.07 square mile) in size, appears to receive a portion of its hydrology as seasonal runoff from Lone Mountain. No streamflow or water-quality data are available for Millers Pond. In Millers, there is a small playa identified as a dry lake, which would be approximately 1.5 kilometers (0.93 mile) north of Montezuma 3. As Montezuma alternative segment 3 passed Millers, it would turn south, proceed past Slime Wash to the east, and enter Montezuma Valley. Montezuma Valley receives drainage from numerous ephemeral washes flowing downslope of Lone Mountain and General Thomas Hills to the west and San Antonio Mountains to the east. As the segment continued south through Montezuma Valley, it would pass a set of three small playas to the east. A few small ephemeral washes originating near Mt. Butte to the east and Lone Mountain to the west might convey seasonal waters toward these playas. As Montezuma alternative segment 3 passed around the northern end of the Montezuma Range, it would cross over ephemeral washes flowing down from Paymaster Ridge, Clayton Ridge, and the Montezuma Range via Nevada Canyon and unnamed washes. After passing through a gap in the Montezuma Range, the Montezuma alternative segment 3 would cross Jackson Wash into an unnamed valley. Drainage from numerous ephemeral washes flows downslope of the Montezuma Range and the Goldfield Hills into this valley. Montezuma alternative segment 3 would skirt the western foothills of the Goldfield Hills, round the southern edge, and pass between Goldfield Hills and Cuprite Hills, crossing over several washes flowing down from both hills. Montezuma 3 would pass between a gap in the Cuprite Hills and end near Lida Junction. There are no streamflow or water-quality data available for the streams and washes Montezuma alternative segment 3 would cross.

Montezuma alternative segment 3 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Montezuma alternative segment 3 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water.

The National Wetland Inventory dataset identifies the large playa in Big Smoky Valley as a wetland; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in these areas (DIRS 180889-PBS&J 2007, all). Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Montezuma alternative segment 3; however, the rail alignment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with the rail alignment.

There are no springs identified within 1.6 kilometers (1 mile) of Montezuma alternative segment 3.

3.3.5.3.8 Mina Common Segment 2

Mina common segment 2 would begin just east of Lida Junction and would cross Alkali Flat (within the Lida Valley) and end near the foot of Stonewall Mountain (see Table 3-108 and Figure 3-185). There are no proposed construction camps or potential quarry sites along Mina common segment 2.

Mina common segment 2 would begin in Lida Valley, south of Stonewall Flat, and cross over Alkali Flat. Runoff from Stonewall Flat drains downslope into Lida Valley where it might remain as surface water for brief periods. The estimated runoff entering Stonewall Flat is 490,000 cubic meters (17.3 million cubic feet) per year (DIRS 101811-DOE 1996, Section 4.2.5.1). Jackson Wash appears to be a notable drainage that contributes seasonal water to Lida Valley.

Table 3-108. Hydrologic features potentially relevant to Mina common segment 2.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[b] of the centerline of the rail alignment
Drainage from northwest side of Stonewall Mountain and the Cuprite Hills would drain into Lida Valley and Alkali Flat Playa.	Jackson Wash, China Wash. Segment would cross three washes.	Alkali Flat/Lida Valley Playa.

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 59.
b. To convert meters to feet, multiply by 3.2808; to convert kilometers to miles, multiply by 0.62137.

There are no perennial streams in any of the surrounding basins; rather, the many washes that drain the upland areas convey ephemeral flow that ponds on the playas during periods of intense precipitation. No streamflow or water-quality data are available for the streams and washes Mina common segment 2 would cross.

Mina common segment 2 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Mina common segment 2 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water.

There are no wetlands within the Mina common segment 2 region of influence.

Federal Emergency Management Agency flood maps provide coverage for the entire length of Mina common segment 2; however, the common segment would not cross any floodplains. Because Mina common segment 2 follows valley floors and crosses unnamed ephemeral washes and playas, it is feasible that a floodplain could exist in low laying areas along this segment. Appendix F further describes possible floodplains associated with the rail alignment.

There are no springs identified within 1.6 kilometers (1 mile) of Mina common segment 2.

3.3.5.3.9 Bonnie Claire Alternative Segments

Bonnie Claire alternative segment 2 would begin south of Stonewall Flat, exit Lida Valley, and turn to the east, entering Sarcobatus Flat, a large playa. Sarcobatus Flat is bounded by Pahute Mesa on the east and Gold Mountain to the west (see Table 3-109 and Figure 3-185). There are no construction camps or quarries proposed for Bonnie Claire 2.

Bonnie Claire alternative segment 2 would be in an area that receives drainage from Stonewall Mountain, the foothills of Gold Mountain, and the Northern Pahute Mesa, which flows toward Lida Valley, Alkali Flat, and the Bonnie Claire area of Sarcobatus Flat. Unnamed washes run northeast to southwest, providing a path for overland flow from Pahute Mesa, including the south and southeast sides of Stonewall Mountain to Sarcobatus Flat. Bonnie Claire 2 would cross a notable braided wash at the north end of Sarcobatus Flat before running adjacent to the same wash for several kilometers. This braided wash flows from Stonewall Pass to the Bonnie Claire area of Sarcobatus Flat. There are no streamflow or water-quality data available for the streams and washes Bonnie Claire 2 would cross.

Bonnie Claire 2 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3).

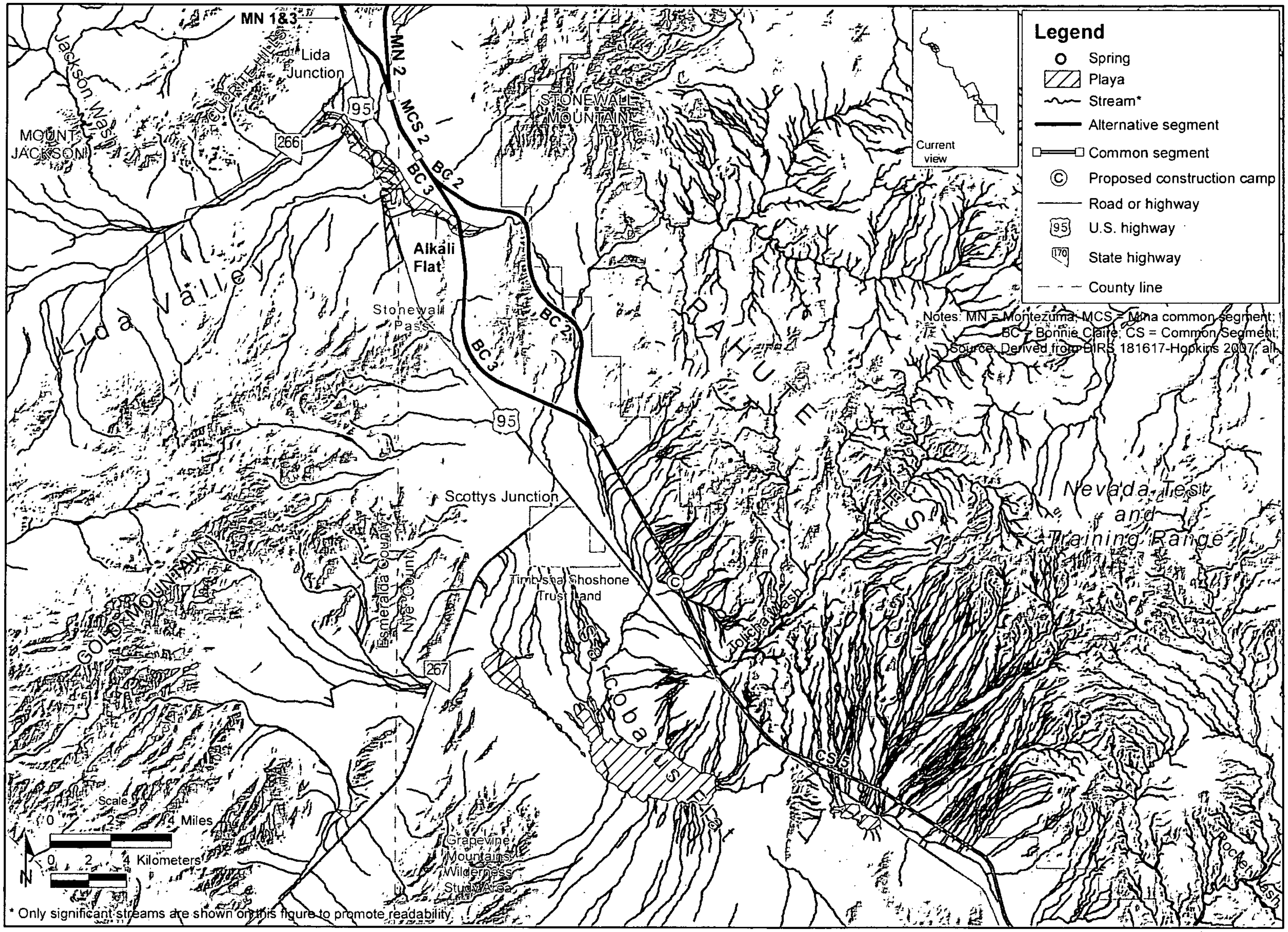


Figure 3-185. Surface drainage within map area 6.

Table 3-109. Hydrologic features potentially relevant to the Bonnie Claire alternative segments.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Bonnie Claire alternative segment 2		
Drainage from Stonewall Mountain, the foothills of Gold Mountain, Stonewall Pass, and Northern Pahute Mesa to Lida Valley, Alkali Flat, and Bonnie Claire area within Sarcobatus Flat.	Segment would cross 31 washes, including an unnamed braided wash.	Alkali Flat/Lida Valley Playa.
Bonnie Claire alternative segment 3		
Drainage from the foothills of Gold Mountain, Stonewall Mountain, Stonewall Pass, and Northern Pahute Mesa to Lida Valley, Alkali Flat, and Bonnie Claire area within Sarcobatus Flat.	Segment would cross Alkali Flat/Lida Valley Playa. Segment would cross 23 washes.	None.

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO06007NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 59-60, and 68.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

Therefore, none of the washes along Bonnie Claire 2 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface water bodies with a connection to interstate water.

There are no wetlands within the region of influence for Bonnie Claire 2.

Federal Emergency Management Agency flood maps cover most of Bonnie Claire 2, but do not include a portion of the land on the eastern side of the alternative segment, which is shown on the maps as an old boundary of the Nevada Test and Training Range. Flood mapping does not extend east of this boundary. The flood maps also show a floodplain for an unnamed drainage feature from Pahute Mesa. The floodplain ends just south of Bonnie Claire 2 near one of the old Nevada Test and Training Range boundaries. It is possible that this floodplain would extend far enough to the northeast to be encountered by Bonnie Claire 2; however, the distance is too far to support such an assumption. In addition, Bonnie Claire 2 would run farther up in the foothill area where the wash would involve few tributaries. Appendix F provides additional information on this floodplain.

There are no springs identified within 1.6 kilometers (1 mile) of Bonnie Claire 2.

Bonnie Claire alternative segment 3 would begin south of Stonewall Flat, exit Lida Valley, and continue south into Sarcobatus Flat, a large playa. Sarcobatus Flat is bounded by Pahute Mesa on the east and Gold Mountain on the west (Table 3-112 and Figure 3-185). There are no potential quarry sites or proposed construction camps along Bonnie Claire alternative segment 3.

Bonnie Claire alternative segment 3 would be in an area that receives drainage from Stonewall Mountain, the foothills of Gold Mountain, and the Northern Pahute Mesa, which flows toward Lida Valley, Alkali Flat, and the Bonnie Claire area of Sarcobatus Flat. Unnamed washes run northeast to southwest, providing a path for overland flow from Pahute Mesa, including the south and southeast sides of Stonewall Mountain to Sarcobatus Flat. Bonnie Claire 3 would pass through Alkali Flat Playa, a major playa shown in Figure 3-185 and cross a notable braided wash in Sarcobatus Flat. This braided wash flows from Stonewall Pass to the Bonnie Claire area of Sarcobatus Flat. There are no streamflow or water-quality data available for the streams and washes Bonnie Claire 3 would cross.

Bonnie Claire alternative segment 3 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Bonnie Claire alternative segment 3 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface water bodies with a connection to interstate water.

There are no wetlands within the region of influence for Bonnie Claire alternative segment 3.

Federal Emergency Management Agency flood maps cover most of Bonnie Claire alternative segment 3, but do not include a portion of the land on the eastern side of the segment, which is shown on the maps as an old boundary of the Nevada Test and Training Range. Flood mapping does not extend east of this boundary. Bonnie Claire alternative segment 3 would cross a 100-year floodplain associated with Alkali Flat Playa. The flood maps also show a floodplain for an unnamed drainage feature from Pahute Mesa. The floodplain ends just south of Bonnie Claire alternative segment 3 at one of the old Nevada Test and Training Range boundaries. The floodplain is close enough to Bonnie Claire alternative segment 3 that it is reasonable to assume it would be at a similar width if it extended farther up the wash to where Bonnie Claire alternative segment 3 would cross. Appendix F provides additional information on this floodplain.

There are no springs identified within 1.6 kilometers (1 mile) of Bonnie Claire alternative segment 3.

3.3.5.3.10 Common Segment 5 (Sarcobatus Flat Area)

Common segment 5 would begin approximately 3.1 kilometers (1.9 miles) east of U.S. Highway 95 and trend generally southeast, through the Sarcobatus Flat Area, and along the east side of U.S. Highway 95 (Table 3-110 and Figures 3-185 and 3-186). Common segment 5 would end approximately 6.4 kilometers (4 miles) north of Springdale. Construction camp 10 would be adjacent to the rail alignment and east of U.S. Highway 95. Numerous ephemeral wash draining downslope of Pahute Mesa would run through the construction camp. There are no potential quarry sites along common segment 5 (DIRS 180875-Nevada Rail Partners 2007, pp. 3-5).

Common segment 5 would cross washes that drain the Tolicha Peak area of Pahute Mesa. Drainage from the Pahute Mesa flows from the east into Sarcobatus Flat. The alluvial flat terrain between Tolicha Peak and U.S. Highway 95 is characterized by numerous braided washes. Although Sarcobatus Flat is an extensive topographic feature, there is only one portion designated as a minor playa that would be close to the rail alignment. The northern edge of this small playa is adjacent to U.S. Highway 95, and would be approximately 1.7 kilometers (1.1 miles) south of common segment 5 to the southeast of the point where Tolicha Wash crosses Interstate Highway 95. The segment would then cross surface drainage originating from Tolicha Peak and Springdale Mountain. There are no streamflow or water-quality data available for the streams and washes common segment 5 would cross.

Common segment 5 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Mina common segment 5 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water.

The National Wetlands Inventory map identifies the playas associated with Sarcobatus Flat as wetlands; however, field studies conducted in support of this Rail Alignment EIS confirmed that there are no ***hydric soils***, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near

Table 3-110. Hydrologic features potentially relevant to common segment 5.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters of the centerline of the rail alignment[b]	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from Pahute Mesa and Bullfrog Hills flows to playas within Sarcobatus Flat and Bonnie Claire Lake within Sarcobatus Flat.	Segment would cross Tolicha Wash and 123 other washes. The alluvial flat terrain between Tolicha Peak and U.S. Highway 95 is characterized by numerous braided washes. Washes within this type of soil and terrain can shift in number and geography with a variation of precipitation intensity.	Dry lake bed 0.5 kilometer south.

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 59-60, 64, and 68.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

the rail alignment (DIRS 180696-Potomac Hudson Engineering 2007, p. 6). Appendix F provides more information about wetlands in this area.

Federal Emergency Management Agency flood maps provide coverage for almost all of common segment 5. The maps show that the segment would cross a 100-year floodplain associated with Tolicha Wash where it drains toward Sarcobatus Flat. Appendix F provides more information on this floodplain.

There are no springs identified within 1.6 kilometers (1 mile) of common segment 5.

3.3.5.3.11 Oasis Valley Alternative Segments

Oasis Valley alternative segment 1 would begin north of Oasis Mountain and would run southeast for approximately 9.8 kilometers (6.1 miles) before converging with common segment 6 (Table 3-111 and Figure 3-186). Construction camp 11 would be along the west side of Oasis Valley alternative segment 1 approximately 3.1 kilometers (1.9 miles) north of its junction with common segment 6. Several ephemeral washes flowing downslope from Bullfrog Hills and mountains to the east would run through the construction camp. There are no potential quarry sites along Oasis Valley alternative segment 1 (DIRS 180875-Nevada Rail Partners 2007, pp. 3-5).

Oasis Valley alternative segment 1 would cross the Amargosa River and its tributaries. Although referred to as a river, the Amargosa River and tributary branches and washes receive ephemeral flows from winter and summer storms, and perennial flows near springs and seeps. For most of the year, the tributaries carry no water. The Amargosa River has approximately 20 branches and 40 tributary washes in Oasis Valley. The main branch enters the valley from the north through Thirsty Canyon. Most of the drainage into Oasis Valley is from Pahute Mesa (including Oasis and Springdale Mountains to the north) and the Bullfrog Hills to the southwest. There are no streamflow or water-quality data available for this area; however, there is regional data for the Death Valley Basin (DIRS 176325-USGS 2006, all).

The Amargosa River interstate drainage system flows to Death Valley in California. A survey of the washes along the Mina rail alignment identified the Amargosa River and one tributary that Oasis Valley alternative segment 1 would cross as waters of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180889-PBS&J 2007, Figure 3B).

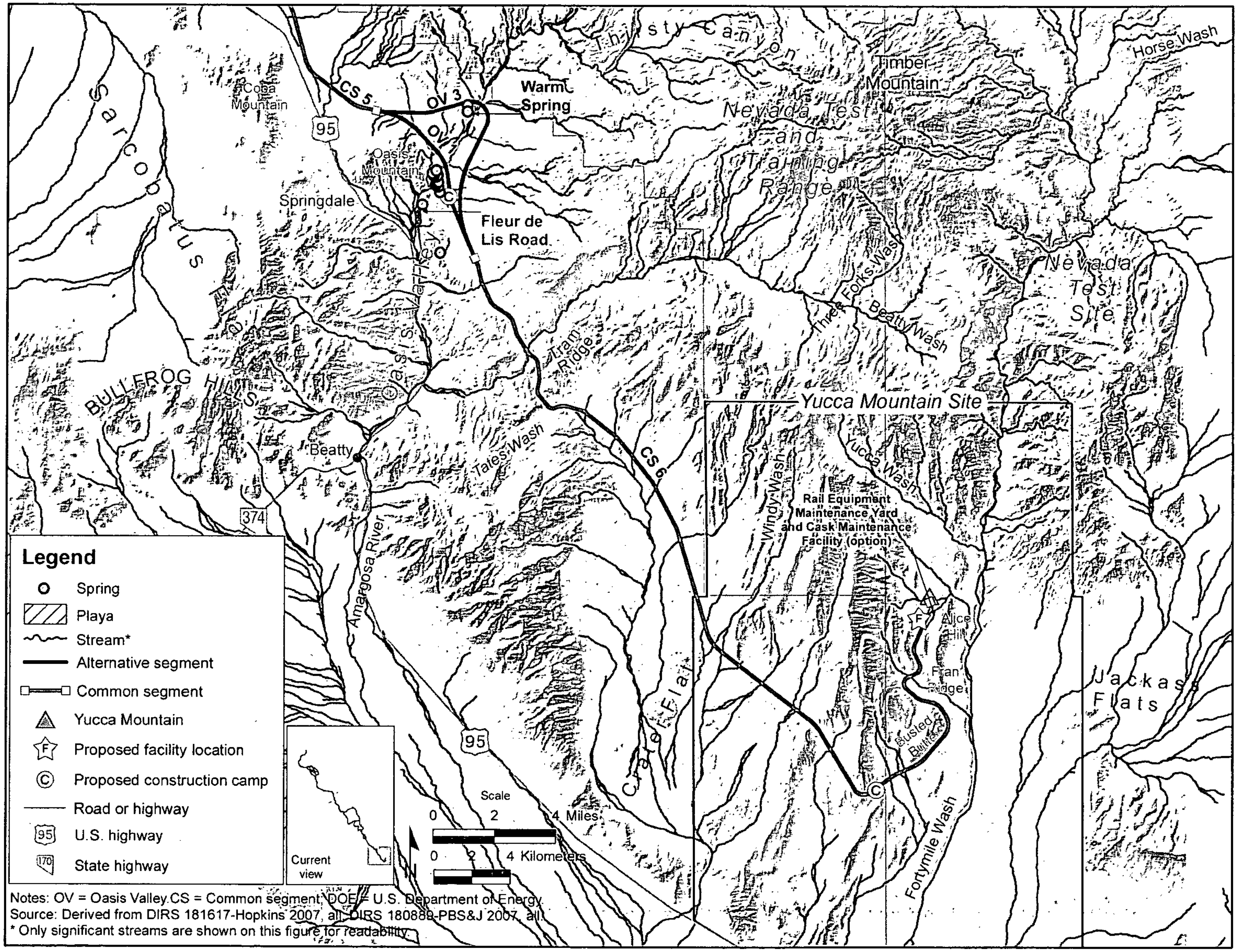


Figure 3-186. Surface drainage within map area 7.

Table 3-111. Hydrologic features potentially relevant to the Oasis Valley alternative segments.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Oasis Valley alternative segment 1		
Drainage from Bull Frog Hills and the Pahute Mesa, including the Amargosa River and Amargosa River tributaries.	Segment would cross the Amargosa River and 23 unnamed washes.	Unnamed springs: 1.5 kilometers west 0.53 kilometer west 0.74 kilometer west 0.69 kilometer west 0.47 kilometer west 0.59 kilometer west 0.46 kilometer west 0.59 kilometer west 0.67 kilometer west 0.54 kilometer west 0.48 kilometer west 1.4 kilometers west 1.5 kilometers west
Oasis Valley alternative segment 3		
Drainage from Bull Frog Hills and the Pahute Mesa, including the Amargosa River and Amargosa River tributaries.	Segment would cross the Amargosa River, and 27 washes/tributaries to the Amargosa River.	Colson Pond (spring fed) 0.24 kilometer southwest. Small wetland 0.5 kilometer from Colson Pond. Unnamed springs: 0.20 kilometer west 1.1 kilometers west 1.2 kilometers west 1.2 kilometers west 1.3 kilometers west 1.3 kilometers west 1.3 kilometers west 1.4 kilometers west 1.4 kilometers west 1.5 kilometers west 1.5 kilometers west 1.6 kilometers west

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 64.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

There are no wetlands identified within the region of influence for Oasis Valley alternative segment 1.

Federal Emergency Management Agency flood maps provide complete coverage for Oasis Valley 1. The maps show that the segment would cross a 100-year floodplain associated with the Amargosa River. Appendix F provides more information about this floodplain.

There are numerous springs in Oasis Valley and Thirsty Canyon near where Oasis Valley alternative segment 1 would cross. Oasis Valley 1 would pass within 0.48 kilometer (0.30 mile) of several springs identified as the upper Oasis Valley Ranch Springs (DIRS 169384-Rainer et al. 2002, Figure 3).

These springs are near the narrows through which the Amargosa River leaves Oasis Valley. Table 3-111 lists these springs.

Oasis Valley alternative segment 3 would begin north of Oasis Mountain, generally run east and then south for approximately 14 kilometers (8.8 miles) and would cross Oasis Valley approximately 0.24 kilometer (0.15 mile) northeast of Colson Pond before converging with common segment 6 (Table 3-111 and Figure 3-186). There are no potential quarry sites or proposed construction camps along Oasis Valley 3.

Oasis Valley alternative segment 3 would cross the Amargosa River and its tributaries, as described above for Oasis Valley alternative segment 1.

A survey of washes performed along the Mina rail alignment identified the Amargosa River, which Oasis Valley alternative segment 3 would cross, as a water of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180889-PBS&J 2007, Figure 3B).

DOE field studies identified a small wetland associated with an unnamed seep located approximately 0.5 kilometer (0.31 mile) from Colson Pond (DIRS 180914-PBS&J 2006, Figure 4T). Appendix F provides more information about this wetland.

Federal Emergency Management Agency flood maps provide complete coverage for Oasis Valley 3. The maps show that the segment would cross a 100-year floodplain associated with the Amargosa River. Appendix F provides more information about this floodplain.

There are numerous springs in Oasis Valley and Thirsty Canyon near where Oasis Valley alternative segment 3 would cross (see Table 3-111). Colson Pond is spring fed and would be within 0.24 kilometer (0.15 mile) of the alternative segment. This spring is commonly known as Colson Pond Spring (DIRS 169384-Reiner et al. 2002, Plate 2), but is also referred to as Warm Spring.

3.3.5.3.12 Common Segment 6 (Yucca Mountain Approach)

Common segment 6 would begin at the south juncture of the end of the Oasis Valley alternative segments and proceed to the southeast toward Yucca Mountain (Table 3-112 and Figure 3-186).

The proposed location for construction camp 12 is adjacent to the rail line approximately 9.7 kilometers (6 miles) south of the ***geologic repository*** operations area. There are no potential quarry sites along common segment 6 (DIRS 180875-Nevada Rail Partners 2007, pp. 3-5).

Table 3-112. Hydrologic features potentially relevant to common segment 6.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of therail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from northern Yucca Mountain Range, including Tram Ridge, and Timber Mountain. Drainage from Yucca Mountain Range to Crater Flat and Amargosa Valley.	Segment would cross Beatty Wash, Tates Wash, Windy Wash, Busted Butte Wash, and 39 unnamed washes.	Fortymile Wash. Midway Valley Wash.

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000, all; DIRS 176730-DeLorme 1996, p. 64-65.
b. To convert meters to feet, multiply by 3.2808
c. To convert kilometers to miles, multiply by 0.62137.

Common segment 6 would cross terrain that drains from the southern end of Pahute Mesa and the Yucca Mountain Range to Crater Flat and the Amargosa River. The first significant tributary common segment 6 would cross is Beatty Wash and its tributaries, which provide drainage from Timber Mountain and Tram Ridge at the northern reaches of Yucca Mountain, to Oasis Valley and the Amargosa River at a point approximately 4.8 kilometers (3 miles) northeast of the community of Beatty. Beatty Wash is one of the largest tributaries of the Amargosa River. Common segment 6 would cross Beatty Wash at the north end of the Yucca Mountain Range, approximately 5.4 kilometers (3.4 miles) southeast of Oasis Valley. After crossing Beatty Wash, common segment 6 would proceed to the southeast toward Yucca Mountain, where it would cross several tributaries of Tates Wash. Approximately 26 kilometers (16 miles) from the start of common segment 6, the segment would cross Windy Wash and unnamed washes carrying drainage from the eastern side of Yucca Mountain. The segment would then continue around the southern tip of the Yucca Mountain Range before turning northeast, skirting the eastern edge of Busted Butte and continuing between Bow and Fran Ridges.

Near the Yucca Mountain Site, Fortymile Wash, a major wash that flows to the Amargosa River, drains the eastern side of Yucca Mountain (DIRS 169734-BSC M&O 2004, p. 7.1-3). The tributaries draining into Fortymile Wash at Yucca Mountain include Yucca Wash to the north; Drill Hole Wash, which, together with a tributary in Midway Valley, drains most of the repository site; and Busted Butte Wash (also known as Dune Wash) to the south. Common segment 6 would cross Busted Butte Wash, some of its unnamed tributaries, and unnamed tributaries of Drill Hole Wash. Common segment 6 would not actually cross Drill Hole Wash, but the wash would be within the common segment 6 region of influence. Fortymile Wash runs parallel to the end of common segment 6 at the Yucca Mountain Site, but common segment 6 would not cross the wash. Fortymile Wash is the most prominent drainage through Jackass Flats to the Amargosa River (DIRS 155970-DOE 2002, p. 3-36, Figure 3-11).

All of common segment 6 is within the Amargosa River interstate drainage system. Of the numerous washes along common segment 6, 14 were identified as waters of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180889-PBS&J 2007, Figures 3B and 3C). The Rail Equipment Maintenance Yard would be where the proposed rail line ends at Yucca Mountain. There are no perennial streams, natural bodies of water, or naturally occurring wetlands at Yucca Mountain (DIRS 155970-DOE 2002, p. 3-35). The facility would overlie an ephemeral stream but would not cross any waters of the United States.

Slightly more than half of common segment 6 has coverage on Federal Emergency Management Agency flood maps. These maps show that common segment 6 would cross a short span of the 100-year floodplain associated with Beatty Wash. Although the flood maps do not provide coverage for the area of the repository on the eastern side of Yucca Mountain, DOE has performed flood studies on several washes in that area, as addressed in the Yucca Mountain FEIS. An overlay of the Mina rail alignment with Yucca Mountain FEIS Figure 3-12 indicates that common segment 6 would cross short stretches of 100-year floodplains associated with Busted Butte Wash and Drill Hole Wash. The rail line would terminate just before reaching a floodplain associated with Midway Valley Wash (also known as Sever Wash) (DIRS 155970-DOE 2002, pp. 3-38 and 3-39, and Figure 3-12). Appendix F further describes the floodplains associated with common segment 6.

There are no springs identified within 1.6 kilometers (1 mile) of common segment 6. Ute Springs, 270 meters (890 feet) west of U.S. Highway 95 in Oasis Valley, would be within about 0.6 to 0.88 kilometer (0.37 to 0.55 mile) of potential alternative well sites OV9 through OV12 (see Figure 3.7) near U.S. Highway 95 (DIRS 169384-Rainer et al. 2002, Plate 2).

3.3.6 GROUNDWATER RESOURCES

This section describes groundwater resources along the Mina rail alignment. Section 3.3.6.1 describes the region of influence for groundwater resources; Section 3.3.6.2 is a general overview of groundwater features along the Mina rail alignment; and Section 3.3.6.3 describes more specific features for each of the Mina rail alignment alternative segments and common segments.

3.3.6.1 Region of Influence

The region of influence for groundwater resources along the Mina rail alignment includes aquifers that would underlie areas of the proposed railroad construction and operations, portions of groundwater aquifers DOE would use to obtain water for construction and operations support and that would be affected by these groundwater withdrawals, and nearby springs that might be affected by such groundwater withdrawals. The horizontal extent of the region of influence varies depending on the particular aspects of the specific project activity, as follows:

- DOE used the nominal width of the rail line construction right-of-way and the footprints of the railroad construction and operations support facilities to define where there would be construction or other land disturbances. These areas could be susceptible to changes in groundwater ***infiltration***, discharge (for example, spring discharge), or quality. There could also be damage to, or loss of use of, an existing well (including potential need for well abandonment), if that well fell within the rail ***roadbed*** or was disturbed during railroad construction activities. Review of the available information on the locations of existing wells indicates that rail roadbed construction would not disturb any existing wells. However, the precise locations for existing wells have not been field-verified and actual well locations might vary from the coordinates identified and cataloged for the wells in State of Nevada and U.S. Geological Survey well databases (see Section 3.3.6.2.1).
- DOE used an initial screening-level distance of 1.6 kilometers (1 mile) on either side of the centerline of the rail alignment and an initial radius of 1.6 kilometers surrounding each proposed new well if that well would be outside of the nominal width of the construction right-of-way to define areas in the general vicinity of the rail alignment and proposed well locations that could also be affected by changes in groundwater discharge or quality at existing wells or springs, or in which there could be damage to, or loss of use of, an existing well if that well fell within the rail roadbed or was disturbed during rail construction activities.
- DOE considered both the individual groundwater basins (hydrographic areas) that underlie the Mina rail alignment and the railroad construction and operations support facilities and adjacent hydrographic areas for evaluating areas that might be affected by proposed groundwater withdrawals for construction or operations support. This would include areas that could be susceptible to changes in groundwater discharge or flow to an adjacent groundwater basin.

3.3.6.2 General Hydrogeologic Setting and Characteristics

This section is an overview of the general hydrogeologic setting and characteristics of groundwater underlying the area along the Mina rail alignment. Water-resource features, primarily those associated with groundwater, are described in relation to the hydrographic areas in which they lie.

Groundwater ***recharge*** in central and southern Nevada is affected by low precipitation and high annual evaporation rates typical of desert climates. Most recharge to aquifers in the region of influence is derived from precipitation falling in the higher parts of the inter-basin mountain ranges (DIRS 103136-Prudic, Harrill, and Burbey 1993, pp. 2, 58, 84, and 88).

3.3.6.2.1 Groundwater Hydrographic Areas and Groundwater Use in Nevada

To classify hydrographic regions and hydrographic areas and facilitate the management of groundwater resources within the State of Nevada, the state has been divided into a series of groundwater basins (designated as hydrographic areas) (DIRS 177741-State of Nevada 2005, all; DIRS 106094-Harrill, Gates, and Thomas 1988, all).

A total of 260 hydrographic areas are recognized within the Great Basin; all or parts of 232 hydrographic areas fall within Nevada (DIRS 106094-Harrill, Gates, and Thomas 1988, all; DIRS 177741-State of Nevada 2005, all).

Three types of aquifers are the principal sources of groundwater found in central and southern Nevada, as follows (DIRS 172905-USGS 1995, all):

- Alluvial valley fill: Composed primarily of unconsolidated alluvial sand and gravel. The distribution of sediment size is directly associated with distance from the mountains. In general, the coarsest materials (for example, gravel and boulders) were deposited near the mountains, and the finer materials (for example, sand, silt, and clay) were deposited in the central parts of the basins or in the lakes and playas. Alluvial fans are important hydrologic features within the hydrographic basins, sometimes serving as targets for groundwater development, and with alluvial valley fill portions of the basins receiving some of their recharge through the coarse sediment deposits in the alluvial fans. Alluvial deposits consisting of alluvial sand and gravel are present along the courses of modern ephemeral and intermittent streams or ancestral streams that generally parallel the long axes of the basins. Alluvial deposits underlie most of the Mina rail alignment.
- Volcanic-rock aquifers: Composed primarily of tuffs (ash flows, ash falls), rhyolite, or basalt. Groundwater movement in these materials is often controlled by the number and degree of joint interconnections, ***fractures*** or faults, or vesicle (void space) interconnection in lavas.
- Carbonate-rock aquifers: Composed primarily of limestones and dolomites. The carbonate rocks are commonly highly fractured and are locally fragmented. Groundwater flow in the carbonate rock aquifers is controlled by interconnected fractures.

Tectonic forces superimposed faulting on existing groundwater-bearing formations (aquifers) in this region. As a result, several aquifer units underlying the Mina rail alignment are fractured and faulted in some locations. These faults and fractures locally can influence groundwater flow patterns within the affected aquifer areas, with these features capable of acting as either barriers to, or conduits for, groundwater flow (see Appendix G).

Within the Basin and Range Province, any or all of the three basic aquifer types discussed above might be present within a particular area and might constitute three separate, hydraulically distinct, sources of water. Alternatively, any or all of the three aquifer types might underlie an area but might be hydraulically connected to form a single groundwater source.

Groundwater levels fluctuate seasonally and annually in response to changes in withdrawal (consumptive use) and climatic conditions, with levels generally rising from late winter to early summer and generally declining from summer to early winter (DIRS 172904-Berris et al. 2003, p. 6). In 2000, an estimated 1.75 billion cubic meters (1.42 million ***acre-feet***) of groundwater were pumped in Nevada (DIRS 175964-Lopes and Evetts 2004, p. 7).

Acre-foot is a unit commonly used to measure water volume. It is the quantity of water required to cover 4,047 square meters (1 acre) to a depth of 0.3048 meter (1 foot), and is equal to 1,233.5 cubic meters (325,851 gallons). Sections 3.3.6 and 4.3.6 list perennial yields, committed groundwater resources, and consumptive use in acre-feet because it is the common unit used by industry and government agencies.

Irrigation and stock watering was the primary groundwater use, accounting for approximately 46 percent of the total groundwater withdrawal, followed by mining (approximately 26 percent), drinking-water systems (approximately 14 percent), geothermal production (approximately 8 percent), self-supplied domestic (approximately 5 percent), and miscellaneous (1 percent) (DIRS 175964-Lopes and Evetts 2004, p. 7) (see Figure 3-187). Virtually all major groundwater development in Nevada has been in the alluvial valley fill, with withdrawals from approximately the upper 460 meters (1,500 feet) of these aquifers. The carbonate rock aquifers in eastern and southern Nevada supply water to numerous springs (DIRS 106094-Harrill, Gates, and Thomas 1988, all).

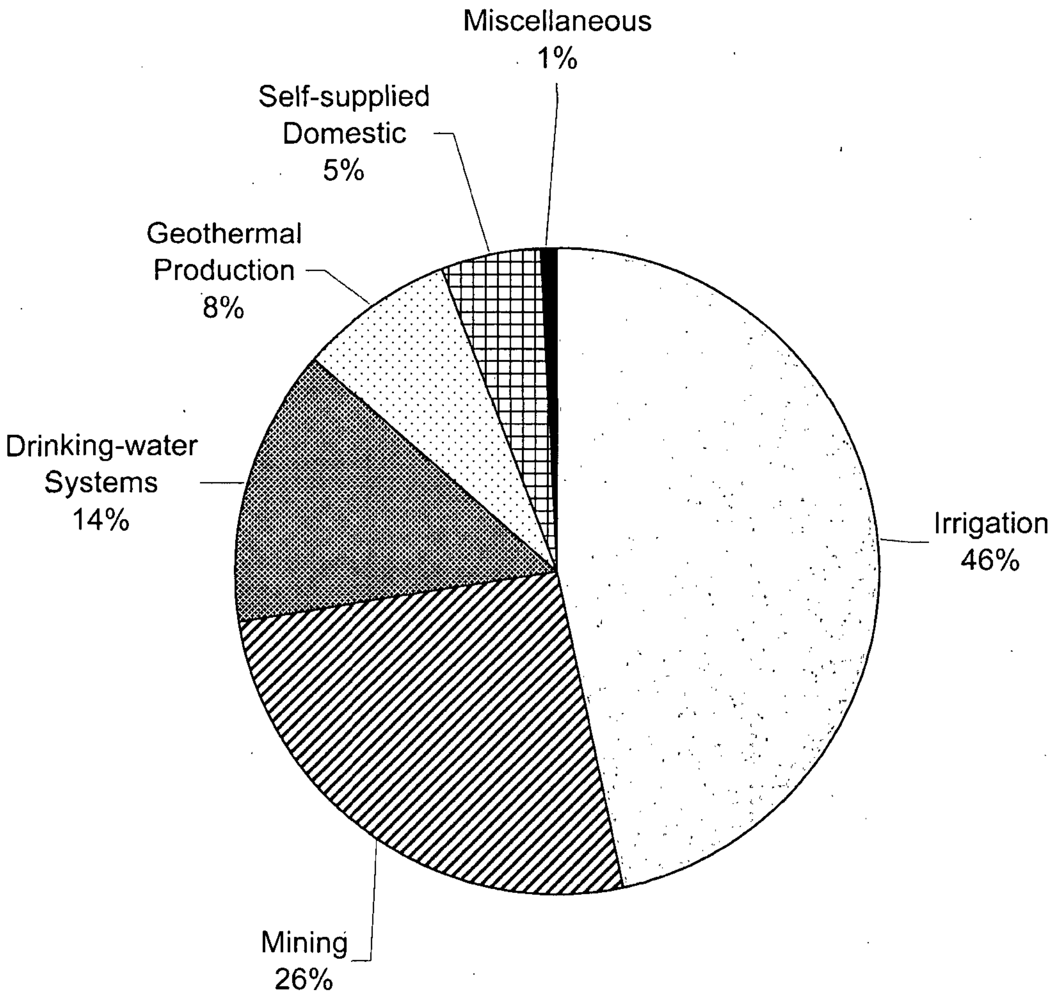


Figure 3-187. Groundwater usage in Nevada in 2000. (Source: DIRS 175964-Lopes and Evetts 2004, p. 7.)

Figure 3-188 shows generalized regional groundwater flow patterns in the vicinity of the Mina rail alignment. Available information regarding groundwater "interbasin" inflow and outflow (groundwater flow across hydrographic area boundaries) characteristics for hydrographic areas (groundwater basins) within central Nevada (DIRS 177524-Anning and Konieczki 2005, pp. 10 and 11, and Plate 1) indicates that interbasin groundwater outflow or groundwater inflow through alluvial valley-fill aquifer materials or through consolidated rock aquifers (lithified or cemented rock aquifers such as carbonate rock units, or

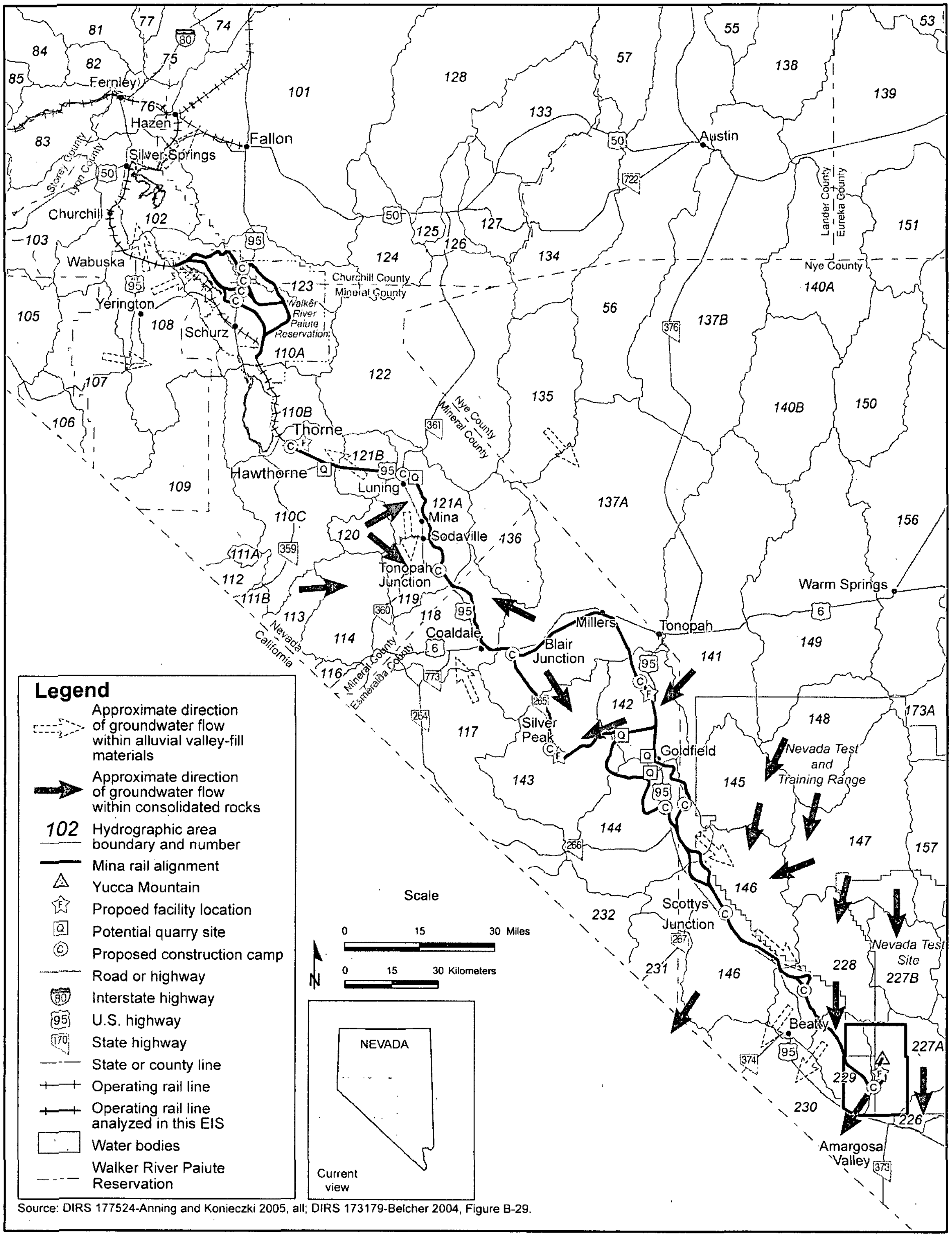


Figure 3-188. Generalized groundwater flow direction through alluvial valley-fill and consolidated rock aquifers in the vicinity of the Mina rail alignment.

clastic, metamorphic, igneous, or volcanic rock aquifers) appears to occur at some locations; at other locations, there appears to be no substantial interbasin groundwater flow occurring through either or both of these types of aquifer units. The figure depicts generalized flow directions within alluvial valley fill units and within consolidated rock aquifers, in areas where such flow is inferred to be occurring across hydrographic area boundaries.

This section describes groundwater resources in relation to hydrographic areas. Figure 3-189 shows the 18 hydrographic areas the Mina rail alignment would cross, depending on alternative segments selected. Table 3-113 lists the estimated annual ***perennial yields*** for the 18 hydrographic areas, and identifies which are State of Nevada-***designated groundwater basins***. The hydrographic areas are presented in the order the Mina rail alignment would cross them, beginning near Wabuska, moving southeast across Nevada toward Yucca Mountain.

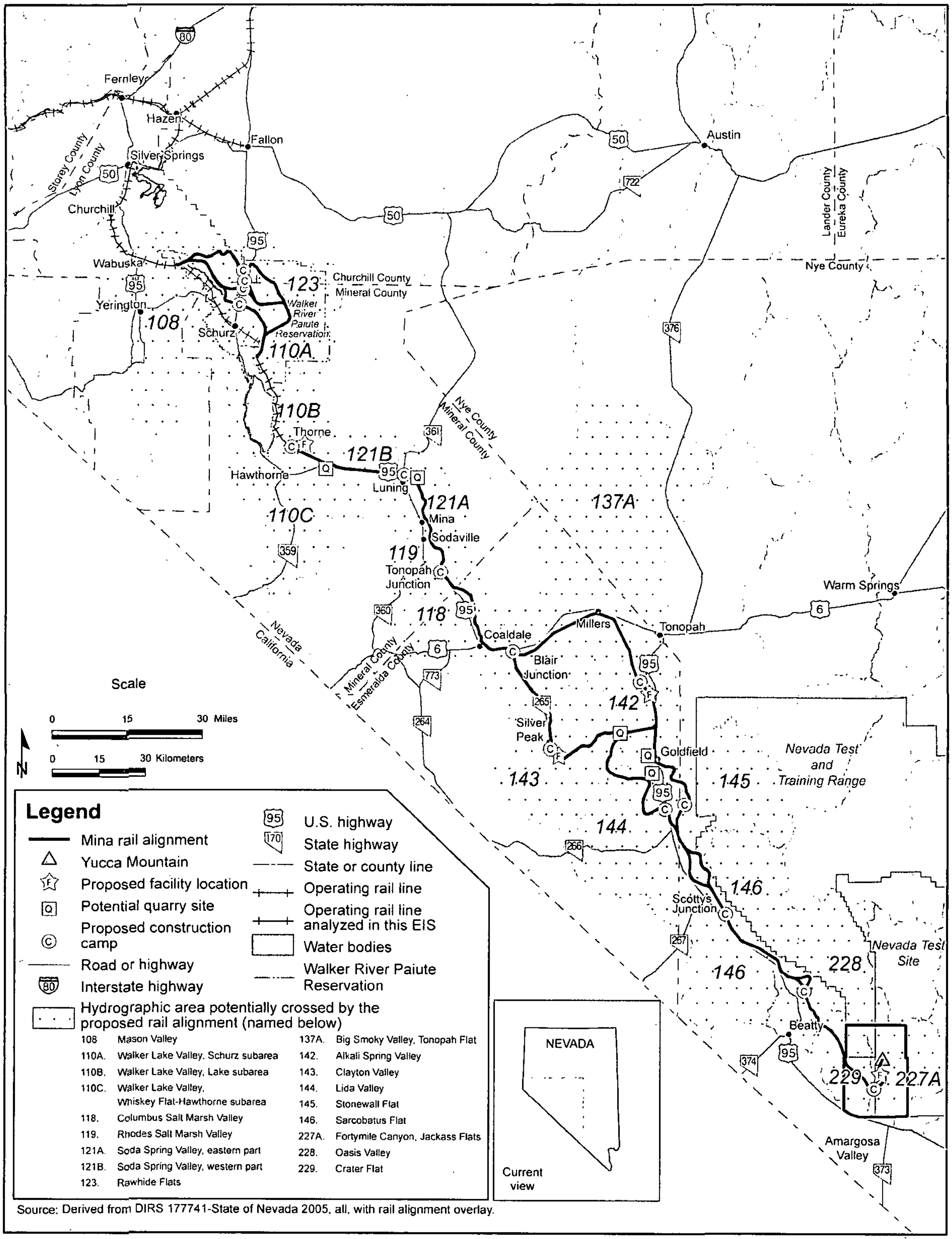
> **Perennial yield** is the amount of useable water from a groundwater aquifer that can be economically withdrawn and consumed each year for an indefinite period. It cannot exceed the natural recharge to that aquifer and ultimately is limited to the maximum amount of discharge that can be utilized for beneficial use.
>
> The State of Nevada may identify a hydrographic area as a **designated groundwater basin** where permitted groundwater rights approach or exceed the estimated average annual recharge and the water resources are being depleted or require additional administration, including a state declaration of preferred uses (for example, municipal and industrial, domestic supply, etc.) (DIRS 103406-Nevada Division of Water Planning 1992, p. 18). Designated groundwater basins are also referred to as administered groundwater basins.

There are a number of published estimates of perennial yield for many of the hydrographic areas in Nevada, and those estimates often differ by large amounts. The perennial-yield values listed in Table 3-113 predominantly come from a single source, the Nevada Division of Water Planning (DIRS 103406-Nevada Division of Water Planning 1992, for Hydrographic Regions 10, 13, and 14); therefore, the table does not show a range of values for each hydrographic area.

In the Yucca Mountain area, the Nevada Division of Water Planning identifies a combined perennial yield for hydrographic areas 225 through 230. DOE obtained perennial yields from *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel Engineering Consultants 1999, pp. 6 to 12) to provide estimates for hydrographic areas the Mina rail alignment would cross: hydrographic areas 227A, 228, and 229. That 1999 document presents perennial-yield estimates from several sources. Table 3-113 lists the lowest (that is, the most conservative) values cited in that document, which is consistent with the approach DOE used in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, pp. 3 to 136).

Table 3-113 also summarizes existing annual ***committed groundwater resources*** for each hydrographic area along the Mina rail alignment. However, all committed groundwater resources within a hydrographic area might not be in use at the same time. Table 3-113 also includes information on pending annual duties within each of these hydrographic areas. A ***pending annual duty*** represents the amount of water for which an appropriation applications has been submitted to the State Engineer for consideration and that the State Engineer has classified as a pending annual ***duty*** value within a hydrographic area, in accordance with applicable state statutes. Unless otherwise noted, the source of data for pending annual duties in the hydrographic areas the alignment would cross is DIRS 182759-Converse Consultants 2007, all; DIRS 182900-NDWR 2007, all; and DIRS 182288-NDWR 2007, all.

These data were acquired on March 31, 2007: NDWR Data Update (DIRS 182759-Converse Consultants 2007, all) and either April 18, 2007: NDWR Water Rights Data Hydrographic Area 110B (DIRS 182900-NDWR 2007, all) or May 30, 2007: NDWR Water Rights Data Update (DIRS 182898-NDWR 2007, all).



Source: Derived from DIRS 177741-State of Nevada 2005, all, with rail alignment overlay.

Figure 3-189. Hydrographic areas the Mina rail alignment would cross.

Table 3-113. Perennial yield and annual committed groundwater resources of hydrographic areas the Mina rail alignment would cross (page 1 of 2).

Rail line segment	Hydrographic area[a] number	Hydrographic area name	Perennial yield (acre-feet)[b,c]	Annual committed groundwater resources/pending annual groundwater duties (acre-feet)[d]	Designated groundwater basin[e,f]
Department of Defense Branchline North	108	Mason Valley	25,000	179,696/25,269	Yes
Schurz alternative segment 1, Department of Defense Branchline South	110A	Walker Lake Valley (Schurz subarea)	1,500	637/2	No
Schurz alternative segment 4, Department of Defense Branchline South					
Schurz alternative segment 5, Department of Defense Branchline South					
Schurz alternative segment 6, Department of Defense Branchline South					
Schurz alternative segment 5	123	Rawhide Flats	500	116/0	No
Schurz alternative segment 6					
Department of Defense Branchline South	110B	Walker Lake Valley (Lake subarea)	700	2,093/0	No
Department of Defense Branchline South, Mina common segment 1	110C	Walker Lake Valley (Whiskey Flat-Hawthorne subarea)	5,000	12,709/0	Yes
Mina common segment 1	121 B	Soda Spring Valley (western part)	200	354/0	Yes
Mina common segment 1	121 A	Soda Spring Valley (eastern part)	6,000	3,168/0	Yes
Mina common segment 1	119	Rhodes Salt Marsh Valley	1,000	49/0	No
Mina common segment 1	118	Columbus Salt Marsh Valley	4,000	1,764/0	No
Mina common segment 1, Montezuma alternative segment 1	137A	Big Smoky Valley (Tonopah Flat)	6,000	19,638/0	Yes
Mina common segment 1, Montezuma alternative segment 2					
Montezuma alternative segment 1	143	Clayton Valley	20,000	23,882/0	No

Table 3-113. Perennial yield and annual committed groundwater resources of hydrographic areas the Mina rail alignment would cross (page 2 of 2).

Rail line segment	Hydrographic area[a] number	Hydrographic area name	Perennial yield (acre-feet)[b,c]	Annual committed groundwater resources/pending annual groundwater duties (acre-feet)[d]	Designated groundwater basin[e,f]
Montezuma alternative segment 1	142	Alkali Spring Valley	3,000	2,596/0	No
Montezuma alternative segment 2					
Montezuma alternative segments 1, 2, and 3					
Montezuma alternative segment 1, Mina common segment 2, Bonnie Claire alternative segment 2	144	Lida Valley	350	72/0	No
Montezuma alternative segment 1, Mina common segment 2, Bonnie Claire alternative segment 3					
Montezuma alternative segment 2	145	Stonewall Flat	100	12/0	No
Bonnie Claire alternative segment 2, common segment 5	146	Sarcobatus Flat	3,000	3,591/0	Yes
Bonnie Claire alternative segment 3, common segment 5					
Common segment 5, Oasis Valley alternative segment 1, common segment 6	228	Oasis Valley	1,000	1,299/0	Yes
Common segment 5, Oasis Valley alternative segment 3/common segment 6					
Common segment 6	229	Crater Flat	220	1,147/82	No
Common segment 6	227A	Fortymile Canyon/Jackass Flats	880[g]	58[f]/5	No

a. Source: DIRS 106094-Harrill, Gates, and Thomas 1988, Summary, Figure 3, with the proposed rail alignment map overlay.
b. Source: DIRS 103406-Nevada Division of Water Planning 1992, Regions 10, 13, and 14, except hydrographic areas 227A, 228, and 229, for which the source is DIRS 147766-Thiel Engineering Consultants 1999, pp. 6 to 12.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; to convert acre-feet to gallons, multiply by 3.259×10^5.
d. Data for committed groundwater and pending annual duties are current as of March 31, 2007 (all hydrographic areas except areas 110B and areas 142, 144, 145, 146, 228, 229, and 227A) (DIRS 182759-Converse Consultants 2007, all); April 18, 2007 (hydrographic area 110B) (DIRS 182900-NDWR 2007, all); and May 30, 2007 (hydrographic areas 142, 144, 145, 146, 228, 229, and 227A) (DIRS 182288-NDWR 2007, all). Data for pending annual duties include underground duties but do not include duties for streams or springs. All values have been rounded to the nearest acre-foot.
e. Sources: DIRS 176488-State of Nevada 2006, Regions 10, 13, and 14; DIRS 177741-State of Nevada 2005, all.
f. Based on a 1979 Designation Order by the State Engineer; there are no committed resources in hydrographic area 227A. However, water-rights information from the Nevada Department of Water Resources indicates there are 58 acre-feet in committed resources for this area. The discrepancy appears to be related to the location of the boundary between areas 227A and 230 (Amargosa Desert) (DIRS 176600-Converse Consultants 2005, p. 29 and Tables 4 through 45). The perennial-yield value shown for hydrographic area 227A is the lowest estimated value presented in *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel Engineering Consultants 1999, p. 8), for the western two-thirds of hydrographic area 227A. The perennial yield estimate for area 277A is broken down into 300 acre-feet for the eastern third of the area and 580 acre-feet for the western two-thirds of the area.

As part of an effort to assess water resources in the vicinity of the Mina rail alignment, DOE performed studies to identify groundwater conditions, the locations of springs, and the locations, use, and water rights status of groundwater-supply wells within 32 kilometers (20 miles) of either side of the centerline of the rail alignment. Information on groundwater characteristics in hydrographic areas that the rail alignment would cross and identified groundwater uses and use types within the 64-kilometer (40-mile) search area are compiled in the *Water Resources Assessment Report, Mina Rail Corridor* (DIRS 180887-Converse Consultants 2007, all). DOE reviewed several other published reports and maps providing information regarding hydrogeologic and groundwater characteristics in hydrographic areas the rail alignment would cross to obtain information to support the groundwater resources impacts assessment.

DOE reviewed several well and spring databases, including Nevada Division of Water Resources (NDWR) and U.S. Geological Survey National Water Information System (USGS NWIS) databases. Unless noted otherwise, the sources for the spring and well data in this section are as follows: DIRS 176600-Converse Consultants 2005, all; DIRS 176979-MO0605GISGNISN.000; DIRS 177294-MO0607USGSWNVD.000, all; DIRS 176325-USGS 2006, all; DIRS 182759-Converse Consultants 2007, all; DIRS 180887-Converse Consultants 2007, all; DIRS 177712-DTNMO0607NHDPOINT.000, all; DIRS 177710-MO0607NHDWBDYD.000; DIRS 182898-NDWR 2007, all; DIRS 182899-NDWR 2007, all; and DIRS 182900-NDWR 2007, all. An initial screening process to identify existing wells within 1.6 kilometers (1 mile) of the centerlines of the respective alternative segments, or within 1.6 kilometers of DOE-proposed new water-supply wells. As described later in this section, before analyzing potential impacts to groundwater resources, DOE extended the search radius for identifying existing beneficial-use wells and springs up to 2.4 kilometers (1.5 miles) away from a proposed new well if the initial search for such wells or springs within 1.6 kilometers (1 mile) did not reveal the presence of any such wells or springs. Additionally, on a case-by-case basis (see Section 4.3.6 and Appendix G) for a selected set of new groundwater withdrawal wells specifically targeted for installation within a fault zone or an extensive fracture zone, DOE identified the locations of existing wells and springs up to 9.7 kilometers (6 miles) away from each such proposed well (to address the possibility of fault zones or extensive fracture zones acting as conduits for groundwater flow).

Information for completing this compilation included well-log data and water-rights information obtained from the NDWR. NDWR well-log database entries and water-rights database information include a general and legal description of the location of existing wells, along with ***borehole*** and well completion information, well testing data (if available), and information on the appropriated water right (diversion rate and/or annual duty). The NDWR water-rights database includes data on the locations, manner of use, and appropriations status of wells having appropriated water rights in Nevada. The USGS website generally includes site information (for example, well location coordinates, elevation, depth) and water-level data. DOE eliminated from consideration in the impacts analysis wells in the NDWR well-log database and the NDWR water-rights database that did not have appropriated water rights or were not domestic wells (such as abandoned or plugged wells, monitoring wells, thermal gradient test wells, oil or gas exploration or groundwater investigation wells). DOE considered all USGS-identified wells.

The compiled well locations had varying levels of accuracy. For example, well locations recorded in the NDWR water-rights database are generally considered to be at the center of each 0.16-square-kilometer (40-acre) parcel representing each quarter-quarter section. Additionally, the well driller might have mapped the well incorrectly, or a well might have been inadvertently recorded in the NDWR water-rights database in the wrong hydrographic area (for example, for wells very near a hydrographic area boundary). Figures 3-190 through 3-196 identify well locations within 1.6 kilometers (1 mile) of the centerline of the Mina rail alignment or proposed wells. As a result of the characteristics of the well location specifications, there might be more than one existing well at some locations on these figures. Table 3-114 lists hydrographic areas the Mina rail alignment would cross and the corresponding number of wells within 1.6 kilometers (1 mile) of the centerline of the rail alignment.

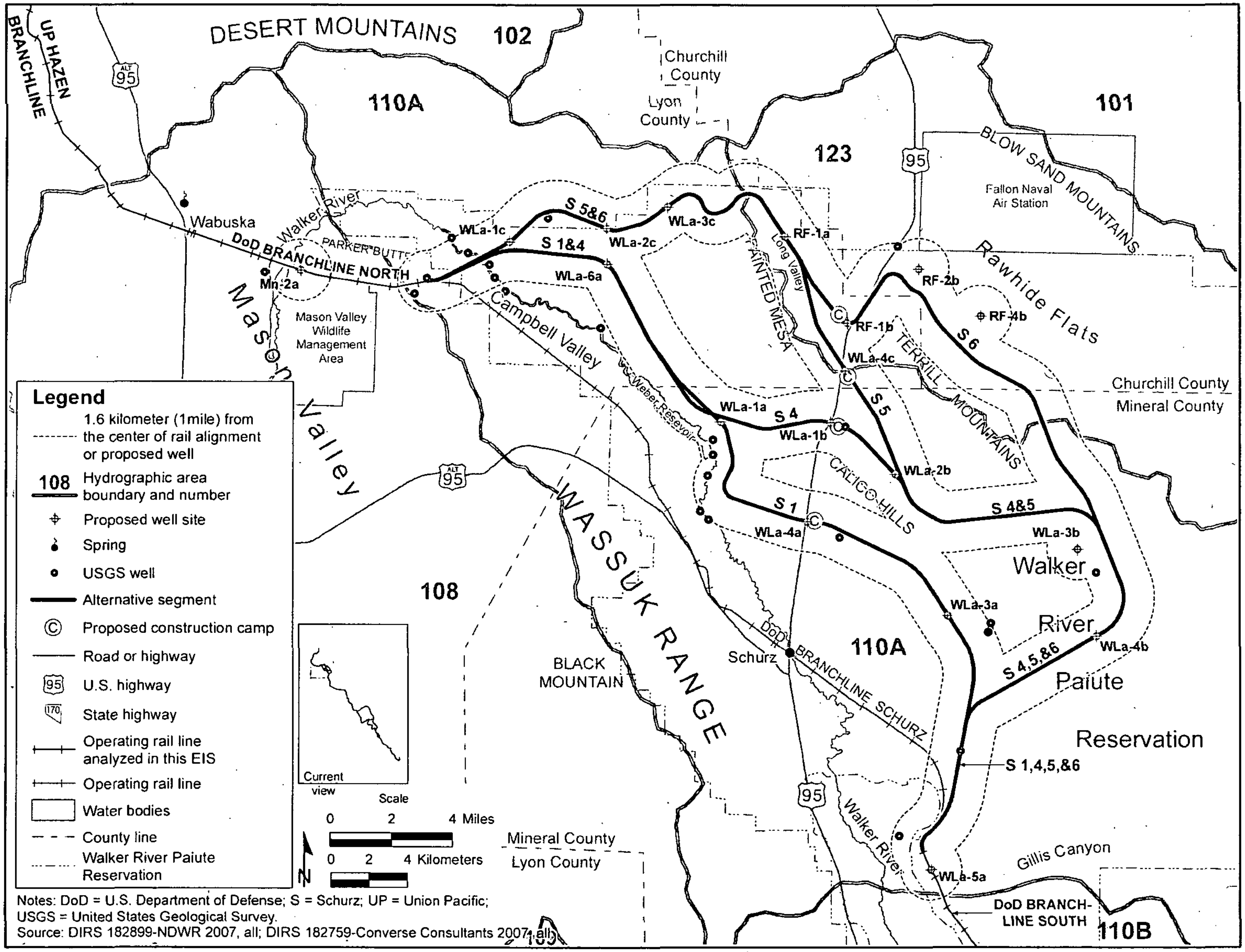


Figure 3-190. Proposed wells and existing USGS and NDWR wells and springs within map area 1.

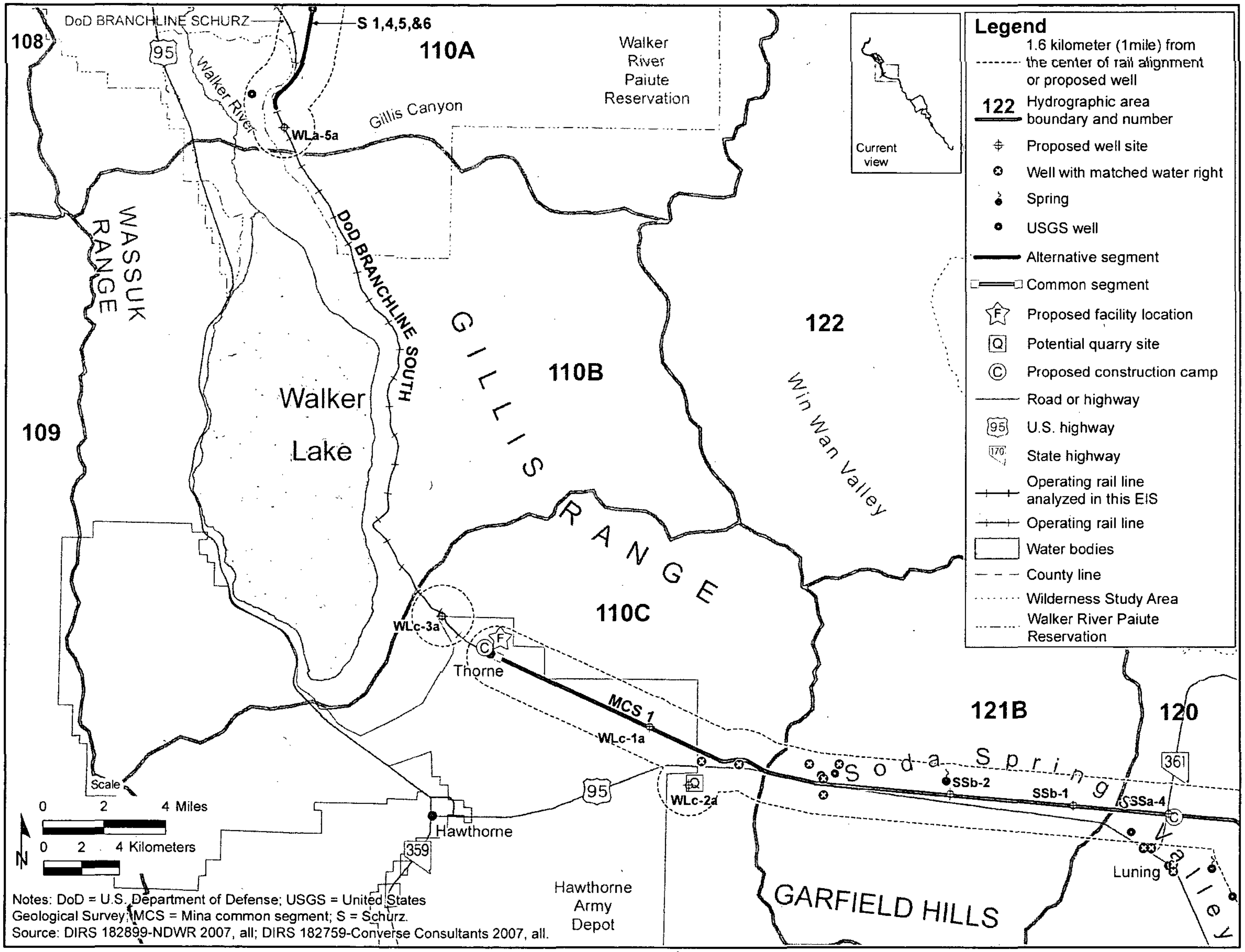


Figure 3-191. Proposed wells and existing USGS and NDWR wells and springs within map area 2.

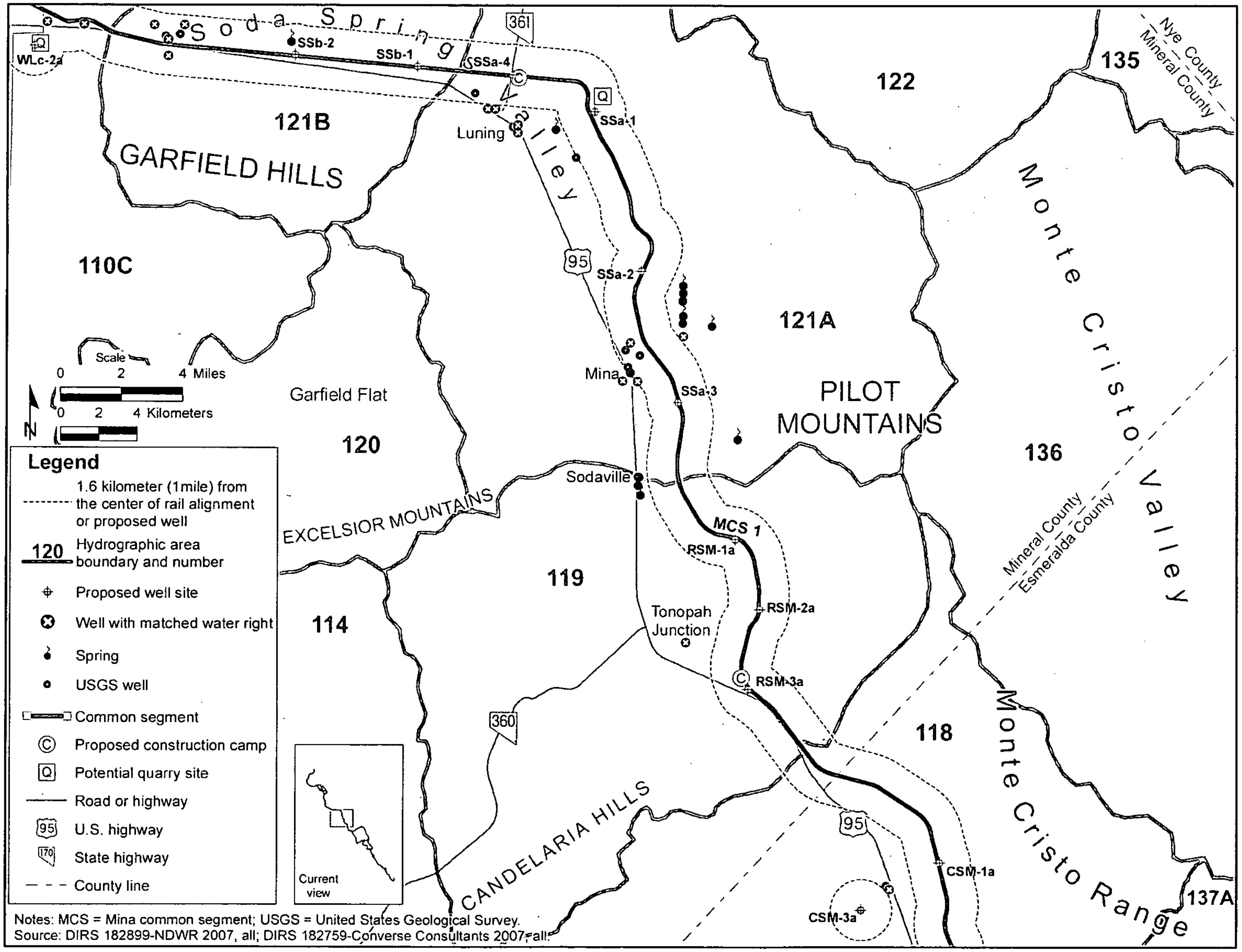
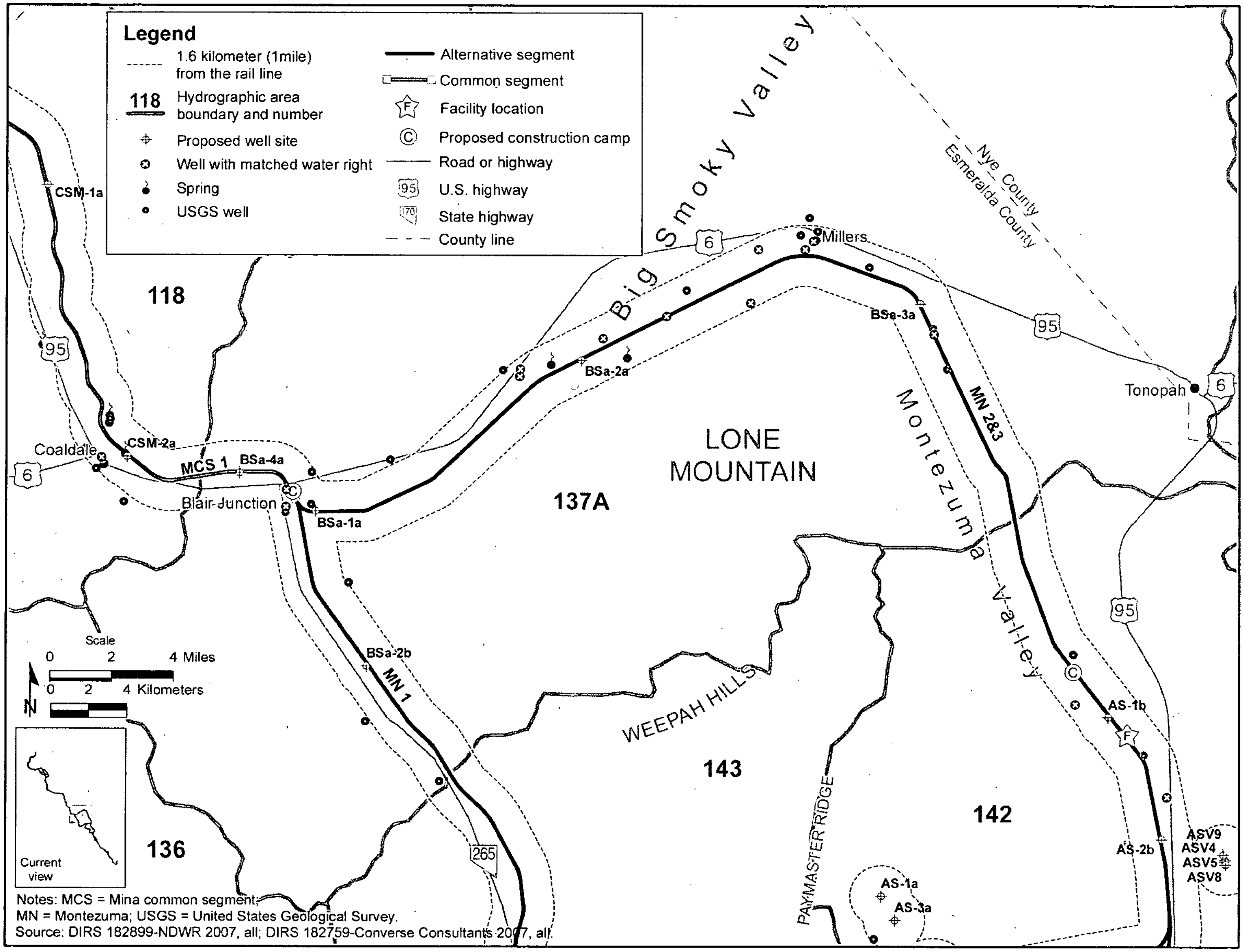


Figure 3-192. Proposed wells and existing USGS and NDWR wells and springs within map area 3.



Notes: MCS = Mina common segment; MN = Montezuma; USGS = United States Geological Survey.
Source: DIRS 182899-NDWR 2007, all; DIRS 182759-Converse Consultants 2007, all.

Figure 3-193. Proposed wells and existing USGS and NDWR wells and springs within map area 4.

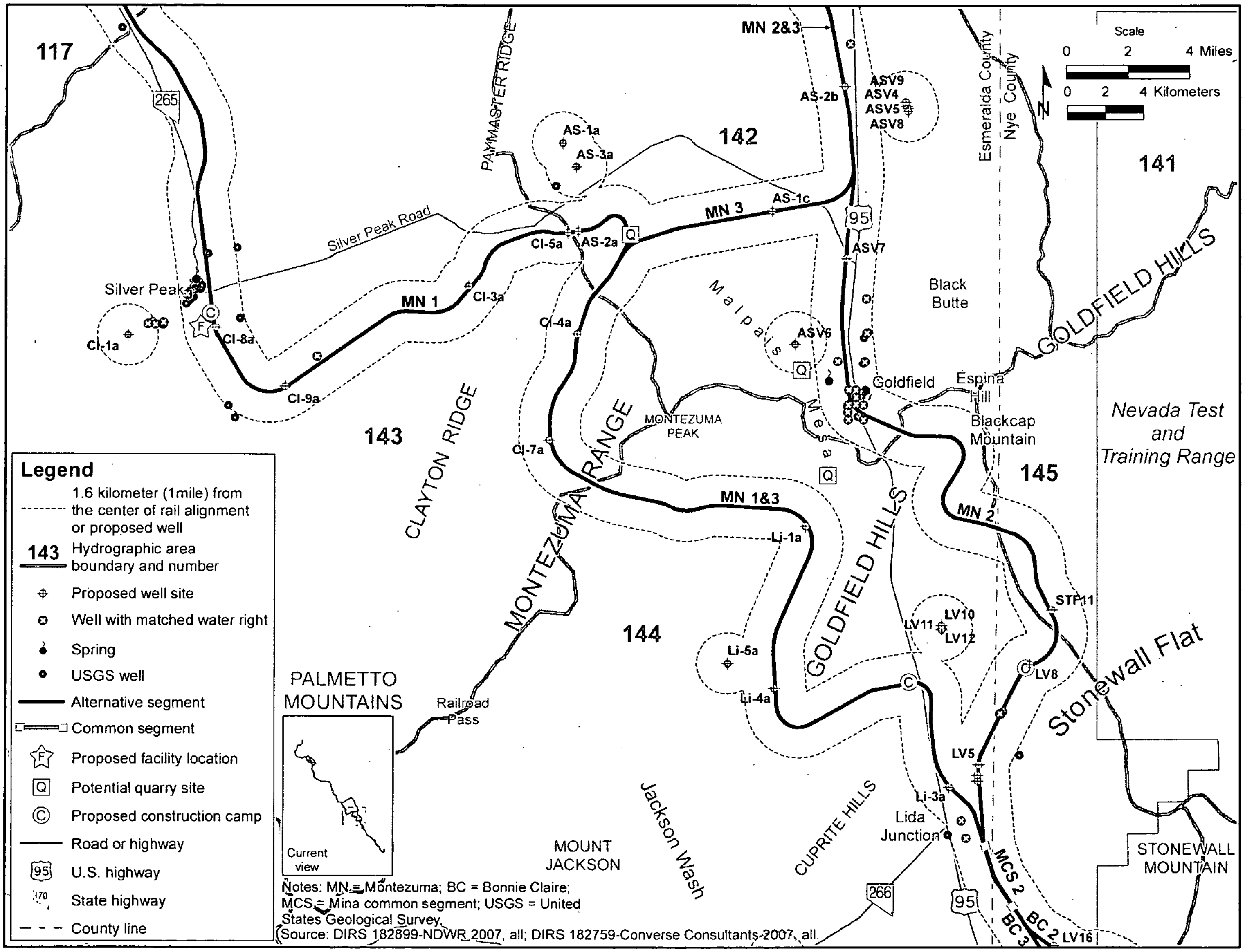


Figure 3-194. Proposed wells and existing USGS and NDWR wells and springs within map area 5.

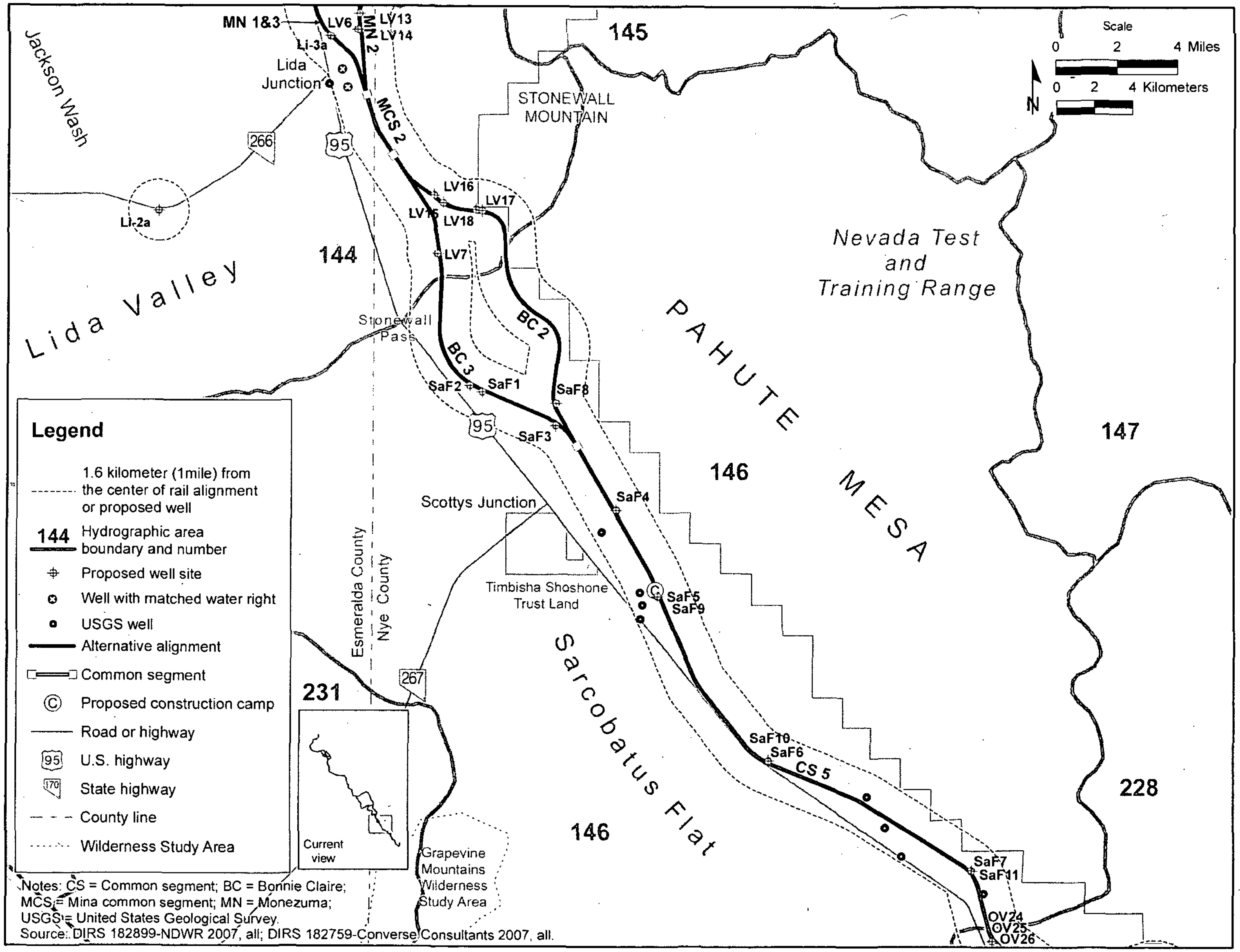


Figure 3-195. Proposed wells and existing USGS and NDWR wells and springs within map area 6.

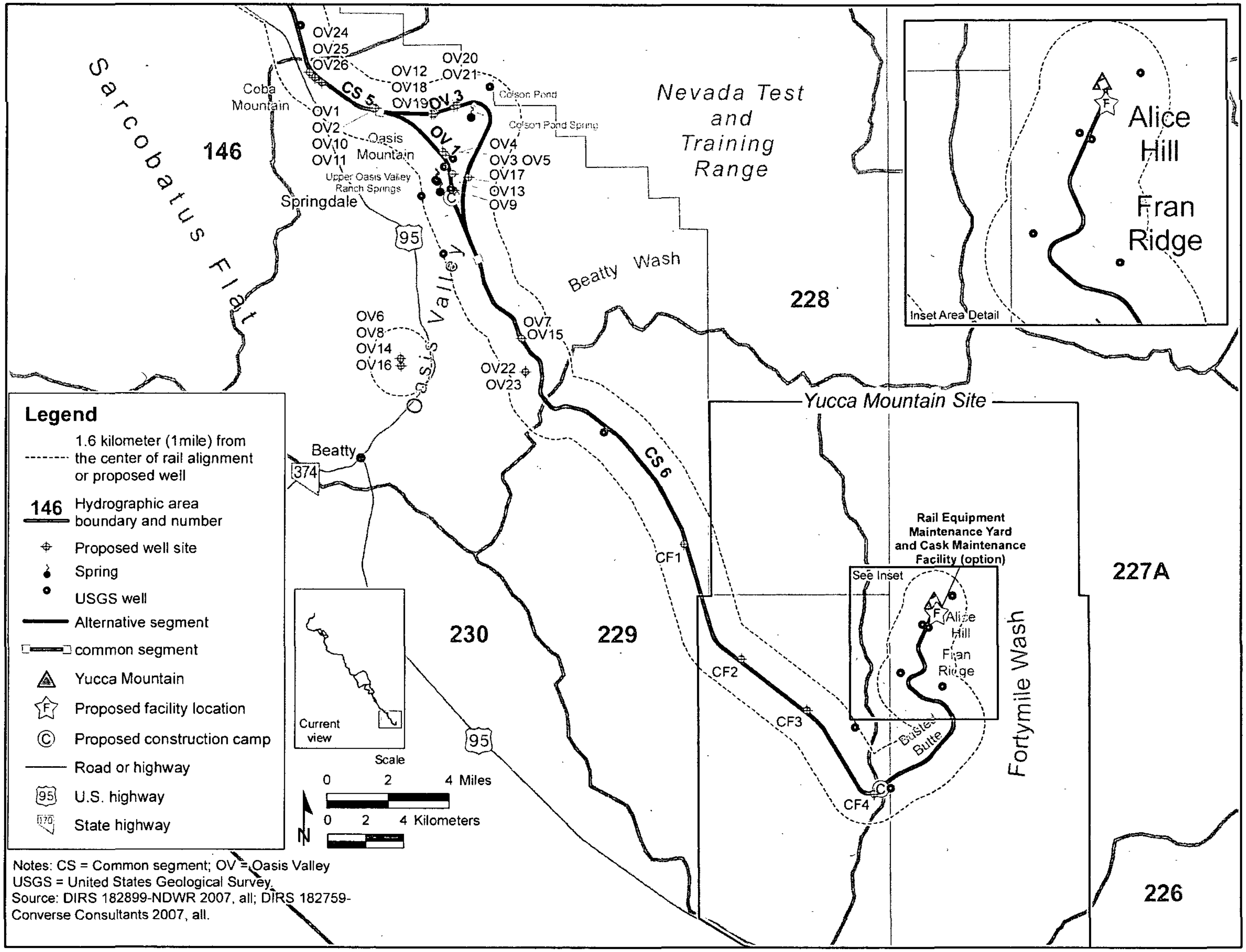


Figure 3-196. Proposed wells and existing USGS and NDWR wells and springs within map area 7.

Table 3-114. Existing wells and proposed new water-supply wells within 1.6 kilometers[a] of the centerline of the Mina rail alignment by hydrographic area and/or within 1.6 kilometers of proposed new wells outside the rail line construction right-of-way.

Hydrographic area		Total number of wells and number of NDWR[b] wells with water rights by proposed-use category[c,d]										
Name	Area number	Number of wells[e,f]	C	G	H	I	K	N	P	S	X	Z
Mason Valley	108	0	0	0	0	0	0	0	0	0	0	0
Walker Lake Valley (Schurz subarea)	110A	32	0	0	0	0	0	0	0	0	0	0
Walker Lake Valley (Lake subarea)	110B	0	0	0	0	0	0	0	0	0	0	0
Walker Lake Valley (Whiskey Flat-Hawthorne subarea)	110C	2	2	0	0	0	0	0	0	0	0	0
Rawhide Flats	123	1	0	0	0	0	0	0	0	0	0	0
Soda Springs Valley (western part)	121B	7	0	0	0	0	4	0	0	1	0	0
Soda Springs Valley (eastern part)	121A	14	0	0	2	0	3	0	3	0	0	1
Rhodes Salt Marsh Valley	119	1	0	0	0	1	0	0	0	0	0	0
Columbus Salt Marsh Valley	118	5	0	0	0	0	0	0	1	1	0	0
Big Smoky Valley	137A	25	0	0	0	0	2	0	1	10	0	0
Clayton Valley	143	13	0	0	0	0	0	0	5	1	0	0
Alkali Spring Valley	142	36	0	0	0	1	5	0	13	5	0	0
Lida Valley	144	6	0	0	1	0	1	0	0	2	0	0
Stonewall Flat	145	0	0	0	0	0	0	0	0	0	0	0
Sarcobatus Flat	146	10	0	0	0	1	0	0	1	0	0	0
Oasis Valley	228	10	0	0	0	0	0	0	0	0	0	0
Crater Flat	229	4	0	0	0	0	1	0	0	0	0	0
Fortymile Canyon, Jackass Flats	227A	14	0	0	0	0	0	0	0	0	0	0
Totals		180	2	0	3	3	16	0	24	20	0	1

a. To convert kilometers to miles, multiply by 0.62137.

b. NDWR = Nevada Division of Water Resources.

c. C = commercial; G = monitoring wells; H = domestic; I = irrigation; K = mining and milling; N = industrial (includes those designated in the database as N for "industrial" and as J for "industrial-cooling"); P = municipal or quasi municipal; S = stock; X = test wells; Z = other (includes those designated in the database as Z for "other," R for "recreation," and U for "unused").

d. Proposed use categories are tabulated only for wells (69 of the 180 wells) listed as NDWR wells with water rights, NDWR domestic wells or NDWR wells with an associated water rights application number.

e. Includes total number of NDWR-documented existing wells with water rights, plus NDWR domestic wells, plus U.S. Geological Survey National Water Information System-listed wells within 1.6 kilometers from the centerline of the rail alignment or within 1.6 kilometers of any DOE-proposed new groundwater-supply well. Note that the number of NDWR wells listed by proposed use category applies only to NDWR wells with water rights and NDWR domestic wells. U.S. Geological Survey wells are not included in the well counts, the Geological Survey NWIS database does not provide information regarding well use category.

f. Well locations have not been field-verified. Therefore, some of the identified wells might be farther than 1.6 kilometers from the centerline of the rail alignment or proposed new groundwater-supply wells.

Table 3-114 identifies the associated proposed-use category of the NDWR-cataloged wells (as defined in the State of Nevada well-log database). The USGS NWIS database does not categorize wells according to their use.

The distance of 1.6 kilometers (1 mile) reflects the first two of three aspects considered in establishing the groundwater region of influence, as described in Section 3.3.6.1. The wells identified in these figures were compiled from information provided in the *Water Resources Assessment Report, Mina Rail Corridor* and an NDWR Data Update Technical Memorandum (DIRS 180887-Converse Consultants 2007, all; and DIRS 182759-Converse Consultants 2007, all) and databases administered by the NDWR and the USGS NWIS. DOE would field-verify the locations of wells that could be affected during rail line construction before starting construction activities.

DOE-compiled well data include data on well locations for well records coded as "new" or "replacement" wells in the Nevada well-log database. Because each entry in the well-log database represents an event at a well site (for example, installation, re-drilling, abandonment), there is a possibility that there is more than one record to represent a particular well. To preclude duplication, DOE summarized only records that identified wells as new or replacement. As a result of the characteristics of the well location specifications, there might be more than one existing well that plot at the same location on these figures.

Table 3-114 lists hydrographic areas the Mina rail alignment would cross and the corresponding number of NDWR wells with water rights and USGS wells within 1.6 kilometers (1 mile) of the centerline of the rail alignment, or within a 1.6-kilometer radius of any proposed new water well that would be outside the rail line construction right-of-way. Table 3-114 identifies the associated proposed-use category of the NDWR-cataloged wells with water rights (as defined in the State of Nevada well-log and water-rights databases). The USGS NWIS database does not categorize wells according to their use. For this reason, the existing USGS wells that are included on Figures 3-190 through 3-196 are not included in the well use categorization presented in Table 3-114.

As shown in Table 3-114, there are 180 NDWR wells with water rights and USGS NWIS wells within 1.6 kilometers (1 mile) of the centerlines of all of the Mina rail alignment segments (combined) and/or within 1.6 kilometers of proposed new groundwater-supply wells. For those hydrographic areas containing multiple (alternative) segments, the actual number of existing wells falling within 1.6 kilometers of the completed rail line within that hydrographic area would be less than the number listed in Table 3-114, since only one alternative segment or unique set of alignment segments would be constructed in that hydrographic area.

As part of the Proposed Action, DOE proposes to install a series of new wells within the nominal width of the rail line construction right-of-way to acquire water needed to support railroad construction and operation. In addition to these wells, DOE might install additional wells at selected locations outside this construction right-of-way to serve as alternative-use water wells, supplemental wells to be used in combination with other water wells installed within the construction right-of-way, or to support proposed quarry operations. The need for installing alternative-use or supplemental wells would be based on wells installed at or very near a certain water ***demand*** location within the construction right-of-way not being adequate for meeting construction or operations needs. The locations of the proposed new wells are depicted on Figures 3-190 through 3-196.

There are numerous existing wells in hydrographic area 108 that are not reflected in Table 3-114; however, except for construction of a new siding in this area, with installation of one associated new small-production rate well, there is no new construction planned along this portion of the Mina alignment (see Section 3.3.6.3.1). There are no existing wells with water rights, no USGS NWIS wells, and no springs within a 1.6-kilometer (1-mile) radius of this proposed new well. Most of the existing wells near the remaining alignment segments are in areas 142 and 137A. Table 3-114 lists public supply-municipal

(24 out of 69 NDWR-listed wells with water rights), stock-watering (20 of 69 NDWR-listed wells with water rights), and mining (16 of 69 NDWR-listed wells with water rights) as the predominant use categories for those NDWR-listed wells with water rights that are within the 1.6-kilometer distance from the Mina rail alignment or any proposed new groundwater-supply well location.

3.3.6.2.2 Groundwater-Quality Characteristics

Water quality in aquifers in Nevada varies with location (DIRS 106094-Harrill, Gates, and Thomas 1988, all). In the Basin and Range, total dissolved solids concentrations can range from less than 500 to more than 10,000 milligrams per liter (DIRS 172905-USGS 1995, all). In general, at hydrographic area margins and on the slopes of alluvial fans, groundwater quality is good. In discharge areas (such as playas) and other selected areas, groundwater quality can be brackish. However, groundwater in deeper alluvial valley-fill units underlying some playa areas can be of better quality (DIRS 172905-USGS 1995, all). Groundwater quality in the carbonate aquifers in southern and central Nevada, including total dissolved solids concentrations, is generally more uniform in character and with depth within the aquifer (DIRS 101167-Winograd and Thordarson, 1975, p. C103). Total dissolved solids concentrations in alluvial valley fill underlying the Mina rail alignment range from less than 500 to more than 10,000 milligrams per liter (mg/L), or approximately 500 to 10,000 parts per million (DIRS 172905-USGS 1995, Figure 70, with overlay of hydrographic area boundaries). The U.S. Environmental Protection Agency has set an aesthetic standard of 500 mg/L (approximately 500 parts per million) of total dissolved solids for drinking water (40 CFR Part 143). Water with a total dissolved solids concentration of 500 mg/L or less is regarded as acceptable and pleasing for general consumption. A secondary preferred drinking water standard for total dissolved solids concentrations of 500 mg/L per liter for public water supplies has been adopted for Nevada. If water supplies that meet the preferred standard are not available, the Maximum Contaminant Level of 1,000 mg/L is enforceable by the State of Nevada. At higher concentrations, general consumption issues (pertaining to hardness, deposits, color, staining, and salty taste) could develop, but the water could be used for other purposes (for example, agriculture or earthwork compaction as part of embankment construction). Another parameter of interest for gauging the quality of groundwater in Nevada is arsenic. A revised drinking water standard for arsenic (for water systems meeting certain specified criteria) of 0.010 mg/L became enforceable in January of 2006 (40 CFR 141.23).

3.3.6.3 Hydrogeologic Setting and Characteristics along Alternative Segments and Common Segments

3.3.6.3.1 Department of Defense Branchline North

The Mina rail alignment would commence with Department of Defense Branchline North, beginning near Fort Churchill, Nevada. The beginning of Department of Defense Branchline North would overlie a portion of Mason Valley (hydrographic area 108). Department of Defense Branchline North would then proceed eastward where it would cross into a small portion of the Walker Lake Valley-Schurz subarea (hydrographic area 110A) (Figure 3-190). Department of Defense Branchline North would predominately overlie alluvial valley fill (DIRS 180887-Converse Consultants 2007, pp. 89 and 101, and Plates 4-10 and 4-12).

Hydrographic area 108, Mason Valley, is a designated groundwater basin (see Table 3-113). Committed groundwater resources exceed estimated perennial yield of 30.8 million cubic meters (25,000 acre-feet). However, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 3.57 billion cubic meters (2.9 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 108 (DIRS 180754-Rush et al. 1971, all). NDWR data indicate that there are approximately 31.2 million cubic meters (25,269 acre-feet) of documented pending annual duties (see Table 3-113) in area 108 (DIRS 182759-Converse Consultants 2007; data acquired on March 31, 2007).

Table 3-115 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 108. The depth at which groundwater occurs varies from less than 3 meters (10 feet) to approximately 30.5 meters (100 feet) below ground along the portion of Department of Defense Branchline North that would lie within hydrographic area 108. Groundwater is primarily produced from the valley-fill sediments (DIRS 180697-Huxel and Harrill 1969, p. 11). Geologic units in the Mason Valley area include alluvial sediments, altered sediments, altered volcanic rocks, and granitic rocks.

Table 3-115. General groundwater-quality and aquifer characteristics – Department of Defense Branchline North.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
108 Mason Valley	Alluvial sediments, altered sediments, altered volcanic rocks, and granitic rocks	3 to 30	Upper 30.5 meters of alluvium: 2.9 million[f]	Total dissolved solids: Less than 500 to 97,100 mg/L [g] Fluoride: 7.7 mg/L (north of Wabuska)[g]
110A Walker Lake Valley (Schurz subarea)	Alluvial valley fill, granitic rocks, volcanics, altered volcanic rocks	0 to 150	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 500 to 1,800 mg/L[g] Fluoride: 9.3 mg/L[g]

a. Source: DIRS 180887-Converse Consultants 2007, pp. 102 and 89.
b. To convert meters to feet, multiply by 3.2808.
c. Source: DIRS 180887-Converse Consultants 2007, Plates 4-11 and 4-12. The listed depth ranges generally apply to areas underlying the alignment segments; groundwater may be deeper in the southern part of hydrographic area 108 (DIRS 180887-Converse Consultants 2007, p. 102).
d. To convert from acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 90 and 102.

One new well (Mn-2a) is proposed along Department of Defense Branchline North in hydrographic area 108 (Figure 3-190). This well would be a small-production rate (less than 3.8 liters [1 gallon] per minute) well, and would supply water to support operation of a proposed rail siding. DOE determined that there are no existing NDWR wells with water rights and no USGS NWIS wells within a 1.6 kilometer (1 mile)-radius of this proposed well location (DIRS 180888-Converse Consultants 2007, Appendix B and Plate 4-12).

Hydrographic area 110A, Walker Lake Valley-Schurz subarea, is not a designated groundwater basin (see Table 3-113). Committed groundwater resources do not exceed estimated perennial yield of 1.85 million cubic meters (1,500 acre-feet). There could be approximately 1.85 billion cubic meters (1.5 million acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 110A (DIRS 180754-Rush et al. 1971, all). NDWR data indicate that there are approximately 2,500 cubic meters (2 acre-feet) of documented pending annual duties (see Table 3-113) in area 110A.

Table 3-115 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 110A. The depth at which groundwater occurs throughout hydrographic area 110A varies from 0 meters (0 feet) to approximately 150 meters (499 feet), with most groundwater being less than 30.5 meters (100 feet) below ground. Depth to groundwater is generally 15 meters (50 feet) along the segments of Department of Defense Branchline North that would lie within and along hydrographic area 110A (DIRS 180887-Converse Consultants 2007, p. 89 and Plate 4-11). Groundwater is primarily produced from the valley-fill sediments. Geologic units in hydrographic area 110A include alluvial sediments, volcanic and altered volcanic rocks, and granitic rocks.

There are no springs and no existing NDWR wells with water rights, and there is one USGS NWIS well within 1.6 kilometers (1 mile) of the centerline of Department of Defense Branchline North in hydrographic area 110A (see Figure 3-190). The land crossed by the short portion of Department of Defense Branchline North (and by the Schurz alternative segments [Section 3.3.6.3.2]) is part of the Walker River Paiute Reservation. There are existing wells on the Reservation rangeland for which there is currently no documentation or information on the wells on file at the Nevada Division of Water Resources. The Nevada Division of Water Resources Well Log and Water Rights Databases are therefore incomplete regarding existing wells present in hydrographic 110A (and in hydrographic area 123 [Section 3.3.6.3.2]). Therefore, DOE does not have a complete record of groundwater usage on the Reservation.

3.3.6.3.2 Schurz Alternative Segments

The Schurz alternative segments would overlie hydrographic area 110A and/or the western part of hydrographic area 123 (Rawhide Flats) as shown on Figure 3-190. These alternative segments would overlie various geologic materials, depending on the specific combination of alternative segments constructed, including alluvial valley-fill materials, volcanic rocks, altered volcanic rocks, and/or granitic rocks (DIRS 180887-Converse Consultants 2007, pp. 89 and 95 and Plates 4-10 and 4-11).

Section 3.3.6.3.1 describes the hydrogeologic characteristics of hydrographic area 110A, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the Schurz alternative segments. Table 3-115 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 110A.

Area 123 is not a designated groundwater basin. Committed groundwater resources do not exceed estimated perennial yield of 617,000 cubic meters (500 acre-feet) (see Table 3-113). There could be between approximately 74 and 666 million cubic meters (60,000 and 540,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 123 (DIRS 180754-Rush et al. 1971, all; DIRS 181394-Everett and Rush 1967, Table 6). NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in area 123. Table 3-116 summarizes general groundwater quality and aquifer characteristics in hydrographic area 123. The depth at which groundwater occurs in hydrographic area 123 varies from less than 15 to greater than 150 meters (less than 50 to greater than 500 feet).

The NDWR Water Rights database (DIRS 182899-NDWR 2007, all) does not include any wells for hydrographic area 123 (DIRS 180887-Converse Consultants 2007, p. 97). According to the NDWR records, there are a total of approximately 2,500 cubic meters (2 acre-feet) in pending annual duties assigned to hydrographic area 110A and no pending annual duties assigned to hydrographic area 123 (see Table 3-113). Similar to the case for hydrographic area 110A as discussed in Section 3.3.6.3.1, land across which Schurz alternative segments would cross in hydrographic area 123 is part of the Walker River Paiute Reservation and therefore the NDWR Well Log and Water Rights Database is incomplete with respect to existing wells that exist in hydrographic area 123. For example, the NDWR Well Log Database has no record of any existing wells in hydrographic area 123, whereas information in a published historical report (DIRS 181394-Everett and Rush 1967, Table 4-9) provide data on two wells in that area (DIRS 180887-Converse Consultants 2007, Table 4-44).

Table 3-116. General groundwater-quality and aquifer characteristics – Schurz alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
110A Walker Lake Valley (Schurz subarea)	Alluvial valley fill, granitic rocks, volcanic rocks, altered volcanic rocks	0 to 140	Upper 30.5 meters: 1.5 million[f]	Total dissolved solids: 500 to 1,800 mg/L[g] Fluoride: 9.3 mg/L[g]
123 Rawhide Flats	Alluvial valley fill and volcanic rocks	Less than 15 to more than 150	Upper 30.5 meters for both aquifer types: 60,000 to 540,000[f,h]	Total dissolved solids: 300 to 1,660 mg/L [g] Sulfate: 52 mg/L[g] Fluoride: 7.9 mg/L[g]
110A Walker Lake Valley (Schurz subarea)	Alluvial valley fill, granitic rocks, volcanic rocks, altered volcanic rocks	0 to 14	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 500 to 1,800 mg/L[g] Fluoride: 9.3 mg/L[g]

a. Source: DIRS 180887-Converse Consultants 2007 pp. 90 and 96.
b. The listed depth ranges generally apply to areas underlying the alternative segments (DIRS 180887-Converse Consultants 2007, Plates 4-10 and 4-11); groundwater can vary over a wide range of depth depending on location in each hydrographic area (DIRS 180887-Converse Consultants 2007, p. 90).
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 90 and 96.
h. Source: DIRS 181394-Everett and Rush 1967, Table 6.

Three wells (RF-2b, RF-4b, and WLa-3b) could be installed in hydrographic area 123 at locations outside of the construction rights-of-way for the various alternative segments (Figure 3-190). Geologic materials underlying these potential well locations are comprised of alluvial slope and alluvial valley-fill materials (DIRS 180888-Converse Consultants 2007, Appendix B and Plate 4-11).

3.3.6.3.3 Department of Defense Branchline South (Walker Lake Valley Area)

Department of Defense Branchline South would overlie the southern part of hydrographic area 110A, continue southward across hydrographic area 110B (Walker Lake Valley – Lake subarea), and cross over a small portion of the northwestern part of hydrographic area 110C (Walker Lake Valley, Whiskey Flat-Hawthorne subarea).

Section 3.3.6.3.1 describes the hydrogeologic characteristics of hydrographic area 110A, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the proposed alignment segments. Table 3-115 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 110A.

Area 110B is not a designated groundwater basin. Committed groundwater resources exceed the estimated perennial yield of 860,000 cubic meters (700 acre-feet) (see Table 3-113). However, as noted previously, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 123 million cubic meters (100,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 110B. NDWR data indicate that there no documented pending annual duties (see Table 3-113) in area 110B.

Department of Defense Branchline South would cross alluvial valley fill in hydrographic area 110B. Adjacent mountain ranges in hydrographic area 110B are comprised primarily of volcanic rocks.

Groundwater quality within hydrographic area 110B varies according to location within the area (DIRS 180887-Converse Consultants 2007, Plate 4-10). Table 3-117 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 110B.

Groundwater depth underlying the alignment in hydrographic area 110B (see Table 3-117) is on the order of 15 meters (50 feet). Groundwater depths reported in three wells in hydrographic area 110C, between 4.5 and 8.9 kilometers (2.8 and 5.5 miles) south of the southern boundary of subarea 110B, range from 15 to 31 meters (50 to 103 feet).

Hydrographic area 110C, Walker Lake Valley (Whiskey Flat-Hawthorne subarea), is a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 6.17 million cubic meters (5,000 acre-feet) (see Table 3-113). There could be approximately 1.11 billion cubic meters (900,000 acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 110C. NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in area 110C.

Geologic units in the Walker Lake Valley (Whiskey Flat-Hawthorne subarea) area include alluvial valley fill, granitic rock, volcanics, altered volcanics and chert (see Table 3-117). The depth to groundwater in Walker Lake Valley (Whiskey Flat-Hawthorne subarea) near the proposed rail line is 15 to 150 meters (50 to 500 feet) (see Table 3-117). The primary source of groundwater in 110C is from unconfined aquifers of alluvial valley fill. Table 3-117 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 110C.

Most groundwater in hydrographic area 110C is a sodium sulfate type (DIRS 181394-Everett and Rush 1967, p. 32). The Hawthorne Army Depot property covers most of the Whiskey Flat-Hawthorne area. Contaminants have been reported in some groundwater monitoring wells underlying the Hawthorne Army Depot property, including explosives, volatile organic compounds, and inorganic nitrogen compounds. Areas of known impacted groundwater underlying the Hawthorne Army Depot property are approximately 4.5 kilometers (2.8 miles) to the west and southwest of the centerline of Department of Defense Branchline South and approximately 3.2 kilometers (2 miles) to the west and southwest of the centerline of Mina common segment 1 (DIRS 182749-Tetra Tech EM Inc., 2007 Figure 5).

Available information indicates that the groundwater flow direction in the areas of identified ***contamination*** and underlying the land surface between these areas and adjacent to Department of Defense Branchline South and Mina common segment 1 is westward to southwestward (DIRS 182749-Tetra Tech EM Inc., 2007, Figures 4A and 4B). On the basis of the groundwater flow directions underlying these areas and the distances to the proposed alignment and the impacted wells on the Hawthorne Army Depot property, it is extremely improbable that new wells installed within the rail alignment construction right-of-way to support construction of the proposed railroad (for example, well WLc-3a on Figure 3-191) would encounter the identified contaminated groundwater.

One new well (location WLa-5a) is proposed within hydrographic area 110A to support water needs associated with railroad construction and operation of a new rail siding. Figures 3-190 and 3-191 show the approximate location of this proposed new water well.

Available information indicates that there are no springs, no existing NDWR wells with water rights, and no USGS NWIS wells within 1.6 kilometers (1 mile) of the centerline of Department of Defense Branchline South or within 1.6 kilometers of the proposed new well location in hydrographic area 110A (see Figures 3-190 and 3-191).

Table 3-117. General groundwater-quality and aquifer characteristics – Department of Defense Branchline South.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
110A Walker Lake Valley (Schurz subarea)	Alluvial valley fill, granitic rocks, volcanic rocks, altered volcanic rocks	0 to 14	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 500 to 1,800 mg/L[g] Fluoride: 9.3 mg/L[g]
110B Walker Lake Valley (Lake subarea)	Alluvial valley fill and volcanic rocks[h]	15 to 31	Upper 30.5 meters for both aquifer types: 100,000[f]	Total dissolved solids: 742 mg/L[i] Sulfate: 92 to 383 mg/L[i] Fluoride: 0 to 1.6 mg/L[i]
110C Walker Lake Valley (Whiskey Flat-Hawthorne subarea)	Alluvial valley fill, granitic rocks, volcanics, altered volcanics, chert	15 to 150	Upper 30.5 meters of alluvium: 900,000[f]	Total dissolved solids: 191 to 1,033 mg/L[g] Sulfate: 19 to 502 mg/L[g] Fluoride: 6.8 mg/L[g]

a. Source: DIRS 180887-Converse Consultants 2007, pp. 82 and 90.
b. Estimated depth to groundwater obtained from DIRS 180887-Converse Consultants 2007, pp. 89 and 90 and Plates 4-9 and 4-10, and based on water depths in three wells in adjacent hydrographic area 110C (DIRS 181394-Everett and Rush 1967, Table 9 and Plate 1). The listed depth range for hydrographic area 110B generally applies to valley floor areas underlying the general vicinity of the proposed alignment segment; groundwater depths in other portions of hydrographic area 110B might be substantially different.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, p. 90.
h. Source: DIRS 182289-Ross 1961, Plate 2.
i. Source: DIRS 181394-Everett and Rush 1967, Table 8 and Plate 1; data are for a spring in hydrographic area 110A about 1.2 kilometers (0.75 mile) north of the subarea 110B boundary and a well 4.4 kilometers (2.75 miles) south of the subarea 110B boundary.

However, as discussed previously, the NDWR Well Log and Water Rights Databases are incomplete with respect to existing wells that might exist on the Walker River Paiute Reservation for this hydrographic area.

3.3.6.3.4 Mina Common Segment 1

Crossing from north to southeast, Mina common segment 1 would overlie hydrographic areas 110C (Walker Lake Valley, Whiskey Flat-Hawthorne subarea), 121B (Soda Spring Valley, western part), 121A (Soda Spring, eastern part), 119 (Rhodes Salt Marsh Valley), 118 (Columbus Salt Marsh Valley), and a small portion of hydrographic area 137A (Big Smoky Valley) (Figures 3-191 through 3-193). Mina common segment 1 would predominantly cross alluvial deposits. The depth to groundwater and groundwater-quality characteristics underlying Mina common segment 1 vary according to location within the hydrographic areas the rail line would cross. Table 3-118 summarizes the groundwater-quality and aquifer characteristics in the hydrographic areas Mina common segment 1 would cross.

Section 3.3.6.3.3 describes the hydrogeologic characteristics of hydrographic area 110C, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the proposed common segment. Table 3-116 and Table 3-117summarize general groundwater-quality and aquifer characteristics in hydrographic area 110A.

Table 3-118. General groundwater-quality and aquifer characteristics – Mina common segment 1.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
110C Walker Lake Valley (Whiskey Flat-Hawthorne subarea)	Alluvial valley fill, granitic rocks, volcanics, altered volcanics, chert	15 to 150	Upper 30.5 meters of alluvium: 900,000[f]	Total dissolved solids: 191 to 1,033 mg/L[g] Sulfate: 19 to 502 mg/L[g] Fluoride: 6.8 mg/L[g]
121B Soda Spring Valley (western part)	Alluvial valley fill, intrusive and metamorphic rock, minor clastic sandstones	15	Upper 30.5 meters for both aquifer types: 280,000[f]	Total dissolved solids: Generally less than 500 to 1,170 mg/L[g] 6,500 mg/L (valley center discharge locations)[g] Sulfate: 350 to 372 mg/L[g]
121A Soda Spring Valley (eastern part)	Alluvial valley fill, intrusive and metamorphic bedrock units, and clastic sandstone	15 to 30	Upper 30.5 meters of alluvium: 430,000[f]	Total dissolved solids: 200 to 1,250 mg/L[g] 6,500 mg/L (valley center discharge locations)[g] Sulfate: 82 to 744 mg/L[g]
119 Rhodes Salt Marsh Valley	Alluvial valley fill deposits, altered volcanics, chert, limestone, dolomite with interbedded zones of sandstone and conglomerates	15 to less than 30	Upper 30.5 meters of alluvium: 340,000[f]	Total dissolved solids: 2,370 mg/L[g] Sulfate: 250 to 1,830 mg/L[g]
118 Columbus Salt Marsh Valley	Alluvial sediments, volcanic rocks and clastic rocks	3 to 30	Upper 30.5 meters of alluvium: 530,000[f]	Total dissolved solids: 5,556 mg/L[g] Sulfate: 250 to 2,600 mg/L[g]
137A Big Smoky Valley	Alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, clastic rocks	Less than 3 to more than 30	Upper 30.5 meters of alluvium: 7 million[f]	Total dissolved solids: 300 to 4,000 mg/L[g] 6,500 mg/L (valley center discharge locations)[g]

a. Source: DIRS 180887-Converse Consultants 2007, pp. 81, 75, 68, 62, 56, and 51.
b. Estimated depth to groundwater obtained from DIRS 180887-Converse Consultants 2007, Plates 4-4 to 4-10 and pp. 51 and 52.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 52, 57, 58, 63, 70, 76, and 83.

Two potential quarry sites have been identified along Mina common segment 1 (Figure 3-191 and Figure 3-192). A new well is proposed at each potential quarry location. The first potential quarry site is in the northeast part of hydrographic area 110C (Walker Lake Valley, Whiskey Flat-Hawthorne subarea), approximately 2.1 kilometers (1.3 miles) south of the centerline of Mina common segment 1. Proposed well WLc-2a would be installed adjacent to this quarry location. Geologic conditions found at this location include primarily volcanic rocks (DIRS 180881-Shannon & Wilson, Inc. 2007, p. 28). The quarry and the quarry well would be located partially on grazing land and partially on the Hawthorne Army Depot (Section 4.3.2).

There are two existing wells in hydrographic area 110C, both NDWR wells with water rights and within 1.6 kilometers (1 mile) of the centerline of Mina common segment 1. One of these two wells is also within 1.6 kilometers of a proposed new well location (Figures 3-191 and 3-192). Figure 3-190 shows the locations of these wells. There are no springs within 1.6 kilometers of the centerline of Mina common segment 1 in hydrographic area 110C.

Hydrographic area 121B, Soda Spring Valley (western part), is a designated groundwater basin. Committed groundwater resources exceed its estimated perennial yield of 246,000 cubic meters (200 acre-feet) (see Table 3-113). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 345 million cubic meters (280,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 121B. NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in the area.

The depth to groundwater in most parts of Soda Spring Valley (western part) ranges from approximately less than 15 to more than 90 meters (less than 50 to more than 300 feet) (DIRS 180887-Converse Consultants, p. 76). Depth to groundwater underlying the rail alignment in hydrographic area 121B is generally 15 meters (50 feet) (see Table 3-118) (DIRS 180887-Converse Consultants, Plate 4-8). Groundwater is generally low in dissolved solids with dominant ions of calcium and bicarbonate. The main use of groundwater in hydrographic area 121B is for mining (DIRS 180887-Converse Consultants, p. 77). The primary source of groundwater in Soda Spring Valley (western part) is inferred to be interbasin flow from the Soda Spring Valley-East Basin. Table 3-118 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 121B.

Geologic units in the Soda Spring Valley (western part) area include alluvial valley fill, metamorphic rocks, and clastic rocks. Alluvial valley fill comprises the best aquifers in hydrographic area 121B. There is an estimated 345 million cubic meters (280,000 acre-feet) of recoverable groundwater in the saturated aquifer material within this basin (see Table 3-118). There are a total of 7 existing NDWR wells with water rights and USGS NWIS wells in hydrographic area 121B within 1.6 kilometers (1 mile) of the centerline of Mina common segment 1 (see Table 3-114). Figures 3-191 and 3-192 identify the locations of these wells. There are no springs within 1.6 kilometers of the centerline of Mina common segment 1 or proposed new well locations outside of the segment construction right-of-way.

Hydrographic area 121A, Soda Spring Valley (eastern part), is a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 7.4 million cubic meters (6,000 acre-feet) (see Table 3-113). There could be approximately 530 million cubic meters (430,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 121A. NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in area 121A.

Geologic units underlying the Soda Spring Valley (eastern part) hydrographic area include alluvial valley fill, intrusive and metamorphic bedrock units, and clastic sandstone (see Table 3-118). Mina common segment 1 would primarily overlie alluvial valley (alluvial valley floor and alluvial slope) deposits. Table -192 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 121A.

Faulting is mapped predominantly on the alluvial aprons in hydrographic area 121A. Mapped fault traces (for example, part of the Benson Springs fault system) in alluvial valley fill to the south of one proposed new well site (SSa-3, see Figure 3-192) could project northeastward past the well location to the east; faults are also identified along the alluvial apron at the bedrock contact to the east (base of the Pilot

Mountains), about 1.6 kilometers (1 mile) east of this proposed well location (DIRS 180888-Converse Consultants 2007, Appendix B; DIRS 180975-Stewart, Carlson, and Johannessen 1982, all). The possible effects of such faults on groundwater flow in hydrographic area 121A in the vicinity of proposed well location SSa-3 (DIRS 180888-Converse Consultants 2007, Appendix B) were evaluated in hydrogeologic impact analyses (Appendix G).

The depth to groundwater beneath Soda Spring Valley (eastern part) is generally between 15 to 30.5 meters (50 to 100 feet) (see Table 3-118). Available data regarding characteristics of the valley-fill aquifer underlying hydrographic area 121A indicate that approximately 530 million cubic meters (430,000 acre-feet) of recoverable groundwater might exist within saturated aquifer material within this basin (see Table 3-118).

A second potential quarry location is in the Gabbs Range northeast of Luning along the northeastern side of Mina common segment 1. Proposed well location SSa-1 is adjacent to this potential quarry site. The geology in this area consists of sedimentary and plutonic rocks (DIRS 180881-Shannon & Wilson, Inc. 2007, p. 28). The quarry and the quarry well would be located on grazing land (Section 4.3.2).

There are a total of 14 existing NDWR wells with water rights and USGS NWIS wells in hydrographic area 121A within 1.6 kilometers (1 mile) of either the centerline of Mina common segment 1 or any proposed new well outside of the segment construction right-of-way (see Table 3-118). There are no springs in hydrographic area 121A within 1.6 kilometers of the centerline of Mina common segment 1 or any proposed new well outside of the segment construction right-of-way.

Hydrographic area 119, Rhodes Salt Marsh Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 1.23 million cubic meters (1,000 acre-feet) (see Table 3-113). There could be approximately 420 million cubic meters (340,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 119. NDWR data indicate that that there are no documented pending annual duties (see Table 3-113) in hydrographic area 119.

In the portion of hydrographic area 119 the rail line would cross, groundwater is approximately 15 meters (50 feet) to less than 30 meters (100 feet) below ground surface (see Table 3-118). Groundwater chemistry within hydrographic area 119 is highly variable. Groundwater is primarily obtained from the alluvial valley-fill aquifer. The primary geologic units comprising Rhodes Salt Marsh Valley include alluvial valley fill, volcanic rocks, and older carbonate and clastic rocks. There is one NDWR well with a water right, and no other USGS NWIS wells within 1.6 kilometers (1 mile) of the centerline of Mina common segment 1 or any proposed new well locations outside of the centerline (see Table 3-114). There are no springs in hydrographic area 119 within 1.6 kilometers of the centerline of Mina common segment 1 or within 1.6 kilometers of any proposed new well locations outside of the centerline (Figure 3-192). There are two existing springs in Sodaville, just north of hydrographic area 119 (Figure 3-192). These springs have documented discharge rates of approximately 280 liters (75 gallons) per minute but are more than 3.2 kilometers (2 miles) from the centerline of Mina common segment 1 (DIRS 180759-Vandenburgh and Clancy, p. 28 and Plate 1). Table 3-118 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 119.

Hydrographic area 118, Columbus Salt Marsh Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 4.9 million cubic meters (4,000 acre-feet) (see Table 3-113). There could be approximately 650 million cubic meters (530,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 118. NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in area 118.

Groundwater derived within area 118 is primarily obtained from alluvial valley fill. Table 3-118 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 118.

The primary geologic units comprising Columbus Salt Marsh Valley are alluvial sediments, volcanic rock, and clastic rocks (see Table 3-118). Available data indicate that depth to groundwater beneath Mina common segment 1 in hydrographic area 118 could vary from about 3 to 30.5 meters (10 to 100 feet) (see Table 3-118).

There are two NDWR wells with water rights, three USGS NWIS wells, and four springs in hydrographic area 118 within 1.6 kilometers (1 mile) of the centerline of Mina common segment 1. Figure 3-192 shows the locations of the wells.

Big Smoky Valley (hydrographic area 137A) is a designated groundwater basin, and the committed groundwater resources exceed the perennial yield of 7.4 million cubic meters (6,000 acre-feet). There could be approximately 8.63 billion cubic meters (7 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 137A. NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in area 137A. Geologic units in this hydrographic area include primarily alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, and clastic rocks (see Table 3-118). The alluvial valley-fill materials include sands and gravels along alluvial fans and washes, and silts and clays along the valley floor; most of the available groundwater in Big Smoky Valley is found in unconfined and semi-unconfined aquifers comprised of these valley-fill sediments.

Depth to groundwater in hydrographic area 137A typically varies from less than 3 to greater than about 30.5 meters (10 to 100 feet) below ground surface (see Table 3-118), with values as deep as 220 meters (720 feet) below ground surface reported for some locations in the alluvial apron. Groundwater in hydrographic area 137A contains dominant ions of calcium and bicarbonate, and groundwater at higher elevations has total dissolved solids concentrations that are relatively low (500 mg/L or less), although discharge areas in the center of the valley may have higher concentrations (see Table 3-118) (DIRS 180887-Converse Consultants 2007, p. 52).

Groundwater in Big Smoky Valley is mainly used for irrigation and mining purposes (DIRS 180887-Converse Consultants 2007, p. 53). Besides groundwater pumping and evapotranspiration, groundwater in the basin flows out of the area as subsurface outflow to Clayton Valley and Columbus Salt Marsh.

There are 25 existing wells in hydrographic area 137A within 1.6 kilometers (1 mile) of the centerline of alternative segments passing through this basin and/or proposed pumping well locations for alternative segments. Twelve of these wells are USGS wells and thirteen are NDWR wells with active water rights. There are no springs within 1.6 kilometers of the centerline of the rail alignment and/or proposed pumping well locations. There are no proposed groundwater supply-well locations in Big Smoky Valley for Mina common segment 1 that are outside of the construction right-of-way (Figures 3-193).

3.3.6.3.5 Montezuma Alternative Segment 1

Starting near Blair Junction, Montezuma alternative segment 1 would proceed southeastward towards Silver Peak, then continue eastward and southward in a sinuous fashion on its way to a point where the segment would connect to the beginning of Mina common segment 2, southeast of the Cuprite Hills. Montezuma alternative segment 1 would cross the following hydrographic areas: 137A (Big Smoky Valley), 143 (Clayton Valley), 142 (Alkali Spring Valley), and 144 (Lida Valley). Figures 3-193 through 3.3.6-8 depict the proposed Montezuma alternative segment 1 configuration. Aquifer characteristics, such as aquifer type(s), groundwater quality, and depth to groundwater underlying Montezuma alternative segment 1 vary according to the locations within the hydrographic areas that the rail line would cross.

Table 3-119 summarizes the groundwater-quality and aquifer characteristics for each hydrographic area Montezuma alternative segment 1 would cross.

Section 3.3.6.3.4 describes the hydrogeologic characteristics of hydrographic area 137A, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the proposed rail alignment segments. Table 3-119 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 137A.

Clayton Valley (hydrographic area 143) is a designated groundwater basin, and the total active annual duties for the basin exceed the perennial yield of 24.6 million cubic meters (20,000 acre-feet) (see Table 3-113). There could be approximately 1.6 million cubic meters (1.3 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 143 (DIRS 180754-Rush et al. 1971, all). NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 143 (see Table 3-113).

Alluvial valley deposits consisting of silts and clays comprise the center of the valley and are hundreds of feet thick. Alluvial valley-fill materials, volcanic rocks, and carbonate and clastic rocks are the major geologic units encountered (see Table 3-119). Most of the available groundwater in Clayton Valley is found in alluvial valley-fill materials, with some groundwater contained in fractured rock of the surrounding mountains. Subsurface inflow from Big Smoky Valley and Alkali Spring Valley contributes most of the recharge to groundwater in Clayton Valley. The majority of groundwater leaves this basin as evapotranspiration or through pumping wells (DIRS 180887-Converse Consultants 2007, p. 47).

Depth to groundwater in hydrographic area 143 ranges from about 3 to 72 meters (10 to 237 feet) below ground surface (see Table 3-119). Groundwater in Clayton Valley is highly mineralized (brackish) with elevated sodium and chloride concentrations, and total dissolved solids as high as 10,000 mg/L in lower parts of the basin (see Table 3-119) (DIRS 180760-Albers and Stewart 1981, p. 2; DIRS 180887-Converse Consultants 2007, p. 46).

The dominant use for groundwater in Clayton Valley is solution-mining of lithium from brines in the playa area (DIRS 180887-Converse Consultants 2007, p. 47). There are 13 existing wells in hydrographic area 143 within 1.6 kilometers (1 mile) of the centerline of Montezuma alternative segment 1 passing through this basin and/or proposed pumping well locations for this alternative segment (see Table 3-114). Seven of these wells are USGS wells, and five are NDWR wells with active water rights. There are six springs within 1.6 kilometers of the centerline of Montezuma alternative segment 1 and/or the proposed pumping well locations.

Proposed groundwater supply-well location Cl-1a is the only proposed well location for Montezuma alternative segment 1 that is outside the construction right-of-way in Clayton Valley (Figure 3-194). It is located on an alluvial fan, about 5.6 kilometers (3.5 miles) west of Montezuma alternative segment 1 (DIRS 180888-Converse Consultants 2007, Appendixes A and B). The quarry and the quarry well would be located on grazing land (Section 4.3.2).

Alkali Spring Valley (hydrographic area 142) is not a designated groundwater basin, and the total active annual duties for the basin do not exceed the perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-113). There could be approximately 1.6 billion cubic meters (1.3 million acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 142 (DIRS 180754-Rush et al. 1971, all). NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 142 (see Table 3-113).

Geologic units in this hydrographic area include primarily alluvial valley fill, volcanic rocks, rhyolite, and clastic and carbonate rocks (see Table 3-119). The alluvial valley deposits of Alkali Spring Valley contain most of the available groundwater, and groundwater production comes mainly from valley-fill wells.

Table 3-119. General groundwater-quality and aquifer characteristics – Mina common segment 1 and Montezuma alternative segment 1.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
137A Big Smoky Valley	Alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, clastic rocks	Less than 3 to more than 30	Upper 30.5 meters of alluvium: 7 million[f]	Total dissolved solids: 300 to 4,000 mg/L[g] 6,500 mg/L (valley center discharge locations)[f]
143 Clayton Valley	Alluvial valley fill, carbonate and clastic rocks, volcanic rocks	Less than 3 to 15	Upper 30.5 meters of alluvium: 1.3 million[f]	Total dissolved solids: Up to 1,700 mg/L[g] (more than 10,000 mg/L lower parts of the basin)[g]
142 Alkali Spring Valley (Esmeralda)	Alluvial valley fill, clastic and subordinate carbonate rocks, rhyolite dikes, volcanic rocks	Less than 3 to 27	Upper 30.5 meters of alluvium: 1.3 million[f]	Total dissolved solids: Less than 1,000 mg/L[g] 1,000 to 3,000 mg/L (in playa area)[g]
144 Lida Valley	Alluvial valley fill, volcanic sediments, and older rock units including hornfels, phyllite, quartzite, limestone, and dolomite	49 to 61	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]

a. Source: DIRS 180887-Converse Consultants 2007, pp. 52, 46, 39, and 32.
b. Estimated depth to groundwater obtained from DIRS 180887-Converse Consultants 2007, Plates 4-1 to 4-4 and pp. 32, 39, 45, 51, and 52; DIRS 176600-Converse Consultants 2005, Plates 4-3 and 4-5.
c. To convert meters to feet, multiply by 3.2808.
d. To convert from acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 34, 40, 46, and 52.

However, fractured rock is the source of groundwater discharging from small springs on the south side of the basin. Most aquifer recharge is from subsurface inflow from Ralston Valley, and groundwater in Alkali Spring Valley flows to the southwest, with the majority of groundwater leaving as outflow to Clayton Valley (DIRS 180887-Converse Consultants 2007, pp. 40 and 41).

Depth to groundwater in hydrographic area 142 varies from approximately 3 to 146.3 meters (10 to 480 feet) below ground surface (see Table 3-119). Depth to groundwater underlying the rail alignment in Alkali Spring Valley is approximately 27 meters (90 feet). Groundwater quality in Alkali Spring Valley varies throughout the basin. The northeastern part has the best water quality, with lower total dissolved solids; while the playa area and the vicinity of Alkali Hot Spring has groundwater that is high in sodium sulfate and total dissolved solids (see Table 3-119).

The dominant uses for groundwater in Alkali Spring Valley are for mining and municipal water supply. There are 36 existing wells in hydrographic area 142 within 1.6 kilometer (1 mile) of the centerline of alternative segments passing through this basin and/or proposed pumping well locations for the alternative segments. Twelve of these wells are USGS wells, and twenty-four are NDWR wells with active water rights. There are two springs within 1.6 kilometer of the centerline of the alternative segments.

Lida Valley (hydrographic area 144) is not a designated groundwater basin, and the committed groundwater resources are less than the perennial yield of 430,000 cubic meters (350 acre-feet). There could be approximately 1.9 billion cubic meters (1.5 million acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 144. NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 144 (see Table 3-113).

Geologic units in hydrographic area 144 include primarily alluvial valley fill, volcanic rocks, limestone and dolomite, hornfels, phyllite, and quartzite (see Table 3-119). Groundwater is mostly found in unconfined aquifers of the alluvial valley-fill materials. Most aquifer recharge is derived from precipitation and subsurface inflow from Stonewall Basin, and groundwater exits the basin in the form of outflow to Sarcobatus Flat (DIRS 180887-Converse Consultants 2007, pp. 34 and 35).

Depth to groundwater in hydrographic area 144 varies from approximately 7.9 to 110 meters (26 to 360 feet) below ground surface. Depth to groundwater underlying the rail alignment in Lida Valley ranges from 50 to 61 meters (160 to 200 feet). Groundwater quality is reflected in the total dissolved solids (see Table 3-119).

The dominant uses for groundwater in hydrographic area 144 (Lida Valley) include mining, stockwatering, and municipal water supply. There are six existing wells in hydrographic area 144 within 1.6 kilometers (1 mile) of the centerline of the alternative segments passing through this basin and/or proposed pumping well locations for the alternative segments. Two of these wells are USGS wells, and four are NDWR wells with active water rights. There are no springs within 1.6 kilometers of the centerline of the alternative segments.

Proposed groundwater-supply wells for Montezuma alternative segment 1 in the Alkali Spring Valley and Lida Valley hydrographic areas that might be required outside the construction right-of-way (Figure 3-194) and which are not related to water-supply requirements for potential quarries include AS-1a and AS-3a and LV10/LV11/LV12 in hydrographic area 144. The AS-1a and AS-3a proposed well locations lie about 4.8 kilometers (3 miles) and 3.7 kilometers (2.3 miles) north, respectively, of the centerline of Montezuma alternative segment 1, on an alluvial valley-fill slope in an area without a history of much groundwater production. These two proposed well locations would be located on grazing land (Section 4.3.2). For both locations, there are north-northeast striking faults in bedrock to the southwest of these proposed well locations, which could impact groundwater flow and pumping conditions in the area (DIRS 180888-Converse Consultants 2007, Appendix B).

Another proposed groundwater supply-well location (Li-5a) that is in hydrographic area 144 for Montezuma alternative segment 1 that is outside of the construction right-of-way (Figure 3-194) is a proposed alternate quarry water-supply well in the central part of an alluvial fan, about 2.4 kilometers (1.5 miles) west of Montezuma alternative segment 1. This well site might be used in lieu of another proposed new well (Li-1a) located within the Montezuma alternative segment 1 construction right-of-way due to the possibility of encountering a sufficient thickness of alluvial valley-fill materials and a thicker ***saturated zone*** at location Li-5a than at location Li-1a (DIRS 180888-Converse Consultants 2007, Appendix B and Plate 4-1). This proposed alternate quarry well would be located on grazing land (Section 4.3.2).

3.3.6.3.6 Montezuma Alternative Segment 2

Montezuma alternative segment 2 would begin near Blair Junction and proceed from west to east through hydrographic area 137A (Big Smoky Valley), then proceed generally southward or southeastward through hydrographic areas 142 (Alkali Spring Valley), 145 (Stonewall Valley), and 144 (Lida Valley), passing west of the community of Goldfield (Figures 3-193 through 3-195). Aquifer characteristics, such as aquifer type(s), groundwater quality and depth to groundwater underlying Montezuma alternative segment 2, vary according to the locations within the hydrographic areas that the rail line would cross. Table 3-120 summarizes the groundwater-quality and aquifer characteristics for each hydrographic area through which the alternative segment would pass.

Section 3.3.6.3.4 describes the hydrogeologic characteristics of hydrographic area 137A, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the proposed rail alignment segments. This information is again presented here for convenience.

Big Smoky Valley (hydrographic area 137A) is a designated groundwater basin, and the committed groundwater resources exceed the perennial yield of 7.4 million cubic meters (6,000 acre-feet) (see Tables 3.3.6-1 and 3.3.6-8). As described previously in Section 3.3.6.3.4, there are no documented pending underground annual duties in area 137A. Geologic units in this hydrographic area include primarily alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, and clastic rocks (see Table 3-120). The alluvial valley-fill materials include sands and gravels along alluvial fans and washes, and silts and clays along the valley floor; most of the available groundwater in Big Smoky Valley is found in unconfined and semi-unconfined aquifers comprised of these valley-fill sediments (DIRS 180887-Converse Consultants 2007, p. 51). Depth to groundwater in hydrographic area 137A typically varies from less than 3 to more than about 30.5 meters (10 to 100 feet) below ground surface (see Table 3-120), with values as deep as 220 meters (720 feet) below ground surface reported for some locations in the alluvial apron. Groundwater in hydrographic area 137A contains dominant ions of calcium and bicarbonate, and total dissolved solids is relatively low, under 500 mg/L (see Table 3-120), although discharge areas in the center of the valley may have higher concentrations.

Section 3.3.6.3.5 describes the hydrogeologic characteristics of hydrographic areas 142 and 144, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the proposed alternative segments. This information is again presented here for convenience.

Alkali Spring Valley (hydrographic area 142) is not a designated groundwater basin, and the total active annual duties for the basin do not exceed the perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-113). As described previously in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 142. Geologic units in hydrographic area 142 include primarily alluvial valley fill, volcanic rocks, rhyolite, and clastic and carbonate rocks (see Table 3-120).

The alluvial valley deposits of Alkali Spring Valley contain most of the available groundwater, and groundwater production comes mainly from valley-fill wells. However, fractured rock is the source of groundwater discharging from small springs on the south side of the basin. Most aquifer recharge is from subsurface inflow from Ralston Valley, and groundwater in Alkali Spring Valley flows to the southwest, with the majority of groundwater leaving as outflow to Clayton Valley (DIRS 180887-Converse Consultants 2007, pp. 40 and 41).

Depth to groundwater in hydrographic area 142 varies from less than 3 to 146.3 meters (10 to 480 feet) below ground surface (see Table 3-120). Groundwater quality in Alkali Spring Valley varies throughout the basin.

Table 3-120. General groundwater-quality and aquifer characteristics – Montezuma alternative segment 2.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
137A Big Smoky Valley	Alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, clastic rocks	Less than 3 to more than 30	Upper 30.5 meters of alluvium: 7 million[f]	Total dissolved solids: 300 to 4,000 mg/L[g]-L[g] 6,500 mg/L (valley center discharge locations)[g]
142 Alkali Spring Valley (Esmeralda)	Alluvial valley fill, clastic and subordinate carbonate rocks, rhyolite dikes, volcanic rocks	Less than 3 to 146	Upper 30.5 meters of alluvium: 1.3 million[f]	Total dissolved solids: Less than 1,000 mg/L[g] 1,000 to 3,000 mg/L (in playa area)[g]
145 Stonewall Flat	Alluvial valley-fill deposits, volcanic rocks, older sedimentary rocks[h]	37 to 60	Upper 30.5 meters: 820,000[f]	Total dissolved solids: Less than 300 mg/L[i]
144 Lida Valley	Alluvial valley fill, rhyolite volcanic sediments (including tuffs of the stonewall flat and tuffs of the Thirty Canyon Group), older rock units including claystone, siltstone, and limestone	50 to 85	Upper 30.5 meters: 1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]

a. Sources: DIRS 180887-Converse Consultants 2007, pp. 52, 39, and 32; DIRS 173842-Shannon and Wilson, 2005, pp. 23 and 24, 29, 30, and 33 to 35.
b. Estimated depth to groundwater obtained from DIRS 180887-Converse Consultants 2007, Plates 4-1 through 4-4 and pp. 32, 39, 45, 51, and 52; DIRS 176600-Converse Consultants 2005, p. 49 and Plate 4-5.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 34, 40, 46, and 52.
h. Source: DIRS 173179-Belcher 2004, p. 28 and Figure B-1.
i. Source: DIRS 176600-Converse Consultants 2007, p. 49.

The northeastern part has the best water quality, with lower total dissolved solids; while the playa area and the vicinity of Alkali Hot Spring has groundwater that is high in sodium sulfate and total dissolved solids (see Table 3-120).

Lida Valley (hydrographic area 144) is not a designated groundwater basin, and the committed groundwater resources are less than the perennial yield of approximately 432,000 cubic meters (350 acre-feet) (see Tables 3.3.6-1 and 3.3.6-8). As described previously in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 144. Geologic units in hydrographic area 144 include primarily alluvial valley fill, rhyolite volcanic rocks, (including tuffs of the Stonewall Flat and tuffs of the Thirty Canyon Group), and older rock units including claystone, siltstone, and limestone (see Table 3-120). Groundwater is mostly found in unconfined aquifers of the alluvial valley fill materials (DIRS 180887-Converse Consultants 2007, p. 32). Most aquifer recharge is derived from precipitation and subsurface inflow from Stonewall Basin, and groundwater exits the basin in the form of outflow to Sarcobatus Flats (DIRS 180887-Converse Consultants 2007, pp. 34 and 35).

Depth to groundwater in hydrographic area 144 varies from approximately 7.9 to 110 meters (26 to 360 feet) below ground surface (see Table 3-120). Depth to groundwater underlying the rail alignment varies from 73 to 85 meters (240 to 280 feet). Groundwater quality is reflected in the total dissolved solids, which are given in Table 3-120.

Two proposed groundwater supply-well locations for Montezuma alternative segment 2, BSa-2a and BSa-3a, both in Big Smoky Valley, are within several kilometers of faults that may act as conduits for a significant amount of groundwater, thus influencing groundwater flow and pumping conditions in the area (DIRS 180888-Converse Consultants 2007, Appendix B).

There are four locations where wells are proposed to support construction of Montezuma alternative segment 2 that would be outside the construction right-of-way. All of these proposed well locations would be located on grazing land (Section 4.3.2). A proposed set of groundwater supply-well locations (ASV4/ASV5/ASV8/ASV9) east of Montezuma alternative segment 2 in hydrographic area 142 (Figure 3-194) are at the same location as a set of wells of the same name that were proposed to support construction of Goldfield alternative segments, as described in Section 3.2.6.3.7 (DIRS 180888-Converse Consultants 2007, Appendix C). A proposed set of groundwater supply-well locations in hydrographic area 144 (LV10/LV11/LV12) west of the Montezuma alternative segment 2 in hydrographic area 144 are the same set of wells of the same name as those proposed for Caliente common segment 4, as described in Section 3.2.6.3.8. Up to two wells each at either proposed well site ASV6, or at a proposed alternate well site ASV7, if needed, west and northwest of Goldfield, respectively (Figure 3-194), could supply water to a potential quarry site (quarry ES-7) in that area. These wells would only be required if Montezuma alternative segment 2 were selected (DIRS 180875-Nevada Rail Partners 2007, pp. 3 and 4). Geologic conditions present at these proposed well sites include fractured volcanic rock units (ASV6 site) and alluvial fan deposits (ASV7 site) (DIRS 180888-Converse Consultants 2007, Appendix D).

Hydrographic area 145 (Stonewall Flat) is not a designated groundwater basin. Committed groundwater resources as of September 2006 do not exceed the perennial yield of approximately 120,000 cubic meters (100 acre-feet) (see Table 3-113). There could be approximately 1 billion cubic meters (820,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 145. NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 145 (see Table 3-113). Geologic units underlying hydrographic area 145 include alluvial valley-fill deposits, volcanic rocks, and older sedimentary rocks (DIRS 173179-Belcher 2004, p. 28 and Figure B-1).

Only a small portion (less than 8 kilometers [5 miles]) of Montezuma alternative segment 2 would overlie hydrographic area 145, and there are no proposed water supply-well locations within this hydrographic area (DIRS 180888-Converse Consultants 2007, Appendix A and Plate 4-1). Depth to groundwater is uncertain along Montezuma alternative segment 2 where it would cross a small portion of Stonewall Flat. However, based on projections from nearby areas, depth to groundwater could be approximately 37 to 60 meters (120 to 200 feet) (see Table 3-120). Groundwater quality is relatively good, with low total dissolved solids concentrations (see Table 3-120). Alluvial valley-fill material, volcanic rock, and older sedimentary rocks are the primary geologic units in the basin (see Table 3-120). There are no existing wells (USGS and NDWR) or springs in Stonewall Flat that are within 1.6 kilometers (1 mile) of Montezuma alternative segment 2.

3.3.6.3.7 Montezuma Alternative Segment 3

Montezuma alternative segment 3 would initially follow the same path as the first portion of proposed Montezuma alternative segment 2, proceeding eastward/northeastward from near Blair Junction through a portion of Big Smoky Valley (hydrographic area 137A) and then proceed southeastward and southward, passing through Alkali Spring Valley (hydrographic area 142). In the Alkali Spring Valley hydrographic area, Montezuma alternative segment 3 would proceed westward beginning at a point along Montezuma alternative segment 2 to where it would intersect with a portion of a segment that would be the same as the eastern and southeastern portion of Montezuma alternative segment 1. Montezuma alternative segment 3 (comprised of the northern portion of Montezuma alternative segment 2, the short connecting Montezuma alternative segment 3, and the southern portion of Montezuma alternative segment 1) would then follow the same path as the southern portion of Montezuma alternative segment 1 through the Clayton Valley and Lida Valley areas, to the beginning of Mina common segment 2, southeast of the Cuprite Hills (Figures 3-193 and 3-194).

Aquifer characteristics, such as aquifer types(s), groundwater quality, and depth to groundwater underlying the portions of Montezuma alternative segments 1 and 2 would be the same as the northern and southern portions of Montezuma alternative segment 3 previously described in Sections 3.3.6.3.4 and 3.3.6.3.5, but this information is again presented here for convenience.

Big Smoky Valley (hydrographic area 137A), which the northern portion of Montezuma alternative segment 3 would cross, is a designated groundwater basin, and the committed groundwater resources exceed the perennial yield of 7.4 million cubic meters (6,000 acre-feet) (see Tables 3.3.6-1 and 3.3.6-9). There are existing groundwater-rights appropriations in hydrographic area 137A, but there are no pending underground annual duties (see Table 3-113). Geologic units in this hydrographic area include primarily alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, and clastic rocks (see Table 3-121). The alluvial valley-fill materials include sands and gravels along alluvial fans and washes, and silts and clays along the valley floor; most of the available groundwater in Big Smoky Valley is found in unconfined and semi-unconfined aquifers of these alluvial valley-fill sediments.

Depth to groundwater in hydrographic area 137A typically varies from less than 3 to more than about 30 meters (10 to 100 feet) below ground surface (see Table 3-121), with values as deep as 220 meters (720 feet) below ground surface reported for some locations in the alluvial apron. Groundwater in hydrographic area 137A contains dominant ions of calcium and bicarbonate, and total dissolved solids are relatively low, under 500 mg/L (see Table 3-121), although discharge areas in the center of the valley may have higher concentrations.

Alkali Spring Valley (hydrographic area 142), which Montezuma alternative segment 3 would cross, is not a designated groundwater basin, and the total active annual duties for the basin do not exceed the perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-113). There are existing groundwater-rights appropriations in hydrographic area 142, but there are no pending underground annual duties (see Table 3-113) (DIRS 182288-NDWR 2007).

Geologic units in this hydrographic area include primarily alluvial valley fill, volcanic rocks, rhyolite, and clastic and carbonate rocks (see Table 3-121). The alluvial valley deposits of Alkali Spring Valley contain most of the available groundwater, and groundwater production comes mainly from valley-fill wells. However, fractured rock is the source of groundwater discharging from small springs on the south side of the basin. Most aquifer recharge is from subsurface inflow from Ralston Valley, and groundwater in Alkali Spring Valley flows to the southwest, with the majority of groundwater leaving as outflow to Clayton Valley (DIRS 180887-Converse Consultants 2007, pp. 40 and 41).

Depth to groundwater in hydrographic area 142 varies from approximately 3 to 150 meters (10 to 480 feet) below ground surface. Depth to groundwater underlying the rail alignment in Alkali Spring Valley varies from 27 to 61 meters (90 to 200 feet) (Table 3-120). Groundwater quality in Alkali Spring Valley varies throughout the basin. The northeastern part has the best water quality, with lower total dissolved solids, while the playa area and the vicinity of Alkali Hot Spring has groundwater that is high in sodium sulfate and total dissolved solids (see Table 3-121).

Table 3-121. General groundwater-quality and aquifer characteristics – Montezuma alternative segments 1, 2, and 3.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[c]
137A Big Smoky Valley	Alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, clastic rocks	Less than 3 to more than 30	Upper 30.5 meters of alluvium: 7 million[f]	Total dissolved solids: 300 to 4,000 mg/L[g] 6,500 mg/L (valley center discharge locations)[g]
142 Alkali Spring Valley (Esmeralda)	Alluvial valley fill, clastic and subordinate carbonate rocks, rhyolite dikes, volcanic rocks	Less than 27 to 61	Upper 30.5 meters of alluvium: 1.3 million[f]	Total dissolved solids: Less than 1,000 mg/L[g] 1,000 to 3,000 mg/L (in playa area)[g]
143 Clayton Valley	Alluvial valley fill, carbonate and clastic rocks, volcanic rocks	Less than 27 to 61	Upper 30.5 meters of alluvium: 1.3 million[f]	Total dissolved solids: Up to 1,700 mg/L[g] (more than 10,000 mg/L lower parts of the basin)[g]
144 Lida Valley	Alluvial valley fill, rhyolite volcanic sediments (including tuffs of the Stonewall Flat and tuffs of the Thirty Canyon Group), older rock units including claystone, siltstone, and limestone	90 to 85	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]

a. Sources: DIRS 180887-Converse Consultants 2007, pp. 51, 44, 45, 39, and 32; DIRS 173842-Shannon and Wilson, 2005, pp. 23-24, 29, 30, and 33 to 35.
b. The listed depth to groundwater ranges generally apply to areas underlying the alignment obtained from DIRS 180887-Converse Consultants 2007, Plates 4-1 through 4-4; groundwater can vary over a wide range of depth depending on location in each hydrographic area (DIRS 180887-Converse Consultants 2007, pp. 32, 39, 45, 51, and 52); DIRS 176600-Converse Consultants, 2005, Plate 4-5.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 34, 40, 46, and 52.

Clayton Valley (hydrographic area 143), which a portion of Montezuma alternative segment 3 would cross, is a designated groundwater basin, and the total active annual duties for this basin exceed the perennial yield of 24.7 million cubic meters (20,000 acre-feet) (see Table 3-113). There are no pending underground annual duties for hydrographic area 143 (see Table 3-113).

Alluvial valley deposits consisting of silts and clays comprise the center of the valley and are hundreds of feet thick. Alluvial valley-fill materials, volcanic rocks, and carbonate and clastic rocks are the major geologic units encountered (see Table 3-121).

Depth to groundwater in hydrographic area 143 ranges from about 3 to 72 meters (10 to 237 feet) below ground surface (see Table 3-121). Depth to groundwater underlying the rail alignment in Clayton Valley ranges from less than 3 to 61 meters (90 to 200 feet). Groundwater in Clayton Valley is highly mineralized with elevated sodium and chloride concentrations, with total dissolved solids as high as 10,000 mg/L in the lower parts of the basin (see Table 3-121) (DIRS 180760-Albers and Stewart 1981, p. 2.

Lida Valley (hydrographic area 144), which a portion of Montezuma alternative segment 3 would cross, is not a designated groundwater basin, and the committed groundwater resources are less than the perennial yield of 430,000 cubic meters (350 acre-feet) (Tables 3.3.6-1 and 3.3.6-9). As described previously in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 144. Geologic units in hydrographic area 144 include primarily alluvial valley fill, volcanic rocks, limestone and dolomite, hornfels, phyllite, and quartzite (see Table 3-121). Groundwater is mostly found in unconfined aquifers of the alluvial valley-fill materials.

Depth to groundwater in hydrographic area 144 varies from approximately 50 to 85 meters (160 to 280 feet) below ground surface (see Table 3-121). Depth to groundwater underlying the rail alignment varies from 73 to 85 meters (240 to 280 feet). Groundwater quality is reflected in the total dissolved solids, which are listed in Table 3-121.

As described in Section 3.3.6.3.6, up to two wells each that would be required if Montezuma alternative segment 2 is selected at either proposed well site ASV6, or at proposed alternate well site ASV7, west and northwest of Goldfield, respectively (Figure 3-194), would not be required if Montezuma alternative segment 3 is selected.

There are no proposed groundwater supply-well locations for the portion of Montezuma alternative segment 3 that is different from Montezuma alternative segments 1 and 2 that would lie outside the construction right-of-way (DIRS 180888-Converse Consultants 2007, Appendix A).

3.3.6.3.8 Mina Common Segment 2

Mina common segment 2 would begin at a point southeast of the Cuprite Hills in hydrographic area 144 (Lida Valley), and then proceed southeastward through that hydrographic area to the beginning of Bonnie Claire alternative segments 2 and 3 (Figures 3-194 and 3-195). Aquifer characteristics, such as groundwater quality and depth to groundwater underlying Mina common segment 2, would vary depending on the location within hydrographic area 144. Table 3-122 summarizes the groundwater-quality and aquifer characteristics for the Lida Valley hydrographic area.

Aquifer characteristics for hydrographic area 144, Lida Valley, have previously been described. Section 3.3.6.3.5 (Montezuma alternative segment 1) provides information regarding geology, groundwater quality, aquifer characteristics, and groundwater uses for this hydrographic area, as well as information regarding existing wells and springs in the vicinity of the proposed rail alignment segment. As described previously in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 144. There are no proposed groundwater supply wells for Mina common segment 2 (DIRS 180888-Converse Consultants 2007, Appendix A). Also, there are no existing USGS NWIS wells, no NDWR wells with water rights, no NDWR domestic wells, or springs in Lida Valley that are within 1.6 kilometers (1 mile) of Mina common segment 2.

3.3.6.3.9 Bonnie Claire Alternative Segments

From north to south, Bonnie Claire alternative segments 2 and 3 would cross hydrographic areas 144 (Lida Valley) and 146 (Sarcobatus Flat) (Figure 3-196). Section 3.3.6.3.5 provides information regarding geology, groundwater quality, aquifer characteristics, and groundwater uses for hydrographic area 144, as well as information regarding existing wells and springs in the vicinity of the proposed rail alignment segments. As described in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 144. There is one existing NDWR well with water rights, no NDWR domestic wells, no existing USGS NWIS wells, and no existing springs in hydrographic area 144 within 1.6 kilometers (1 mile) of the proposed Bonnie Claire alternative segments. There are four NDWR wells with water rights, no NDWR

Table 3-122. General groundwater-quality and aquifer characteristics – Mina common segment 2.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
144 Lida Valley	Alluvial valley fill, rhyolite volcanic sediments, (including tuffs of the Stonewall Flat and tuffs of the Thirty Canyon Group) and older rock units including claystone, siltstone, and, limestone	70 to 85	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]

a. Sources: DIRS 180887-Converse Consultants 2007, pp. 31 and 32; DIRS 176600-Converse Consultants 2005, Plate 4-5.
b. Estimated depth to groundwater obtained from DIRS 180887-Converse Consultants 2007, Plate 4-1 and p. 32.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, p. 34.

domestic wells, no USGS NWIS wells, and no existing springs in area 146 within 1.6 kilometers of the centerlines of the proposed Bonnie Claire alternative segments.

The Bonnie Claire alternative segments would predominantly overlie alluvial valley fill (see Table 3-123). Geologic units Bonnie Claire alternative segments 2 and 3 would cross primarily include alluvial valley-fill deposits and some volcanic rocks (DIRS 173842-Shannon & Wilson 2005, p. 28). The primary volcanic unit encountered along Bonnie Claire alternative segments 2 and 3 is tuff of the Timber Mountain Group (DIRS 173842-Shannon & Wilson 2005, p. 30 and Plate 2).

Hydrographic area 146, Sarcobatus Flat, is a designated groundwater basin, and has a perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-113). Committed groundwater resources in hydrographic area 146 exceed the estimated perennial yield, but as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 2.96 billion cubic meters (2.4 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 146. NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 146 (see Table 3-113).

There are no existing water-supply wells or springs in hydrographic area 146 within 1.6 kilometers (1 mile) of the centerlines of Bonnie Claire alternative segments.

Table 3-123 summarizes general groundwater characteristics in hydrographic areas 144 and 146. Groundwater in hydrographic area 146 contains elevated levels of sodium bicarbonate.

Most of the existing groundwater wells in hydrographic area 146 are ***screened*** in the alluvial valley fill; a few wells in the western portion of the basin are screened in volcanic rocks. The total volume of alluvial valley fill comprising the primary aquifer reservoir in hydrographic area 146 is not known because of variations in the thickness of valley fill that result in variations in the surface of the underlying bedrock. However, Malmberg and Eakin (DIRS 106695-Malmberg and Eakin 1962, pp. 13 and 19) suggested the maximum thickness of valley fill in hydrographic area 146 could be as much as thousands of meters (several thousand feet).

Table 3-123. General groundwater-quality and aquifer characteristics – Bonnie Claire alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
144 Lida Valley	Alluvial valley fill, rhyolite, volcanic sediments, (including tuffs of Stonewall Flat and tuffs of the Thirsty Canyon Group) and older rock units including claystone, siltstone, and, limestone	50 to 25	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]
146 Sarcobatus Flat	Alluvial valley-fill deposits and some volcanic rocks[h] (Volcanic units are tuff of the Timber Mountain Group)[i]	24 to 40	Upper 30.5 meters of alluvium: 24,000[f]	Total dissolved solids: 540 mg/L[j]

a. Sources: DIRS 180887-Converse Consultants 2007, pp. 31 and 32.
b. Estimated depths to groundwater obtained from DIRS 180887-Converse Consultants 2007, Plate 4-1 and p. 32; DIRS 176600-Converse Consultants 2005, p. 41 and Plate 4-5. The listed range of depths generally applies to the area underlying the proposed Bonnie Claire alternative segments.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 182759-Converse Consultants 2007, p. 34.
h. Source: DIRS 176600-Converse Consultants 2006, p. 40.
i. Sources: DIRS 173842-Shannon & Wilson 2005, pp. 23 and 24, 29, 30, and 33 to 35 and Plate 2; DIRS 173179-Belcher 2004, Figure B-1.
j. Source: DIRS 176600-Converse Consultants 2006, p. 42.

Figure 3-195 shows DOE-proposed wells for supplying water to support construction of Bonnie Claire alternative segments. All proposed water wells would be within the nominal width of the construction right-of-way of the selected alternative segment. There are no potential quarry sites along Bonnie Claire alternative segments.

3.3.6.3.10 Common Segment 5 (Sarcobatus Flat Area)

Crossing from north to south, common segment 5 would overlie hydrographic area 146 (Sarcobatus Flat) and a small portion of hydrographic area 228 (Oasis Valley) (Figures 3-195and 3-196). Section 3.3.6.3.9 describes the groundwater-quality and aquifer characteristics of hydrographic area 146, which are summarized in Table 3-123. As described in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 146. There are four NDWR wells with water rights, one NDWR domestic well, eight USGS NWIS wells, and no springs within approximately 1.6 kilometers (1 mile) of the centerline of common segment 5 within area 146.

The categories for the NDWR wells with water rights are irrigation, quasi-municipal, and stock-watering (see Table 3-114). Most wells in hydrographic area 146 are screened in alluvial valley fill; a few wells are screened in volcanic rocks on the west side of the basin (DIRS 176600-Converse Consultants 2005, pp. 41 and 42).

Section 3.3.6.3.11 describes the hydrogeologic characteristics of hydrographic area 228, including groundwater-quality and aquifer characteristics; Table 3-124 summarizes those characteristics. Committed groundwater resources in these areas exceed estimated perennial yields (see Table 3-113). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There are no NDWR wells with water rights, no USGS NWIS wells, and no springs within approximately 1.6 kilometers (1 mile) of the centerline of common segment 5, as shown on Figures 3-195and 3-196 (DIRS 176600-Converse Consultants 2005, all; DIRS 176325-USGS 2006, all).

Table 3-124. General groundwater-quality characteristics – Oasis Valley alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
228 Oasis Valley	Volcanic rocks, clastic rocks, older carbonate rocks, and alluvial valley fill[e]	10 to 30	Upper 30.5 meters of alluvium: 400,000[f]	Total dissolved solids: Less than 500 to 1,000 mg/L[g] Fluoride: 1 to more than 4 mg/L[h]

a. Estimated depth to groundwater obtained from DIRS 176600-Converse Consultants 2005, p. 38. The listed depth range generally applies to the area underlying the proposed Oasis Valley alternative rail alignments; depth to groundwater is much greater in the central and northern parts of hydrographic area 228 (DIRS 176600-Converse Consultants 2005, Plate 4-3).
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Sources: DIRS 176600-Converse Consultants 2005, p. 36; DIRS 181909-Fridrich et al. 2007.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 172905-USGS 1995, Figure 70, with overlay of hydrographic area boundaries.
h. Source: DIRS 176600-Converse Consultants 2005, p. 38.

Common segment 5 would predominantly overlie alluvial valley fill, with depth to groundwater generally approximately 3 to 55 meters (10 to 180 feet) in those portions of hydrographic areas 146 and 228 the rail line would cross. Volcanic rocks are the predominant rock type comprising the hills surrounding the basin.

Figures 3-195 and 3-196 show DOE-proposed wells (see Section 4.3.6) for supplying water to support construction of common segment 5. All proposed water wells would be within the rail line construction right-of-way. There are no potential quarry sites along common segment 5.

3.3.6.3.11 Oasis Valley Alternative Segments

Oasis Valley alternative segments 1 and 3 would cross hydrographic area 228 (Oasis Valley) (Figure 3-196). This area is a designated groundwater basin with an estimated perennial yield in the range of 1.23 to 2.46 million cubic meters (1,000 to 2,000 acre-feet) (DIRS 147766-Thiel Engineering Consultants 1999, pp. 6 to 12) (see Table 3-113). Committed groundwater resources in hydrographic area 228 total 1.6 million cubic meters (1,300 acre-feet) per year (see Table 3-113). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 493 million cubic meters (400,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 228 (DIRS 180754-Rush et al. 1971, all). NDWR data indicate that there are no documented pending underground annual duties in area 228A (see Table 3-113).

Geologic units Oasis Valley alternative segments 1 and 3 would cross include sedimentary rocks, small areas underlain by volcanic rocks, and some alluvial valley fill (see Table 3-124). Depth to groundwater is generally 3 to 46 meters (10 to 150 feet), with the shallowest groundwater occurring along Oasis Valley alternative segment 1, northeast of Springdale (see Table 3-124).

Oasis Valley has several springs and seeps. The locations of these springs and seeps are dictated by structurally controlled changes in rock unit ***lithology*** and thickness and conduits. The springs, seeps, and shallow groundwater in the valley are maintained primarily by groundwater flow moving into the area through a regional volcanic rock aquifer system (DIRS 169384-Reiner et al. 2002, p. 8). Most groundwater flowing south-southeastward into Oasis Valley through the welded tuff aquifer is diverted upward along faults where it either forms springs or flows laterally out of Oasis Valley as underflow, indicating a regional groundwater inflow component to the flow at the springs. Springs and seeps occur where upward diversion coincides with areas where the potentiometric surface is above the ground surface (DIRS 169384-Reiner et al. 2002, pp. 9 and 10). Most historical groundwater resource development in this area has been from springs.

Available information indicates a non-welded confining tuff unit separates the alluvial aquifer from a regional welded tuff volcanic rock aquifer throughout much of Oasis Valley, and indicates the regional welded tuff aquifer has moderate fracture ***permeability***. Most groundwater flowing south-southeastward into Oasis Valley through the welded tuff aquifer is also diverted upward along faults where it either forms springs or flows laterally out of Oasis Valley as underflow, indicating a regional groundwater inflow component to the flow at the springs (DIRS 169384-Reiner et al. 2002, pp. 9 and 10).

Based on a review of the NDWR and USGS NWIS databases and other published information, Figure 3-196 identifies seven USGS NWIS wells, four springs, and one surface-water body within approximately 1.6 kilometers (1 mile) of the centerlines of the Oasis Valley alternative segments. As shown on the figure, there is a series of three springs (Upper Oasis Valley Ranch Springs) southwest of Oasis Valley alternative segment 1 (DIRS 177712-MO0607NHDPOINT.000). Colson Pond and Colson Pond Spring are also near Oasis Valley alternative segment 3 (Figure 3-196) (DIRS 177712-MO0607NHDPOINT.000; DIRS 177710-MO0607NHDWBDYD.000).

There are no existing NDWR wells with water rights and no NDWR domestic wells within 1.6 kilometers (1 mile) of the centerline of the Oasis Valley alternative segments. There is one cluster of three USGS-installed wells within approximately 0.64 kilometer (0.40 mile) of the centerline of Oasis Valley alternative segment 3 (wells ER-OV-01, ER-OV-06a, and ER-OV-06a2), and one USGS-installed well (ER-OV-02) within approximately 0.4 kilometer (0.25 mile) of Oasis Valley alternative segment 1 (DIRS 176600-Converse Consultants 2005, Plate 4-3 and Appendix A; DIRS 169384-Reiner et al. 2002, Plate 2). The use category for these wells is monitoring. There are three additional shallow USGS-installed wells (the OVU-Dune Well, OVU-Middle ET Well, and the OVU-Lower ET Well), used for monitoring groundwater levels, within approximately 0.32 to 0.48 kilometer (0.2 to 0.3 mile) of Oasis Valley alternative segment 1 (DIRS 176600-Converse Consultants 2005, Plate 4-3 and Appendix A; DIRS 169384-Reiner et al. 2002, Plate 2). Figure 3-196 does not show all existing wells in hydrographic area 228 that lie within 1.6 kilometers of the centerlines of Oasis Valley alternative segments because some wells are at very nearly the same locations and cannot be shown at the scale used in the figure.

Groundwater in much of Oasis Valley exhibits elevated levels of fluoride, in excess of the 4 milligrams per liter Nevada drinking water standard level (see Table 3-124). Dissolved-solids concentrations in the alluvial valley fill are expected to be less than 500 milligrams per liter (approximately 500 parts per million) in the vicinity of the Oasis Valley alternative segments.

Figure 3-196 shows DOE-proposed wells for supplying water to support construction of the Oasis Valley alternative segments. In addition to a series of new wells proposed for installation within the construction right-of-way, DOE might install other wells at other locations outside the construction right-of-way, and use them either as principal water wells or in combination with other water wells installed within the construction right-of-way. These wells would be drilled in cases where either (1) groundwater resources within the construction right-of-way would not be adequate for meeting construction or operations needs, or (2) groundwater withdrawals would need to be spread out to reduce potential impacts on existing groundwater resources (see Section 4.3.6). Possible locations for wells in this category that could be used to obtain water for constructing the Oasis Valley alternative segments include the following (Figure 3-196):

- Up to two locations in the Oasis Valley groundwater basin, approximately 5.6 to 5.8 kilometers (3.5 to 3.6 miles) southwest of the centerline of common segment 6 (locations OV6 and OV8, or OV14 and OV16, depending on alternative segment). The target water source at this location would be alluvial valley fill (DIRS 176189-Converse Consultants 2006, Appendixes A and B, and Maps 14a and 14b).

- Locations in the southeastern part of Oasis Valley, approximately 0.8 kilometer (0.5 mile) west of common segment 6 (well location OV22 or OV23, depending on alternative segment). The target water source at this location would be a possibly water-bearing fault system (DIRS 176189-Converse Consultants 2006, Appendixes A and B, and Maps 14a and 14b).

Review of NDWR and USGS database data and other published information (DIRS 169384-Reiner et al. 2002, Plate 2) on existing wells and springs indicates the following:

- There are two existing NDWR wells with water rights, no NDWR domestic wells, and no USGS NWIS wells within 1.6 kilometers (1 mile) of locations OV6 and OV8, or OV14 and OV16; however, two springs (Ute Springs and Manley Springs) lie within approximately 1.3 to 1.4 kilometers (0.8 to 0.9 mile) east of locations OV6 and OV8, or OV14 and OV16.

- There are no known existing wells or springs within 1.6 kilometers of the proposed alternative well location at OV22/OV23.

3.3.6.3.12 Common Segment 6 (Yucca Mountain Approach)

From north to south, common segment 6 would cross a portion of hydrographic area 228 (Oasis Valley), all of hydrographic area 229 (Crater Flat), and a portion of hydrographic area 227A (Jackass Flats), as shown in Figure 3-196. Section 3.3.6.3.11 describes, and Table 3-125 summarizes groundwater-quality and aquifer characteristics of hydrographic area 228.

There are 14 USGS NWIS wells, no NDWR wells with water rights, no NDWR domestic wells, and no springs within approximately 1.6 kilometers (1 mile) of the centerline of common segment 6, as shown on Figure 3-196 (DIRS 176600-Converse Consultants 2005, all; DIRS 176325-USGS 2006, all; DIRS 177294-MO0607USGSWNVD.000, all; DIRS 182898-NDWR Water Rights Data 2007, all; DIRS 176979-MO0605GISGNISN.000, all; DIRS 182759-Converse Consultants 2007, all; DIRS 177712-MO0607NHDPOINT.000, all). Figure 3-196 does not show all existing wells in hydrographic area 227A that lie within 1.6 kilometers of the centerline of common segment 6 because some wells, particularly in hydrographic area 227A, are at very nearly the same locations and cannot be shown at the scale used in this figure.

Geologic units that common segment 6 would cross include volcanic rocks and basin-fill alluvium (DIRS 173179-Belcher 2004, p. 28). Specific volcanic rock units the segment would cross include volcanic rocks of the Crater Flat and Paintbrush Groups (DIRS 173842-Shannon & Wilson 2005, Plate 2).

Table 3-125. General groundwater-quality and aquifer characteristics – common segment 6.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
228 Oasis Valley	Volcanic rocks, clastic rocks, older carbonate rocks, and alluvial valley-fill deposits[e]	10 to 30	Upper 30.5 meters of alluvium: 400,000[f]	Total dissolved solids: Less than 500 to 1,000 mg/L[g] Fluoride: 1 to more than 4 mg/L[h]
229 Crater Flat	Volcanic rocks and alluvial valley fill[e]	180 to 370	Upper 30.5 meters of alluvium: 350,000[f]	Total dissolved solids: 270 mg/L[h]
227A Fortymile Canyon, Jackass Flats	Volcanic rocks and alluvial valley fill[e]	210 to 370	Upper 30.5 meters of alluvium: 740,000[f]	Total dissolved solids: Less than 500 to 1,000 mg/L[g]

a. Estimated depth to groundwater obtained from DIRS 176600-Converse Consultants 2005, p. 30, 31, 34, and 38. The listed depth range for hydrographic area 228 generally applies to the area underlying the rail alignment; depth to groundwater is much greater in the central and northern parts of hydrographic area 228 (DIRS 176600-Converse Consultants 2005, Plate 4-3). The listed depth range for hydrographic area 229 generally applies to the area underlying the rail alignment; depth to groundwater is less in the northwestern and southern parts of hydrographic area 229 (DIRS 176600-Converse Consultants 2005, Plate 4-2).

b. To convert meters to feet, multiply by 3.2808.

c. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the ground water quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.

d. mg/L = milligrams per liter.

e. Sources: DIRS 176600-Converse Consultants 2005, p. 36; DIRS 181909-Fridrich et al. 2007.

f. Source: DIRS 180754-Rush et al. 1971, all.

g. Sources: DIRS 172905-USGS 1995, Figure 70; DIRS 177741-State of Nevada 2005, all, with overlay of hydrographic area boundaries.

h. Source: DIRS 176600-Converse Consultants 2005, pp. 35 and 38.

Hydrographic area 229, Crater Flat, is not a designated groundwater basin. Committed groundwater resources exceed the estimated perennial yield of about 271,000 cubic meters (220 acre-feet) (see Table 3-113). As previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 431 million cubic meters (350,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 229. In addition to existing groundwater wells in hydrographic area 229 that have water-rights appropriations, NDWR data indicate that approximately 101,000 cubic meters (82 acre-feet) of pending annual duties (see Table 3-113) exist in hydrographic area 229. The pending water-rights locations are not within 1.6 kilometers (1 mile) of the centerline of common segment 6.

Table 3-125 summarizes groundwater-quality and aquifer characteristics of hydrographic area 229. Groundwater is typically very deep in hydrographic area 229 beneath the rail alignment, generally 180 to 370 meters (600 to 1,200 feet) below ground. In the northwestern portion of hydrographic area 229 and west of the rail alignment, groundwater occurs within two aquifers and the estimated depth to groundwater varies from 55 to 200 meters (180 to 650 feet). There are three USGS NWIS wells, no NDWR wells with water rights, no domestic wells, and no springs in hydrographic area 229 within approximately 1.6 kilometers (1 mile) of the centerline of common segment 6, as shown on Figure 3-196 (DIRS 176600-Converse Consultants 2005, all; DIRS 176325-USGS 2006, all; DIRS 177292-MO0607NDWRWELD.000; DIRS 177294-MO0607USGSWNVD.000; DIRS 182898-NDWR 2007, all; DIRS 176979-MO0605GISGNISN.000, all).

Hydrographic area 227A, Fortymile Canyon (Jackass Flats), is not a designated groundwater basin. Committed groundwater resources do not exceed the total perennial yield value of 1.09 million cubic meters (880 acre-feet) per year estimated for the entire hydrographic area (see Table 3-113). NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 227A (see

Table 3-113) (DIRS 178726-State of Nevada 2006, all). The perennial yield estimate for the western two-thirds of hydrographic area 227A is assumed to be approximately 720,000 cubic meters (580 acre-feet) per year, while the perennial yield estimate for the eastern one-third of this hydrographic area has been estimated at approximately 370,000 cubic meters (300 acre-feet) per year. There could be approximately 910 million cubic meters (740,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 227A.

Table 3-125 summarizes groundwater-quality and aquifer characteristics of hydrographic area 227A. In hydrographic area 227A, groundwater occurs in alluvial valley-fill deposits in the southern portion of the area and deeper in volcanic rocks in the central part of the basin. The depths to groundwater in wells throughout the area vary from approximately 12 to 650 meters (38 to 2,150 feet) (DIRS 176600-Converse Consultants 2006, p.31). Most groundwater storage in hydrographic area 227A occurs toward the southern end of the basin, south of the rail alignment. Groundwater is typically very deep near the rail alignment, generally 210 to 370 meters (700 to 1,200 feet) below ground.

Most wells penetrating the volcanic rocks are monitoring wells used for monitoring groundwater conditions southwest, southeast, and south of the Yucca Mountain Site. There are 8 USGS NWIS wells, no NDWR wells with water rights, no NDWR domestic wells, and no springs in area 227A within 1.6 kilometers (1 mile) of the centerline of common segment 6 (Figure 3-196). The volcanic rocks in this area generally have low porosity, and are not considered suitable for groundwater production except in major fractured areas.

Figure 3-196 shows DOE-proposed wells for supplying water to support construction of common segment 6. All proposed water wells would be within the rail alignment construction right-of-way. There are no potential quarry sites along common segment 6.

3.3.7 BIOLOGICAL RESOURCES

This section describes the biological resources that could be affected by construction and operation of the proposed railroad along the Mina rail alignment.

Biological resources include vegetation, wildlife, special status species, game species, and wild horses and burros within or near the construction right-of-way described in Section 3.3.7.1. This discussion of biological resources is based on the results of a review of available data from federal, State of Nevada, local agencies, and data gathered during field investigations.

Special Status Species

Endangered species are classified under the Endangered Species Act as being in danger of extinction throughout all or a significant part of their range.

Threatened species are classified under the Endangered Species Act as likely to become endangered species in the foreseeable future.

Proposed species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information on their biological status and threats and that are the subject of a Fish and Wildlife Service *Federal Register* rulemaking notice to list them as endangered or threatened.

Candidate species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information to support a proposal to list as endangered or threatened, but development of a listing regulation is precluded by other higher priority listing activities.

Endangered Species Act candidate species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act.

State protected plant and animal species. Wildlife species or subspecies are classified as protected under Nevada Administrative Code (NAC) Chapter 503 if one or more of the following criteria exists:

1. The wildlife is found only in the State of Nevada and its population, distribution, or habitat is limited.
2. The limited population or distribution within Nevada is likely to decline.
3. The population is threatened as a result of the deterioration or loss of its habitat.
4. The wildlife has ecological, scientific, educational, or other value that justifies its classification as protected.
5. The available data is not adequate to determine the exact status of the wildlife population, but does indicate a limited population, distribution, or habitat.
6. The wildlife is listed by the U.S. Fish and Wildlife Service as a candidate species, or it is classified as threatened or endangered in the federal Endangered Species Act.
7. Other evidence exists to justify classifying the wildlife as protected.

Under NAC Chapter 527, plants are classified as being in danger of extinction if their survival requires assistance because of overexploitation, disease, or other factors or because its habitat is threatened with destruction, drastic modification, or severe curtailment. There are no State of Nevada-listed endangered plants present in the areas of assessment.

BLM-designated sensitive species are species other than federally listed, proposed, or candidate species, and may include such native species as those that:

1. Could become endangered in or extirpated from a state or within a significant portion of their distribution in the foreseeable future;
2. Are undergoing a status review by the U.S. Fish and Wildlife Service to determine whether to list the species as a threatened or endangered species across all or a significant portion of its range under the Endangered Species Act;
3. Are undergoing significant current or predicted downward trends in habitat capability that would reduce their existing distribution;
4. Are undergoing significant current or predicted downward trends in population or density such that federally listed, proposed, candidate, or state listed status might become necessary;
5. Have typically small and widely dispersed populations;
6. Are inhabiting ecological refugia or specialized or unique habitats; or
7. Are state listed but might be better conserved through application of BLM sensitive species status. Such species should be managed to the level of protection required by State laws or under the BLM policy for candidate species, whichever would provide better opportunity for their conservation.

Section 3.3.7.2 provides a general overview of biological resources, including vegetation, wildlife, special status species, game species, and wild horses and burros along the Mina rail alignment. Section 3.3.7.3 describes biological resources unique to each Mina rail alignment alternative segment and common segment. Appendix H, Biological Resources, provides additional information regarding biological resources along the Mina rail alignment.

3.3.7.1 Areas of Assessment

DOE used two areas of assessment to describe the affected environment for biological resources: the greater study area and the construction right-of-way area.

3.3.7.1.1 Construction Right-of-Way

The rail line construction right-of-way would be a nominal width of 300 meters (1,000 feet), which is 150 meters (500 feet) on either side of the rail alignment centerline. The footprint, which would be within the construction right-of-way, is the area that would involve clearing of vegetation, excavation, and filling for subgrade to support the rail line. This area would be directly affected, long term, by rail line construction activities. The footprint would fluctuate throughout the alignment due to topography, cut and fill requirements, land use, and the selected alternative segment. The footprint could also vary based on land use and avoidance or minimization of impacts to other resources (for example, water and structures) but generally would be 300 meters or less. The area between the footprint and the outer edge of the construction right-of-way would be directly affected, short term, by construction-related activities such as construction staging and temporary access roads construction. DOE analyzed the area between the footprint and the outer edge of the construction right-of-way for ***short-term impacts*** even though the use of this area would be minimized and the area might not be disturbed. For purposes of this analysis, DOE has taken a conservative approach of potentially overstating the environmental impacts to biological resources. For facilities that would be outside the nominal width of the rail line construction right-of-way (such as quarries and other ***infrastructure***), the area DOE assessed as the affected environment is the maximum area or the footprint of the proposed facility.

3.3.7.1.2 Study Area

DOE identified a study area (16 kilometers [10 miles] wide, extending 8 kilometers [5 miles] on either side of the centerline of the rail alignment) for use in database and literature searches to ensure the identification of sensitive habitat areas near the Mina rail alignment and transient or migratory wildlife, particularly special status species, that could pass through the construction right-of-way. Using the larger study area also increased the chance of identifying special status species and/or habitat that could be present near the rail alignment, to better describe the habitat value and species use within the construction right-of-way.

3.3.7.2 General Environmental Setting and Characteristics

This section describes the affected environment for biological resources that could be present or have the potential to occur within the construction right-of-way or the study area. DOE used the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all), which the BLM currently uses in its conservation and management actions, to characterize the land-cover types for the affected environment for the Mina rail alignment.

As a starting point for classification, the 2004 Southwest Regional Gap Analysis Project divided the southwestern United States into general ***ecoregions*** (relatively discrete sets of ecosystems characterized by certain plant communities or assemblages) based on physical and biological similarities. Using satellite imagery and field data, the Project classified geographic areas or "mapping zones" within each ecoregion based on their land-cover types, and generated maps of these land-cover types. The Project classified naturally vegetated types using the "ecological systems" and developed and described types based on dominant vegetation, physical characteristics of the land, hydrology, and climate in the area (DIRS 176369-Lowry et al. 2005, all; DIRS 173051-Comer et al. 2003, all). These mapping zones represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding. As shown in Figure 3-197, the Mina rail alignment would cross three mapping zones: the Humboldt, the Nellis, and the Mojave. However, only the Nellis and Mojave mapping zones are considered in the analysis because the segment that crosses the Humboldt is an existing Union Pacific Railroad rail line and there would be no construction-related impacts. The land-cover types are grouped into land-cover classes. Eleven land-cover classes occur in this part of Nevada. To identify the land-cover types and classes within the construction right-of-way and the study area, digital maps of the land-cover types within the affected map zones were overlain (spatial analysis using a Geographic Information System) with the Mina rail alignment construction right-of-way and operations facilities. The Mina rail alignment construction right-of-way would cross 9 of the 11 classes (DIRS 174324-NatureServe 2004, all). Table 3-126 lists classes and types, and Figures 3-198 through 3-204 show the classes the rail alignment would cross.

To document additional site-specific information regarding vegetation and habitat, DOE performed literature and database searches, and consulted with land and resource management agencies and authorities, including the BLM, the U.S. Fish and Wildlife Service, the Nevada Natural Heritage Program, the Nevada Department of Wildlife, the University of Nevada–Reno, and the Nevada Division of Forestry.

In addition to the review of existing information, DOE conducted field surveys and gathered data to further characterize the mapping zones and associated vegetation communities, and to further characterize the habitats in the study area that might support special status species. DOE chose field survey locations to provide representative survey coverage of the different types of vegetation along the Mina rail alignment, specifically in the construction right-of-way, but also in the larger study area. The field survey data that was collected helped further characterize the types of habitats in the construction right-of-way and identified by the Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all). Appendix H describes the field survey methodology. The additional surveys and data searches are outlined in each specific resource area below.

3.3.7.2.1 Vegetation

The Mina rail alignment is situated within two large deserts: the Great Basin and the Mojave. The Great Basin Desert is considered a cold desert and has been referred to as the Basin and Range region due to its parallel north-south trending ranges, or mountains, and intervening basins, or valleys. This region covers most of central and northern Nevada, with its southern extent ending roughly in southern Lincoln, Esmeralda, and Nye Counties. The Mojave Desert is considered a hot desert and covers most of southern Nevada and much of southeastern California (DIRS 174412-Ryser 1985, p. 4). Although the two deserts are distinguished from one another climatically, the predominant vegetation and vegetation communities also distinguish each desert.

The Great Basin Desert is generally characterized by big sagebrush (*Artemisia tridentata*), which is mostly absent from the Mojave Desert except at moderate to high elevations in the mountains. Alternatively, the Mojave Desert is dominated by creosote bush (*Larrea tridentata* var. *arenaria*), which is mostly absent from the Great Basin Desert. There is a broad transitional zone where these two deserts meet, which exhibits characteristics of both regions.

Based on the spatial analysis described above, the Mina rail alignment would intersect 25 land-cover types, which are listed in Table 3-126 and shown in Figures 3-203 through 3-204. The most common

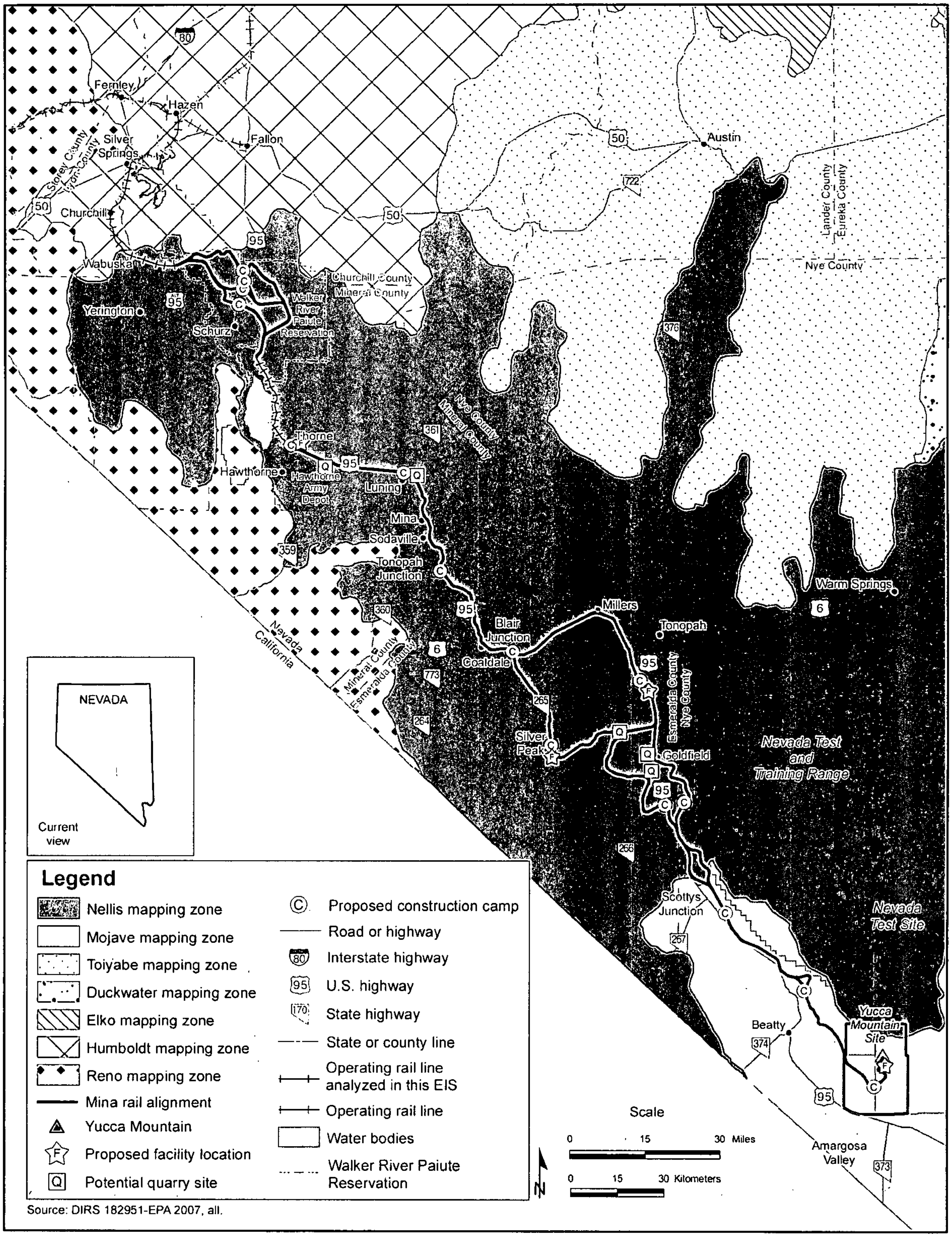


Figure 3-197. Mapping zones along the Mina rail alignment.

Table 3-126. Land-cover classes and types in the mapping zones.[a]

Class and type[b]	Total amount of classes and land-cover types within the Mojave and Nellis mapping zones (square kilometers)[c]
Barren Lands	
Inter-Mountain Basins Playa	1,115
Inter-Mountain Basins Cliff and Canyon	394
North American Warm Desert Playa	524
North American Warm Desert Bedrock Cliff and Outcrop	525
Inter-Mountain Basins Active and Stabilized Dune	29
Evergreen Forest	
Great Basin Pinyon-Juniper Woodland	4,966
Scrub/Shrub	
Inter-Mountain Basins Mixed Salt Desert Scrub	25,547
Inter-Mountain Basins Big Sagebrush Shrubland	8,013
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	19,415
Great Basin Xeric Mixed Sagebrush Shrubland	6,328
Mojave Mid-Elevation Mixed Desert Scrub	10,030
Sonora-Mojave Mixed Salt Desert Scrub	2,976
Grassland/Herbaceous	
Inter-Mountain Basins Semi-Desert Shrub Steppe	4,768
Inter-Mountain Basins Semi-Desert Grassland	75
Woody Wetland	
Inter-Mountain Basins Greasewood Flat	1,409
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	77
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	28
Emergent Herbaceous Wetland	
North American Arid West Emergent Marsh	32
Altered or Disturbed	
Invasive Annual Grassland	48
Invasive Annual and Biennial Forbland	29
Developed and Agriculture	
Developed, Open Space - Low Intensity	430
Developed, Medium - High Intensity	84
Other	
Barren Lands, Non-specific	30

a. Source: DIRS 174324-NatureServe, all.
b. Mojave and Nellis ecoregions are included in totals. Humboldt ecoregion was excluded because construction-related impacts would not occur there.
c. To convert square kilometers to acres, multiply by 247.10.

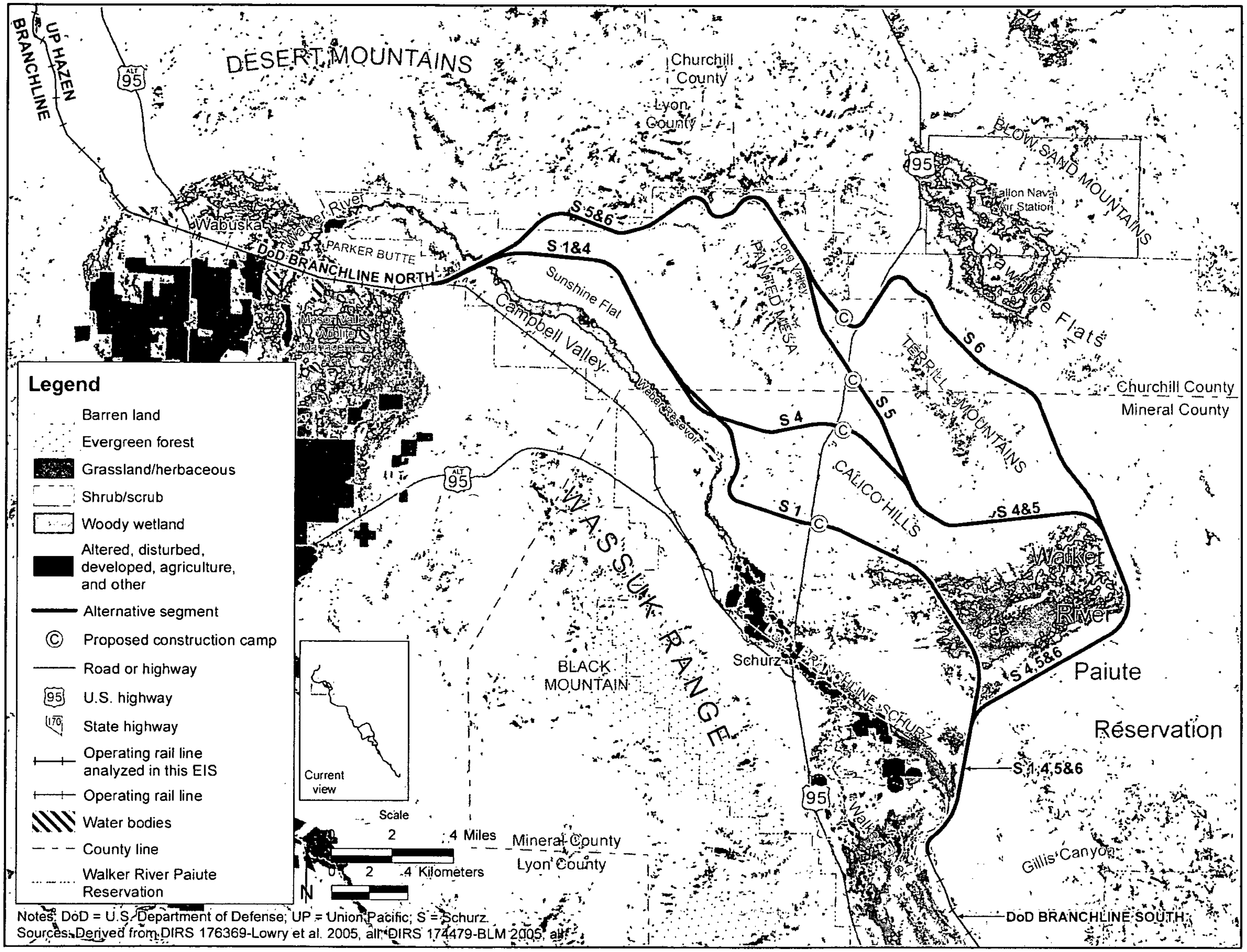


Figure 3-198. Land-cover classes the Mina rail alignment would cross within map area 1.

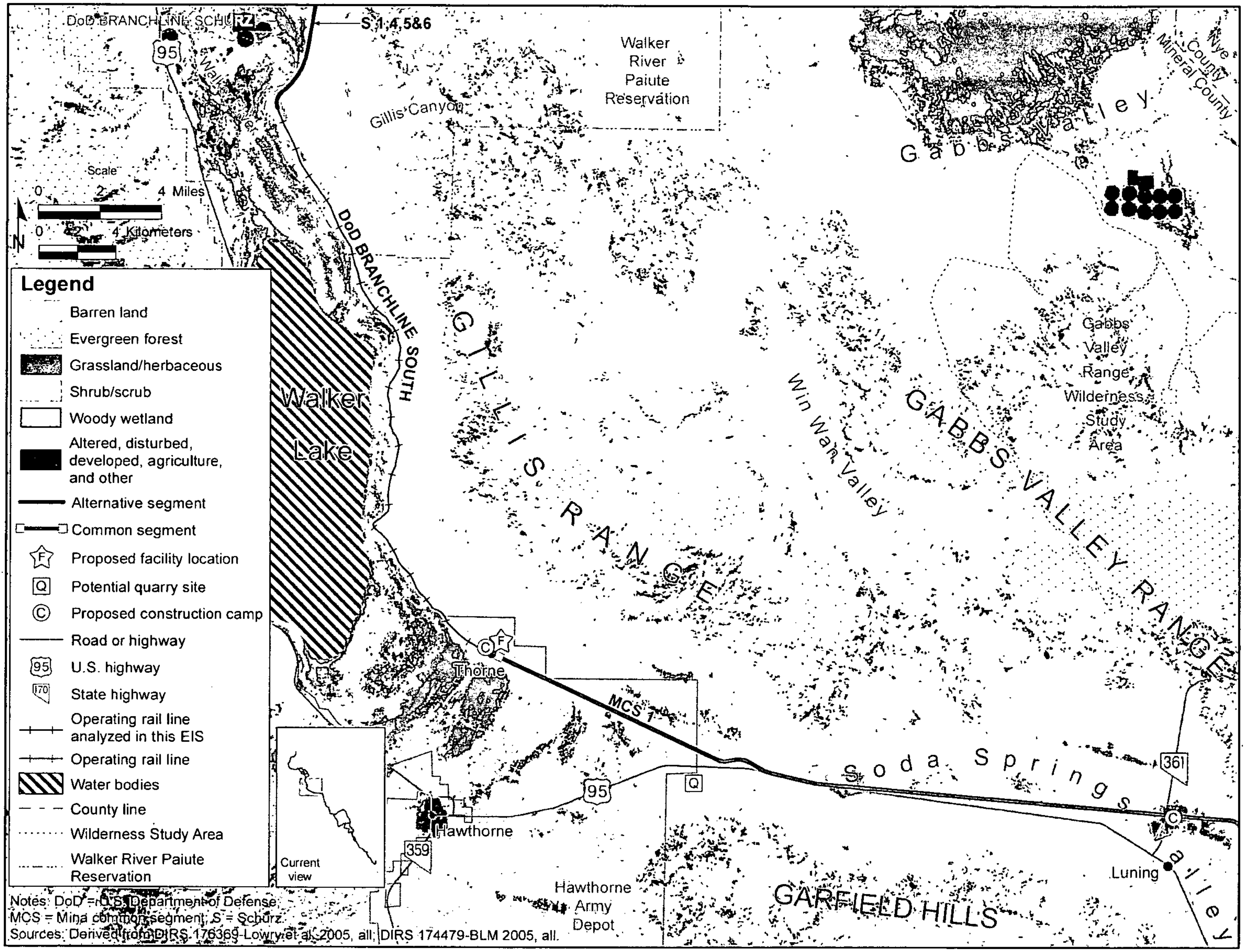


Figure 3-199. Land-cover classes the Mina rail alignment would cross within map area 2.

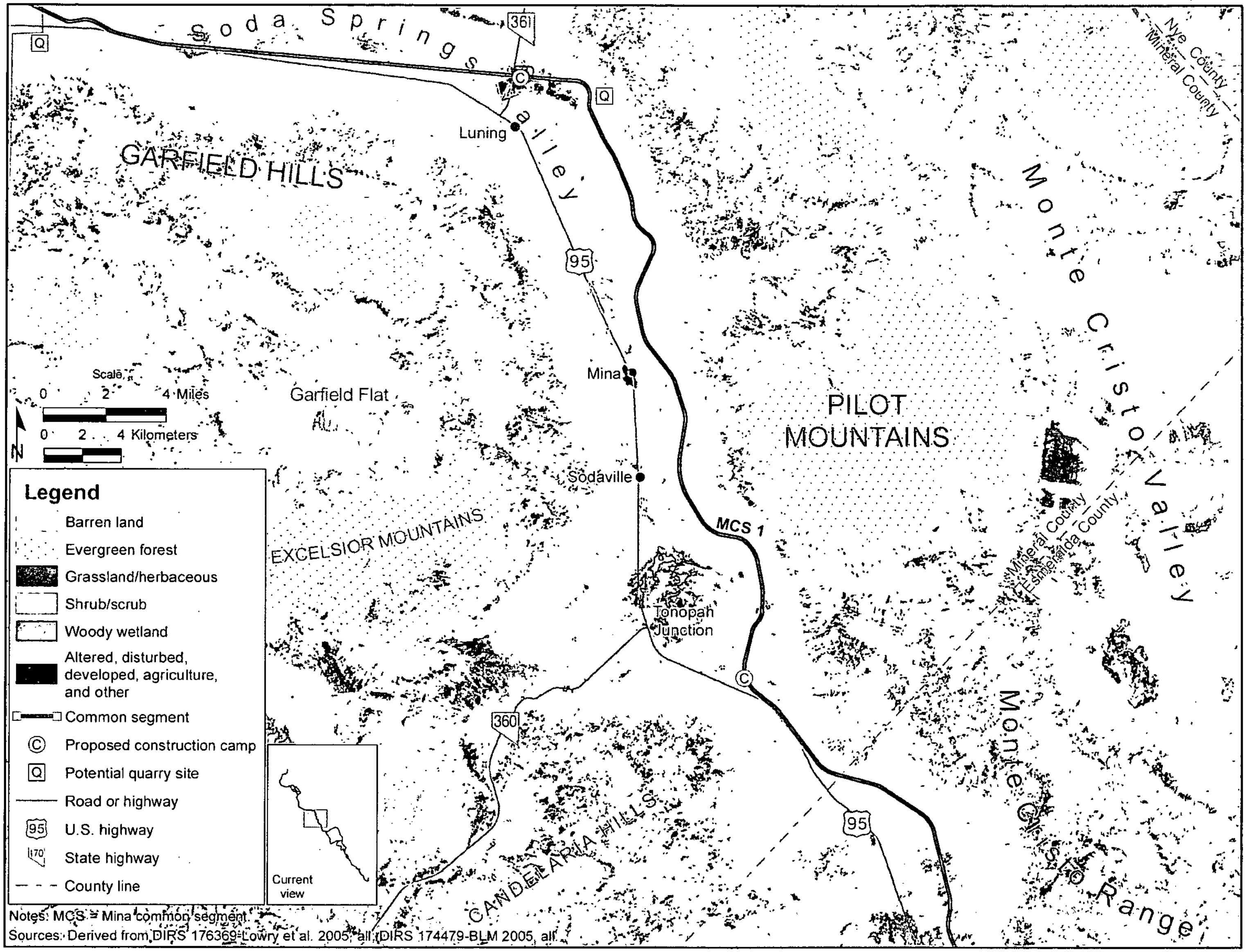


Figure 3-200. Land-cover classes the Mina rail alignment would cross within map area 3.

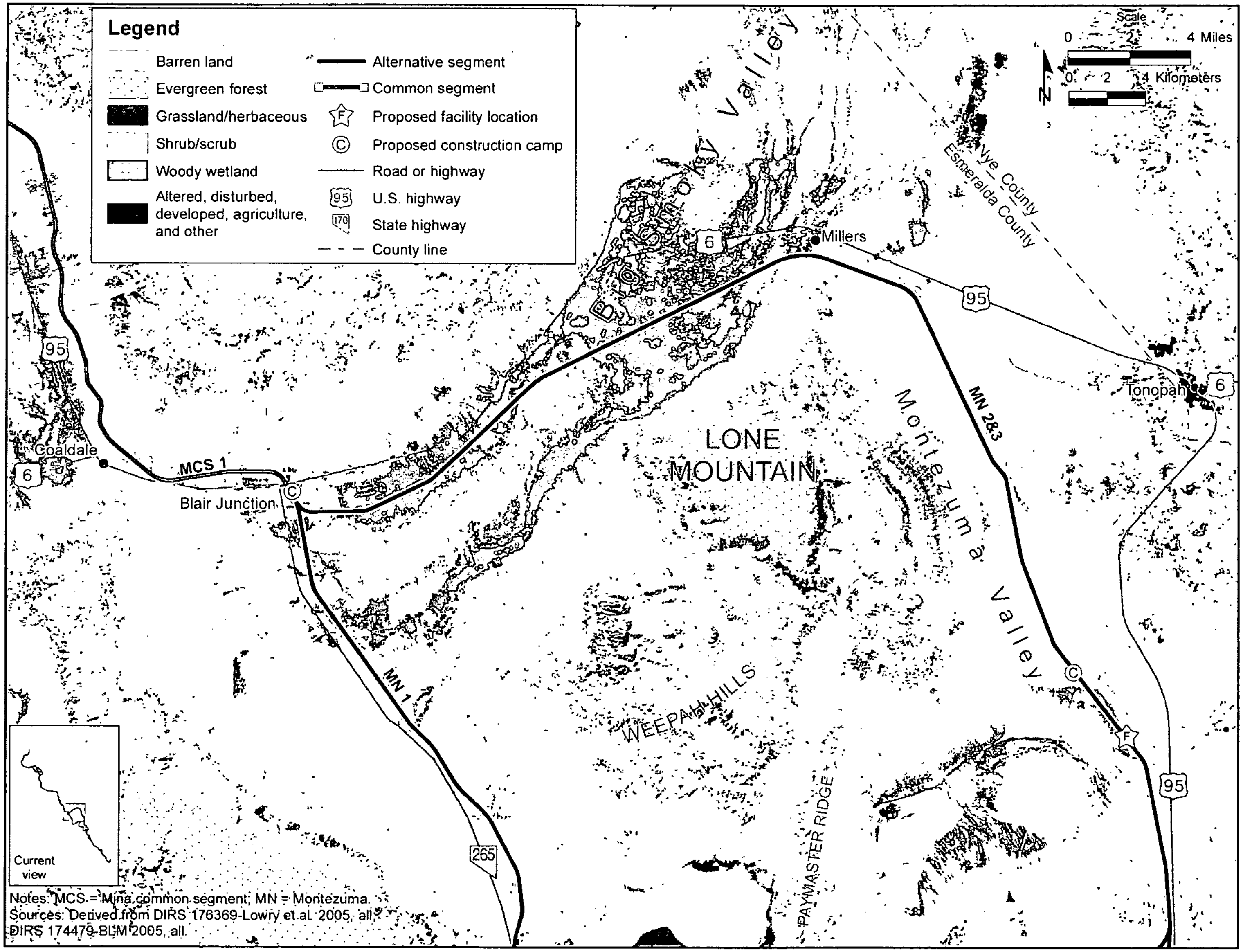


Figure 3-201. Land-cover classes the Mina rail alignment would cross within map area 4.

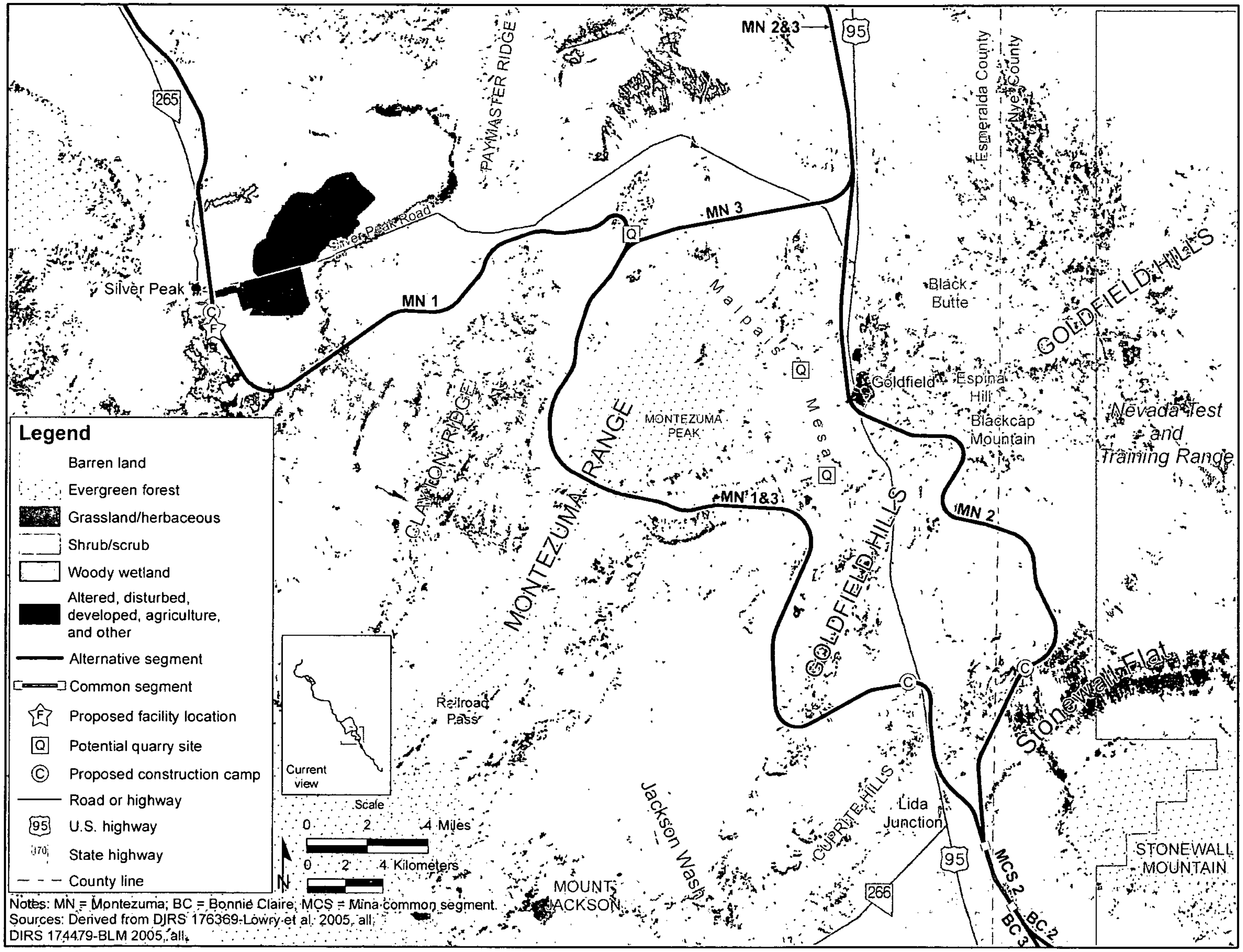


Figure 3-202. Land-cover classes the Mina rail alignment would cross within map area 5.

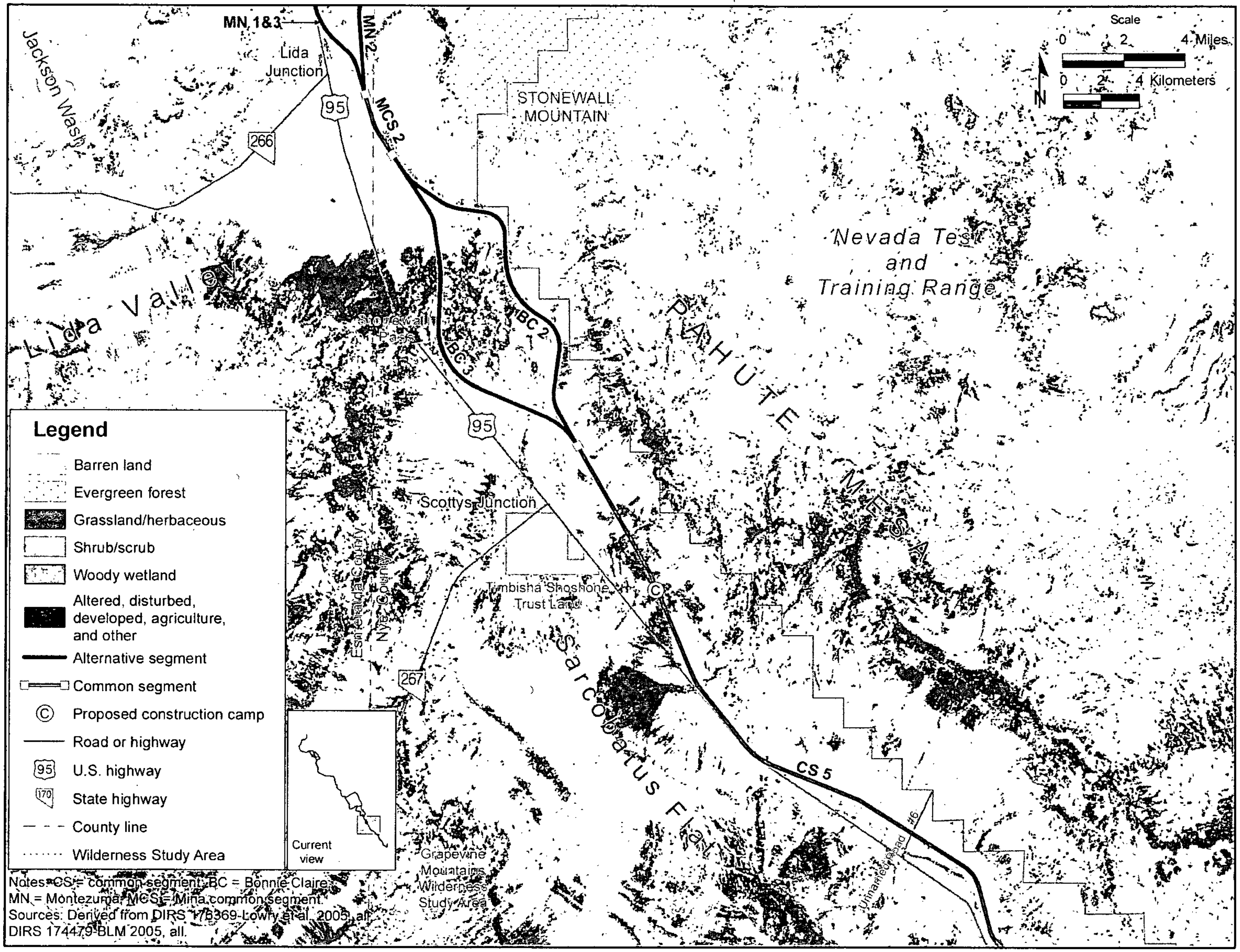


Figure 3-203. Land-cover classes the Mina rail alignment would cross within map area 6.

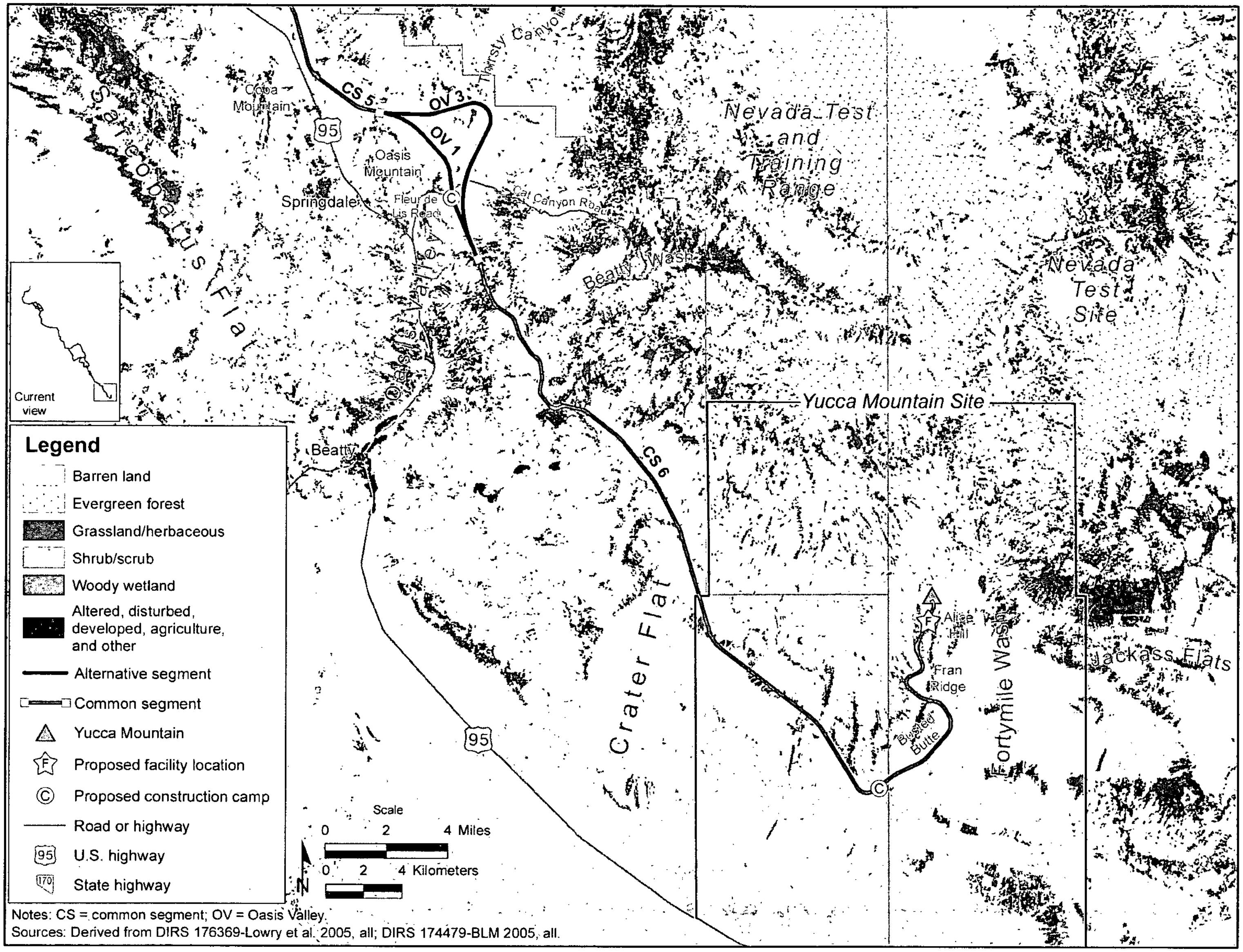


Figure 3-204. Land-cover classes the Mina rail alignment would cross within map area 7.

land-cover types within the construction right-of-way and study area are the Inter-Mountain Basins Mixed Salt Desert Scrub and the Inter-Mountain Basins Big Sagebrush Shrubland.

Appendix H, Table H-1, describes land-cover types.

Undisturbed areas of winterfat, or whitesage (*Krascheninnikovia lanata*), are present, but uncommon, within the construction right-of-way. While they have no official protected status with any federal or state agency, the BLM has identified these vegetation communities as important and their conservation or protection should be considered during development of any projects.

In addition to shrubs and grasses, biological soil crusts are an important component to both the Mojave and Great Basin ecosystems. Biological crusts are comprised of multiple species of lichen, moss, cyanobacteria and algae which live on top of the soil surface, binding with soil particles and forming a cohesive mat or crust on the surface of arid landscapes (DIRS 181866-Belnap 2006, p. 1). Biological crusts (if present) could play an important role in maintaining the health of some of the desert vegetation communities listed in Table 3-6, including but not limited to facilitating water infiltration, retaining soil moisture, and reducing soil loss from wind and water erosion (DIRS 181957-Kaltenecker and Wicklow-Howard 1994, p. 1-8). Crusts are highly sensitive to surface disturbance and are easily destroyed. Biological crusts likely occur within the region of influence in some areas where there has been no surface disturbance. Biological crusts are potentially present in areas where construction would occur, but because of insufficient data regarding the location and extent of biological crusts in the region of influence, Section 4.3.7 does not discuss impacts to biological crusts.

Nonnative plant species: A species found in an area where it has not historically been found.

Native plant species: With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem (Executive Order 13112, *Invasive Species*).

Invasive plant species: An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112, *Invasive Species*).

Noxious weeds: The BLM defines noxious weeds as: "A plant that interferes with management objectives for a given area of land at a given point in time." (DIRS 177037-BLM 1996, p. 3) The State of Nevada defines noxious weeds as: "Any species of plant which is, or liable to be, detrimental or destructive and difficult to control or eradicate..." (Nevada Revised Statute 555.005).

Weeds can be native or nonnative, invasive or non-invasive, and noxious or not noxious. Invasive species include not only noxious weeds, but also other non-native plants. The BLM considers plants invasive if they have been introduced into an environment where they did not evolve. As a result, invasive species usually have no natural enemies to limit their spread and can produce significant detrimental changes.

3.3.7.2.1.1 Noxious Weeds and Invasive Species. The Great Basin-Mojave Desert region is threatened by a number of ***nonnative,*** invasive plant species that have displaced ***native plant species***. Invasive plant species, such as red brome *(Bromus rubens)*, tamarisk *(Tamarix ramosissima)*, and cheatgrass *(Bromus tectorum)*, have the ability to out-compete individual species of native range plants, which results in extensive monocultures of the introduced species. ***Invasive species*** usually have little to no nutritional value for livestock and wildlife; some invasive species are toxic or physically injurious to animals, can increase the frequency of wildfires, and degrade wildlife habitat by reducing the diversity of native vegetation (DIRS 155925-Nevada Weed Action Committee 2000, p. 5).

Some plant species are considered ***noxious weeds***, an official designation used by federal and state authorities to identify species with a high likelihood of being very destructive or difficult to control or eradicate. Chapter 555.010 of the Nevada Administrative Code lists species designated as noxious. Chapter 555 of the Nevada Revised Statutes directs that designated noxious weeds are to be controlled on both public and private land, and provides for enforcement measures should the landowner or occupier fail to take corrective action. While many noxious species are invasive, invasiveness is not required for a species to be designated noxious. Some species managed as noxious weeds are not considered truly invasive because they cannot effectively out-compete healthy communities of native vegetation.

3.3.7.2.1.2 Wetlands and Riparian Habitats. Riparian habitats are transition areas from wetland or stream habitat to upland habitat. Wetlands are areas that are saturated by water for a sufficient amount of time to support vegetation that is adapted to saturated soil conditions. While wetland and riparian habitats in Nevada cover a very small percentage of the total area of the state, they support a comparatively high number and large diversity of species, many of which are locally ***endemic***. Wetland and riparian habitats have been reduced in the region over the years due in part to water removal, drought, and the presence of invasive species, such as tamarisk (DIRS 174518-BLM 2005, p. 3.5-9). Appendix F contains information on wetlands within the project area and Sections 3.3.5 and 4.3.5 discuss impacts in relation to Section 404 of the Clean Water Act and wetland fill permitting. This section discusses wetlands and riparian habitats that support terrestrial and aquatic species.

To maintain consistency within this section, DOE assessed the amount and type of wetland and riparian habitat utilizing the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all). Section 3.3.5, Surface Water Resources, utilizes National Wetlands Inventory maps (DIRS 176976-NWI 2006, all) and the results of the wetland delineations conducted during the field surveys in 2007 (DIRS 180889-PBS&J 2007, all) and 2006 (DIRS 180889 PBS&J 2007, pp. 11 and 12) to calculate the area of the wetlands. Therefore, the area totals differ between Sections 3.3.5 and 3.3.7 because Section 3.3.7 analyzes wetland and riparian habitat and Section 3.3.5 analyzes only the wetland areas.

According to the Southwest Regional Gap Analysis Project, there are three types of wetland or riparian land-cover types along the Mina rail alignment and at locations of the proposed rail line construction and operations support facilities: North American Warm Desert Lower Montane Riparian Woodland and Shrubland; Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland; and North American Arid West Emergent Marsh (Figures 3-205 to 3-211) and (see Table 3-126).

The North American Warm Desert Lower Montane Riparian Woodland and Shrubland is found along perennial and seasonally intermittent streams. Generally located in middle to low elevations and found in canyons and valleys, vegetation in this land-cover type depends on seasonal flooding and removal of sediment that occurs during these flood events. The vegetation is a mix of tree and shrub species including Fremont cottonwood (*Populus fremontii*) and willows, including sandbar willow (*Salix exigua*) and seep willows (*Baccharis salicifolia*) (DIRS 174324-NatureServe 2004 pp. 140 to 142).

The Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland land cover occurs in the mountains of the Great Basin from middle to high elevations. This habitat requires flooding, and the scouring and subsequent deposition of soils that occurs during flood events, for maintenance and germination of vegetation. Vegetation typically associated with this type of riparian habitat includes Fremont cottonwood, willows, rushes (*Juncus* spp.), and sedges (*Carex* spp.) (DIRS 174324-NatureServe 2004, pp. 149 and 150).

The North American Arid West Emergent Marsh land-cover type occurs throughout the arid regions of the western United States. This land cover occurs along slow-moving streams, has soils that are able to accumulate organic material, and contains vegetation that is adapted to frequently or continually saturated soil conditions. Vegetation commonly found in marsh areas includes bulrushes (*Scirpus* spp.), cattails (*Typha* spp.), and rushes (DIRS 174324-NatureServe 2004, pp. 154 to 156).

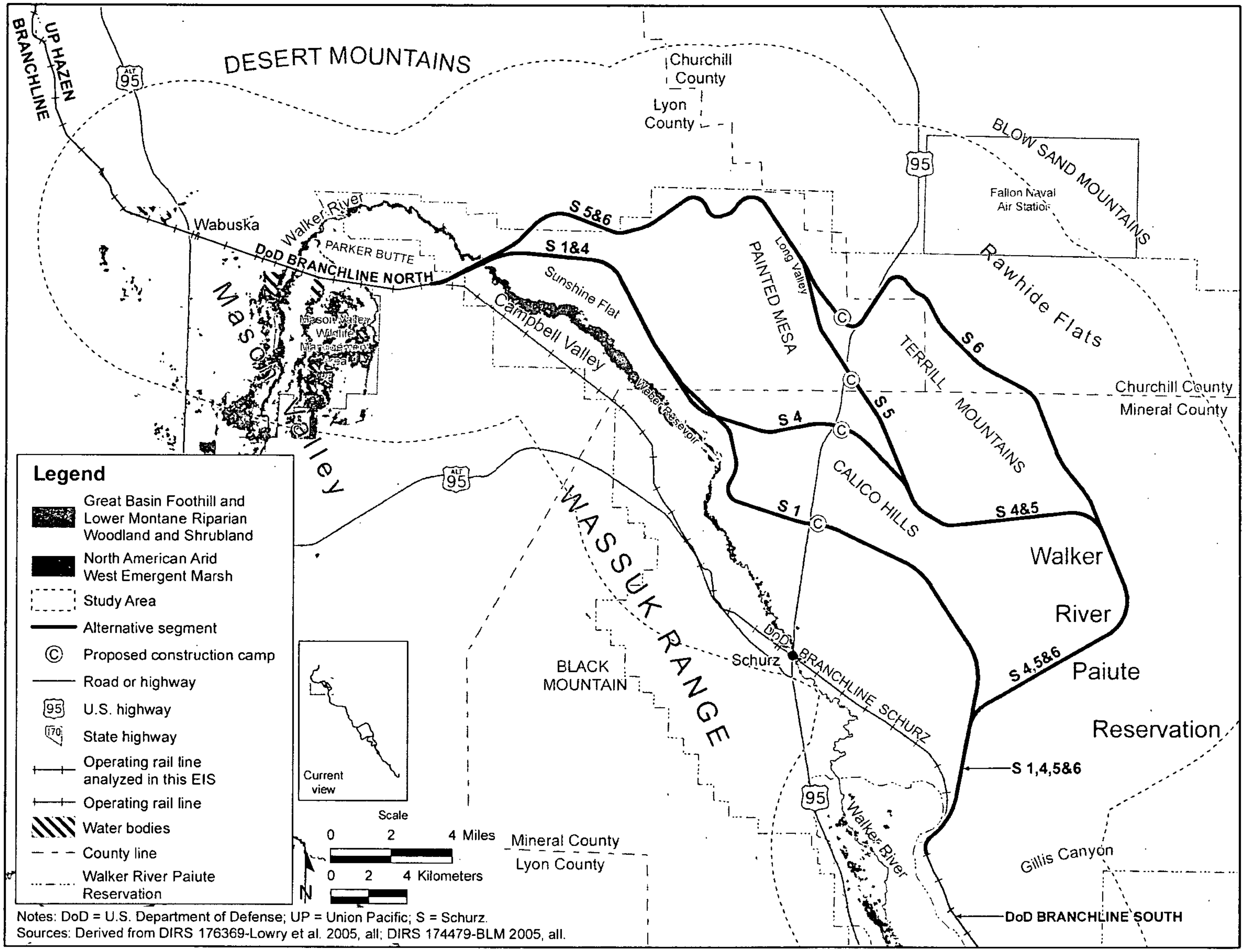


Figure 3-205. Wetland/riparian habitat the Mina rail alignment would cross in map area 1.

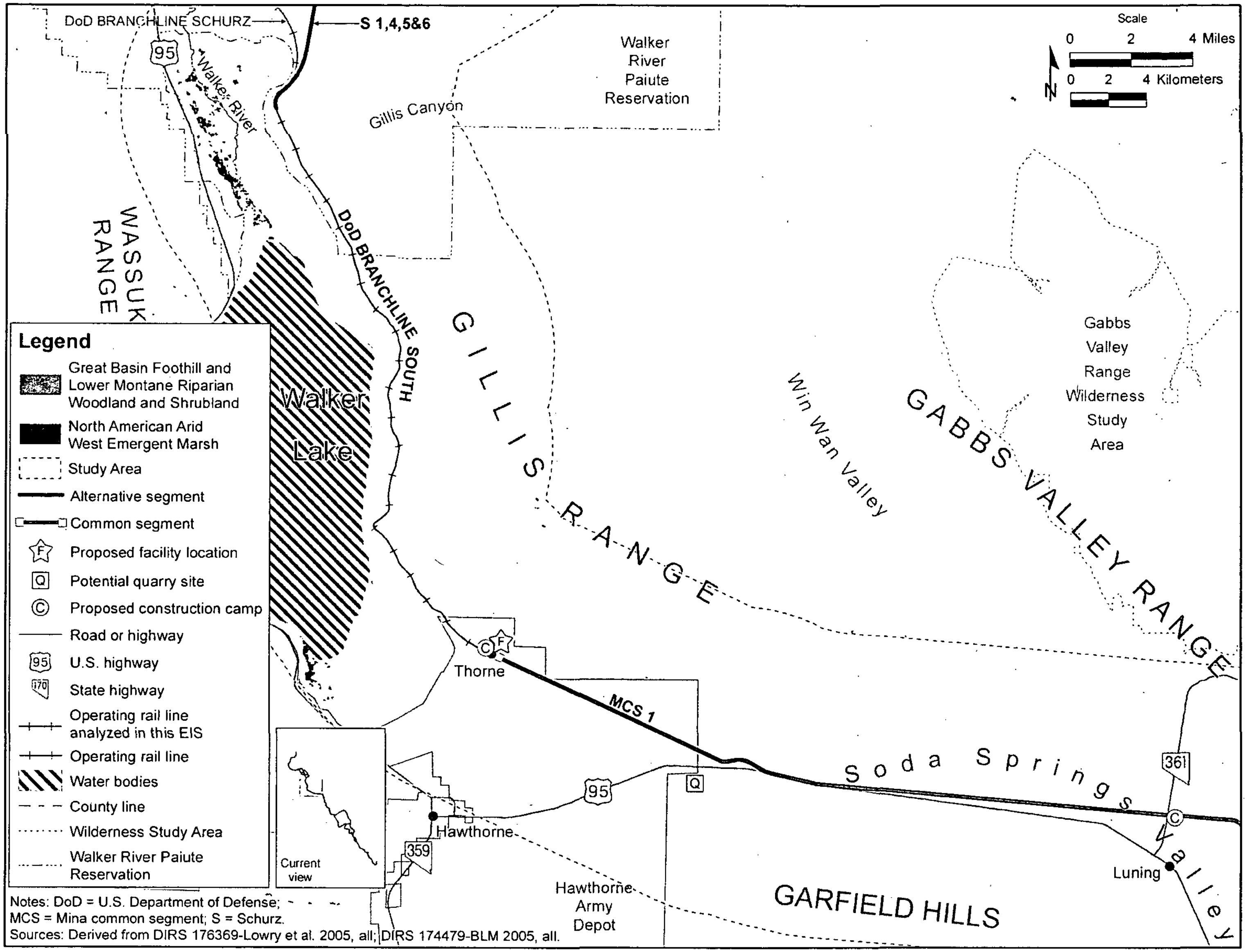


Figure 3-206. Wetland/riparian habitat the Mina rail alignment would cross in map area 2.

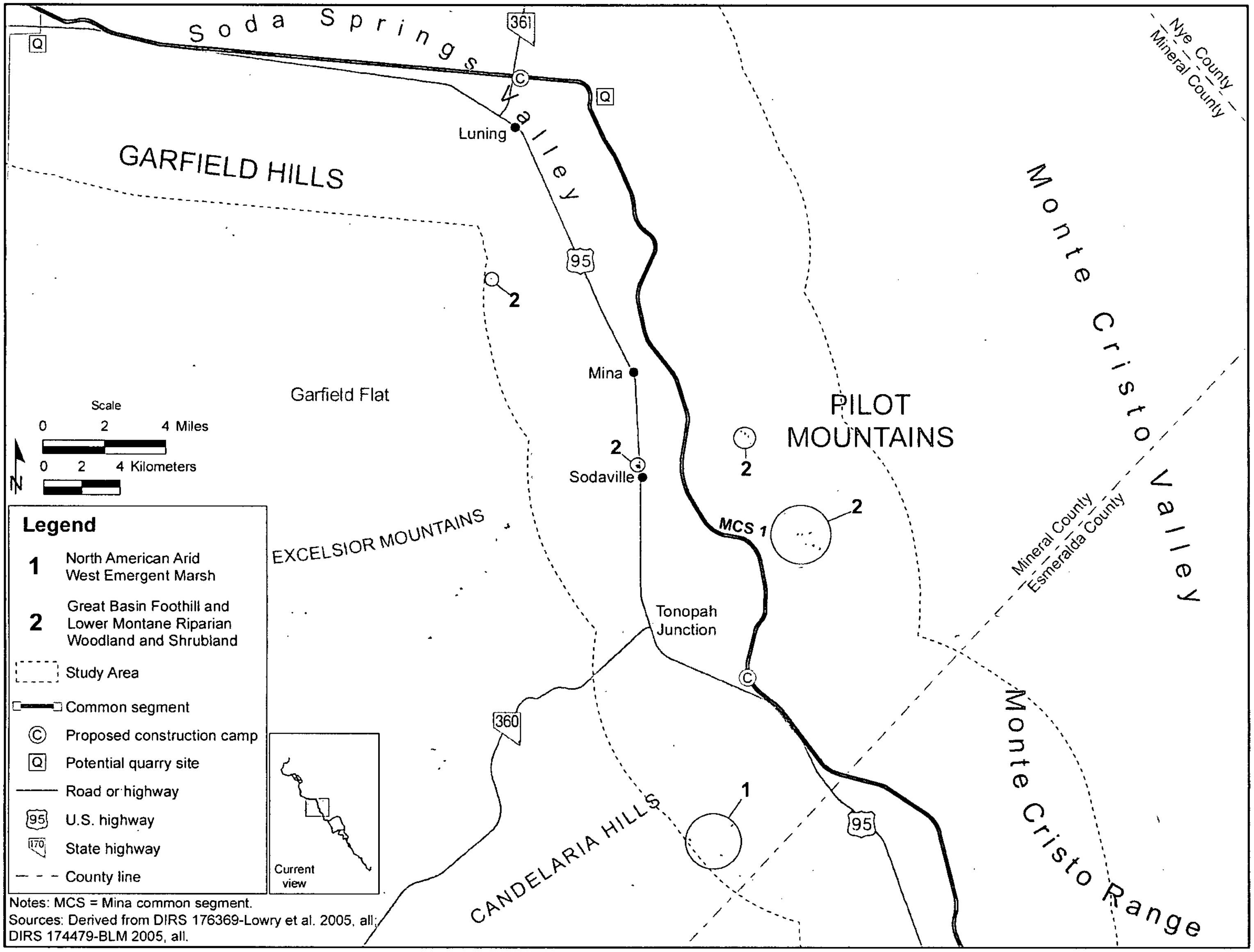


Figure 3-207. Wetland/riparian habitat the Mina rail alignment would cross in map area 3.

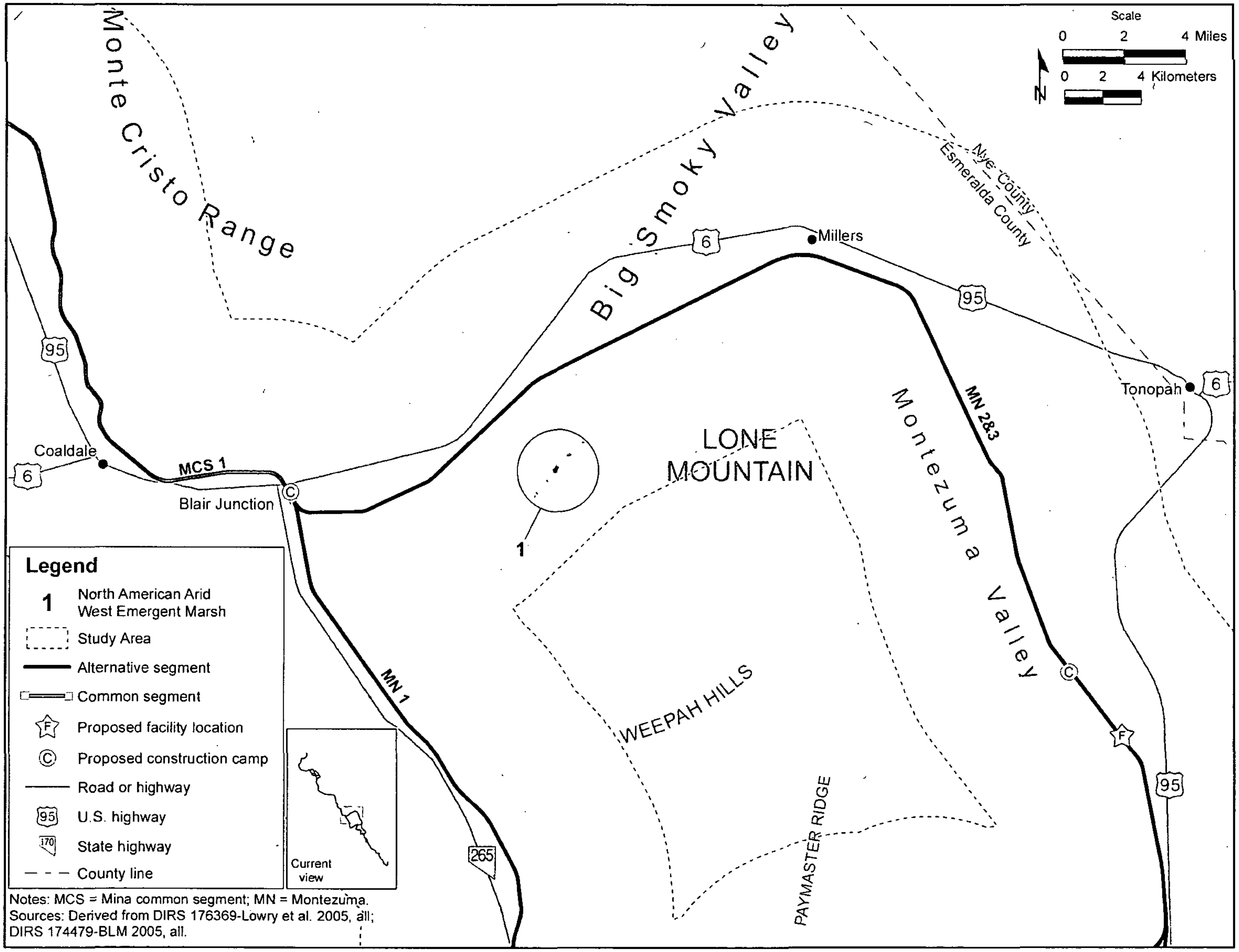


Figure 3-208. Wetland/riparian habitat the Mina rail alignment would cross in map area 4.

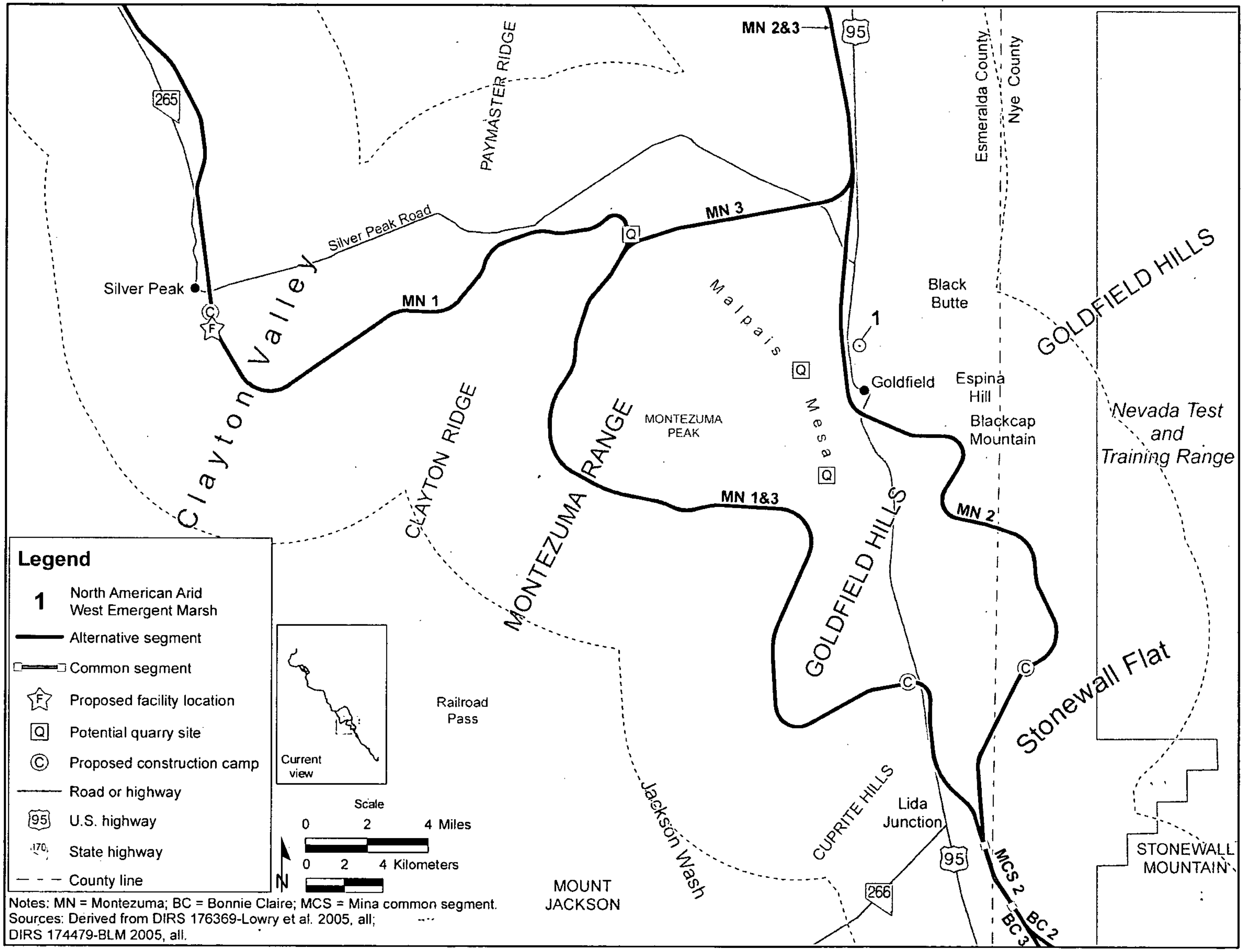


Figure 3-209. Wetland/riparian habitat the Mina rail alignment would cross in map area 5.

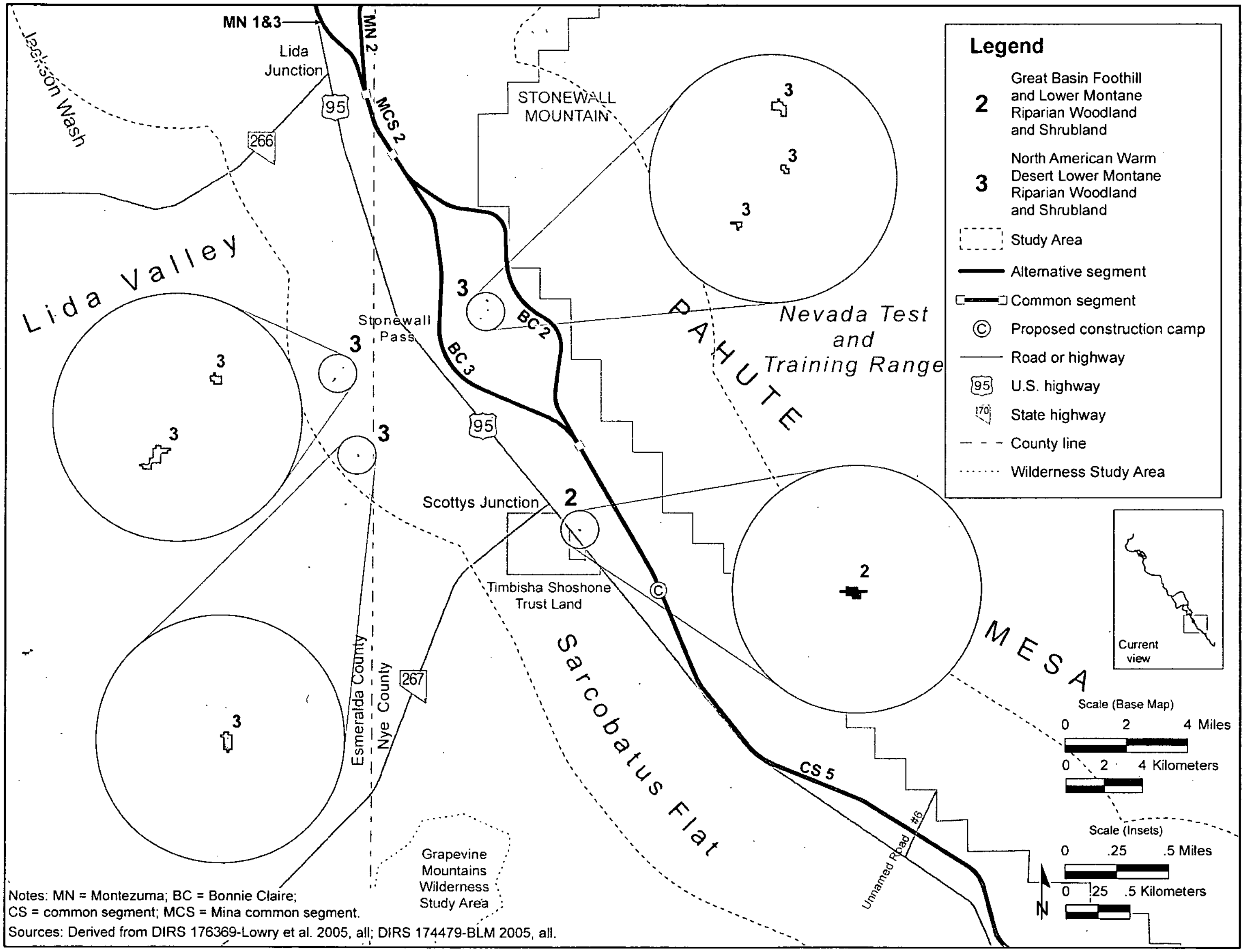


Figure 3-210. Wetland/riparian habitat the Mina rail alignment would cross in map area 6.

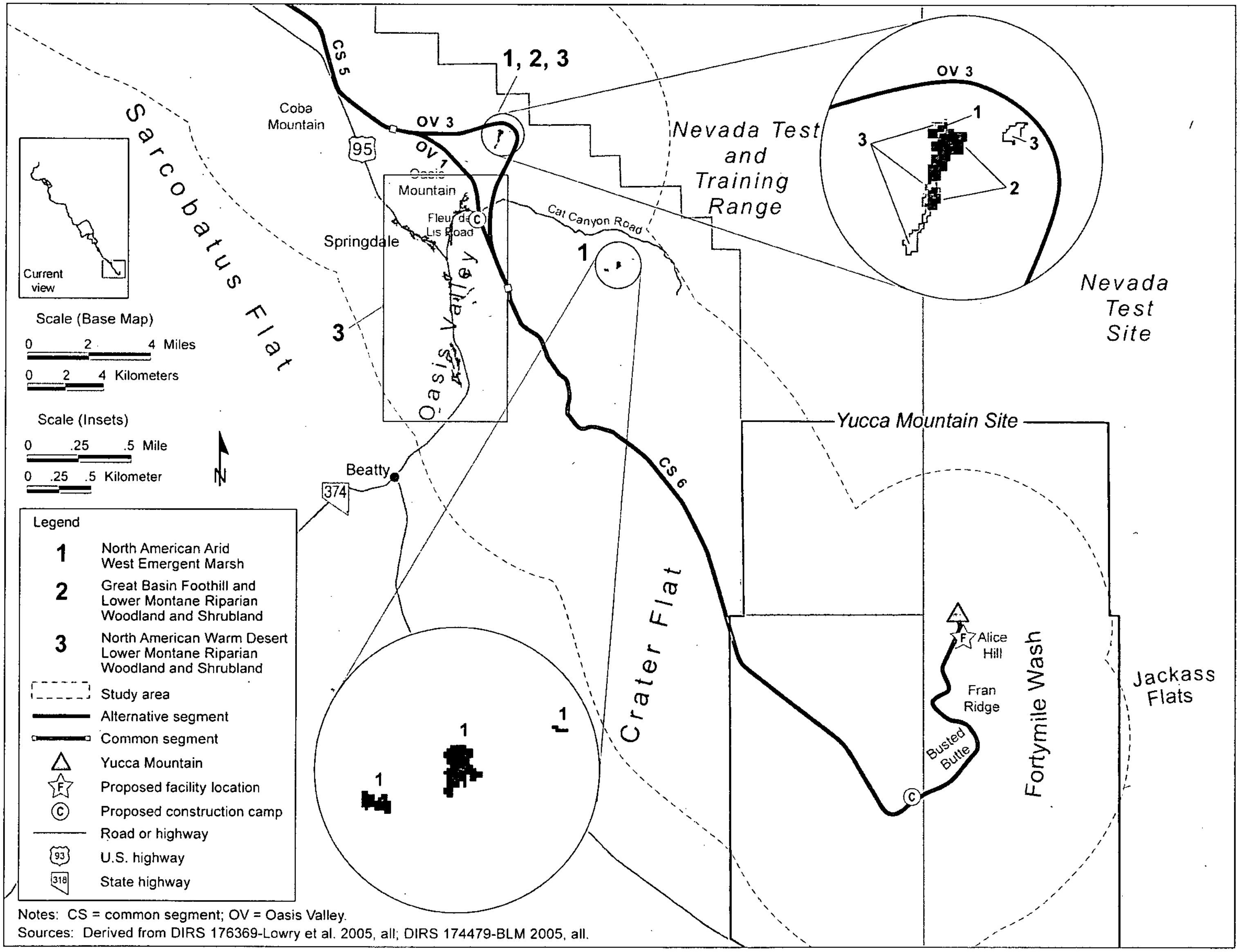


Figure 3-211. Wetland/riparian habitat the Mina rail alignment would cross in map area 7.

3.3.7.2.2 Wildlife

As with the vegetation communities and wetland habitats, DOE gathered data on wildlife communities to identify existing information regarding the occurrence and distribution of wildlife, including mammals, birds, reptiles, and aquatic species, within the construction right-of-way. These investigations incorporated literature and database searches and consultations with land and resource management agencies and authorities, including the BLM, the U.S. Fish and Wildlife Service, the Nevada Natural Heritage Program, and the Nevada Department of Wildlife. DOE also obtained information regarding Nevada game species from these agencies. Concurrent with other field surveys, the Department gathered information during field observations to identify the presence of wildlife within the construction right-of-way. DOE used habitat-related information from the Southwest Regional Gap Data to identify areas where a high probability of species existence occurred in relation to the construction right-of-way. Appendix H contains a map detailing field survey locations.

3.3.7.2.3 Special Status Species

Special status species are plants, fish, and wildlife species that are afforded some level of protection or special management under federal or state laws or regulations. DOE contacted the U.S. Fish and Wildlife Service to obtain a list of species protected under the federal Endangered Species Act that are known to exist or could exist within the construction right-of-way or within the study area (DIRS 181055-Williams 2007). The Department assessed the potential for federally listed species to occur within the construction right-of-way by reviewing agency listings of known, or potentially occurring, listed species, and through a review of potential habitat for those species along the Mina rail alignment. The Department also obtained location records for special status species from a statewide database managed by the Nevada Natural Heritage Program that contains records of incidental observations of rare or protected plants, fish, and wildlife species (DIRS 182061-Hopkins 2006, all). The special status species DOE selected for further consideration are one or a combination of the following:

- Special status species documented as occurring within the study area (Figure 3-212 and Figure 3-213)
- Special status species identified as potentially occurring in the study area by personnel affiliated with appropriate resource management agencies, including the BLM (DIRS 172900 BLM 2003, all), the U.S. Fish and Wildlife Service, the Nevada Department of Wildlife, or the Nevada Division of Forestry
- Special status species identified as potentially occurring in the study area because field personnel identified potentially suitable habitat during the field surveys

DOE used a Geographic Information System database to map the documented occurrences of special status plants and wildlife species within the study area in relation to the Southwest Regional Gap Analysis Project land-cover types. The Department then used these maps to identify areas of potential habitat and the presence of the documented special status species. Through field surveys, the Department further evaluated areas that appeared to contain viable habitat for a special status species. Appendix H provides details on the survey methodology for special status species.

3.3.7.2.4 State of Nevada Game Species

Table 3-127 lists the game species identified in the Nevada Administrative Code Sections 503.020, 503.045, and 503.060 that potentially occur in the study area and construction right-of way. Game species identified in these sections of the Nevada Administrative Code that are absent from the study area are listed in Appendix H, Table H-5, and are not considered further in this Rail Alignment EIS.

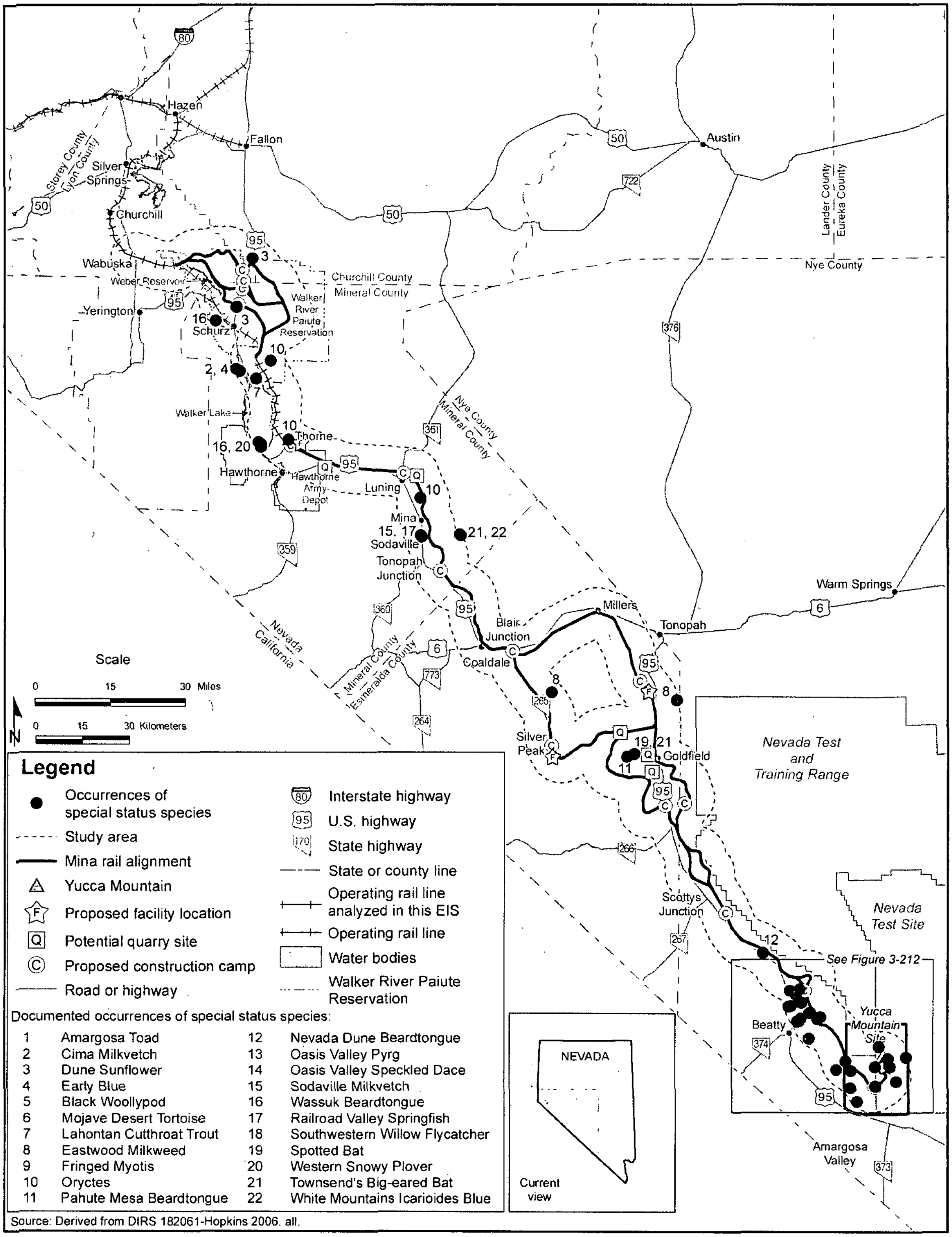


Figure 3-212. Occurrences of special status species documented in the Nevada Natural Heritage Program database along the Mina rail alignment.

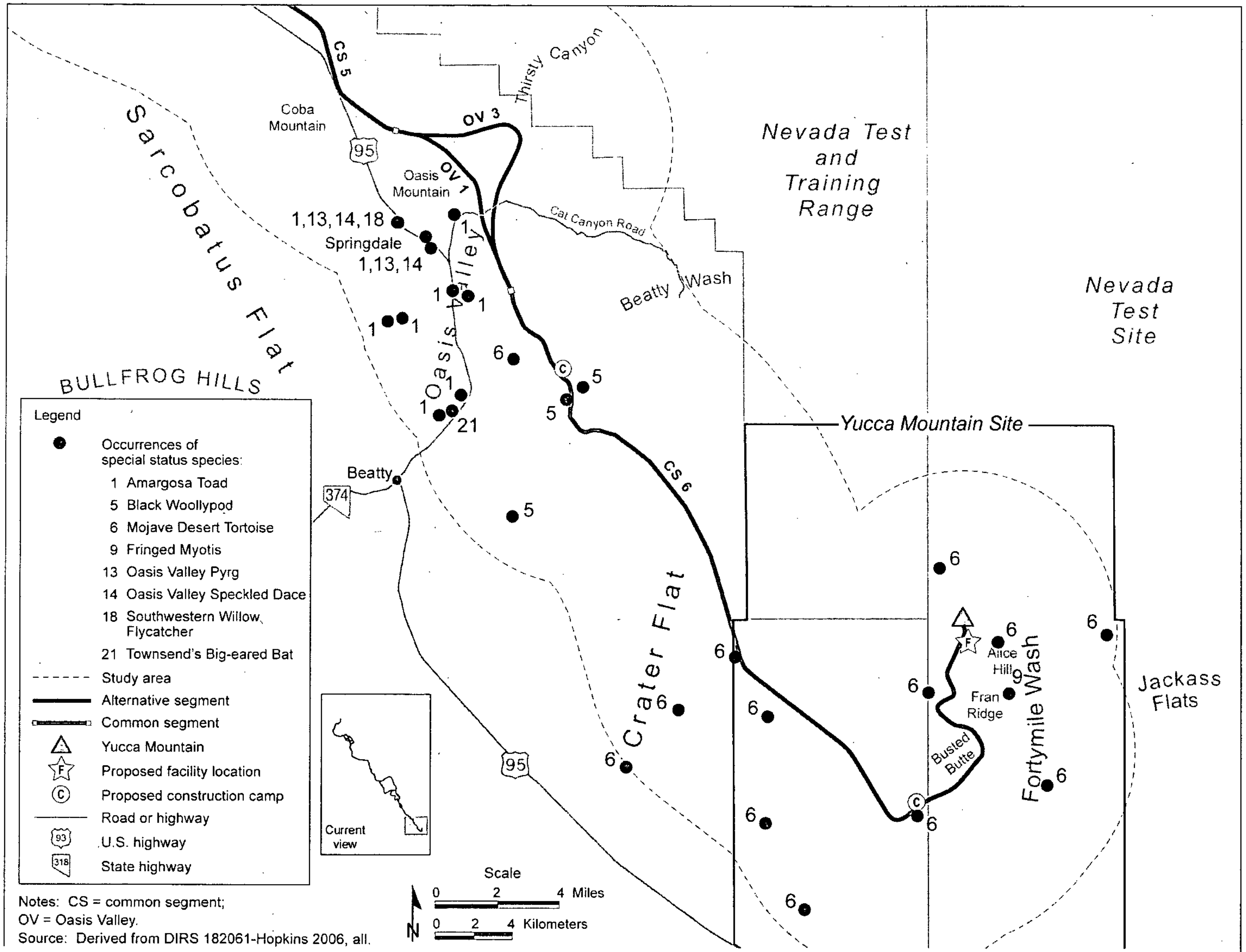


Figure 3-213. Occurrences of special status species documented in the Nevada Natural Heritage Program database adjacent to the Oasis Valley alternative segments and the Yucca Mountain Site.

The greater sage-grouse (*Centrocercus urophasianus*) and pygmy rabbit (*Sylvilagus idahoensis*) are game species that are also BLM-listed sensitive and State of Nevada protected. The bighorn sheep is a BLM-listed sensitive species that is managed by the Nevada Department of Wildlife as a big game mammal.

DOE conducted surveys along the Mina rail alignment to further characterize the presence or absence of game species. Observations included identification of tracks and fecal pellets, and direct observation of animals on or near the rail alignment. Results do not imply population level or habitat quality, only the presence or absence of game species and their approximate level of use.

3.3.7.2.5 Wild Horses and Burros

The BLM has delineated herd management areas within the wild horse herd areas. Each herd management area has an appropriate management level determined by the BLM through a rangeland assessment and a public review process. The appropriate management level is the number of wild horses and burros that the herd management area is managed for, and it is established to avoid the ecological degradation of the herd management area. DOE reviewed the Tonopah Resource Management Plan (DIRS 173224-BLM 1997, all), Carson City Consolidated Resource Management Plan (DIRS 179560-BLM 2001, all), and herd management plans for the Battle Mountain and Carson City BLM Districts to obtain current information on herd management areas. The Department contacted the BLM to obtain Geographic Information System data on management areas and to obtain data regarding the use of the herd management areas by wild horses and burros (Figure 3-214). Concurrent with other field investigations, DOE performed observations for wild horses and burros, or signs of their presence. Section 3.3.2, Land Use and Ownership, describes the grazing allotment planning process.

3.3.7.3 Affected Environment along Alternative Segments and Common Segments

This section describes biological resources in the Mina rail alignment construction right-of-way and study area. To avoid unnecessary repetition, this section discusses biological resources by resource type (vegetation, wildlife, special status species, migratory birds, State of Nevada game species, and wild horses and burros) rather than by alternative segment or common segment.

3.3.7.3.1 Vegetation

There are 25 different land-cover types within the construction right-of-way and multiple options for the proposed Mina railroad construction and operations support facilities. Tables 3-128 through 3-130 list land-cover types along the rail alignment and the areas of proposed operations support facilities. The percentages disclosed are the percent of land-cover types that could be affected and these percentages are related to the total acreages in the Mojave and Nellis mapping zones (see Table 3-126). The land-cover types listed and the percentages that could be affected are based on the nominal width of the rail line construction right-of-way for the alternative segments and common segments and the footprint of each proposed operation support facility. Table 3-131 lists the land-cover types present in the areas of the potential quarry sites.

3.3.7.3.1.1 Noxious Weeds and Invasive Species. Cheatgrass is found along most of the Mina rail alignment where it fills open space between shrubs. Red brome is also common, although it is generally confined to areas along the rail alignment that would cross the Mojave Desert region. These observations were made during the 2005 field surveys.

Table H-2 in Appendix H of this Rail Alignment EIS lists invasive and noxious species likely to occur in the area around the Mina rail alignment. The information is based on general habitat requirements or documented occurrences.

Table 3-127. Nevada game species present or potentially present in the biological resources study area – Mina rail alignment.[a]

Common name	Scientific name	Occurrence within the study area
Game mammals		
Pronghorn antelope	*Antilocapra americana*	Present
Mule deer	*Odocoileus hemionus*	Present
Mountain lion	*Felis concolor*	Present
Cottontail rabbit	*Sylvilagus* spp	Present
Black-tailed jackrabbit	*Lepus californicus*	Present
Bighorn sheep	*Ovis canadensis*	Present
Elk	*Cervus elaphus*	Present
Upland and migratory game birds		
Greater sage-grouse	*Centrocercus urophasianus*	Potentially present
Chukar	*Alectoris chukar*	Present
Ring-necked pheasant	*Phasianus colchicus*	Present
Gambel's quail	*Callipepla gambelii*	Present
Wild turkey	*Meleagris gallopavo*	Present
American crow	*Corvus brachyrhynchos*	Present
Ducks, geese, and swans	Family*Anatidae*	Present only in wetland/marsh areas
Wild doves and pigeons	Family *Columbidae*	Present
Cranes	Family *Gruidae*	Present only in wetland/marsh areas
Rails, coots, and gallinules	Family *Rallidae*	Present only in wetland/marsh areas
Woodcocks and snipes	Family *Scolopacidae*	Present only in wetland/marsh areas
Game fish		
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	Present
Brown trout	*Salmo trutta*	Present
Rainbow trout	*Oncorhynchus mykiss*	Present
Mountain whitefish	*Prosopium williamsoni*	Present
Channel catfish	*Ictalurus punctatus*	Present
White catfish	*Ameiurus catus*	Present
White bass	*Morone chrysops*	Present
Largemouth black bass	*Micropterus salmoides*	Present
Spotted bass	*Micropterus punctulatus*	Present
White crappie	*Pomoxis annularis*	Present
Yellow perch	*Perca flavescens*	Present
Bluegill sunfish	*Lepomis macrochirus*	Present
Walleye	*Stizostedion vitreum*	Present

a. Source: Nevada Administrative Code Sections 503.020, 503.045, and 503.060.

3.3.7.3.1.2 Wetlands and Riparian Habitat. Before conducting field surveys, DOE reviewed pertinent maps, the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all), and available state wetland and land-use inventories to identify the locations of possible wetland and riparian habitat within the rail line construction right-of-way and the study area.

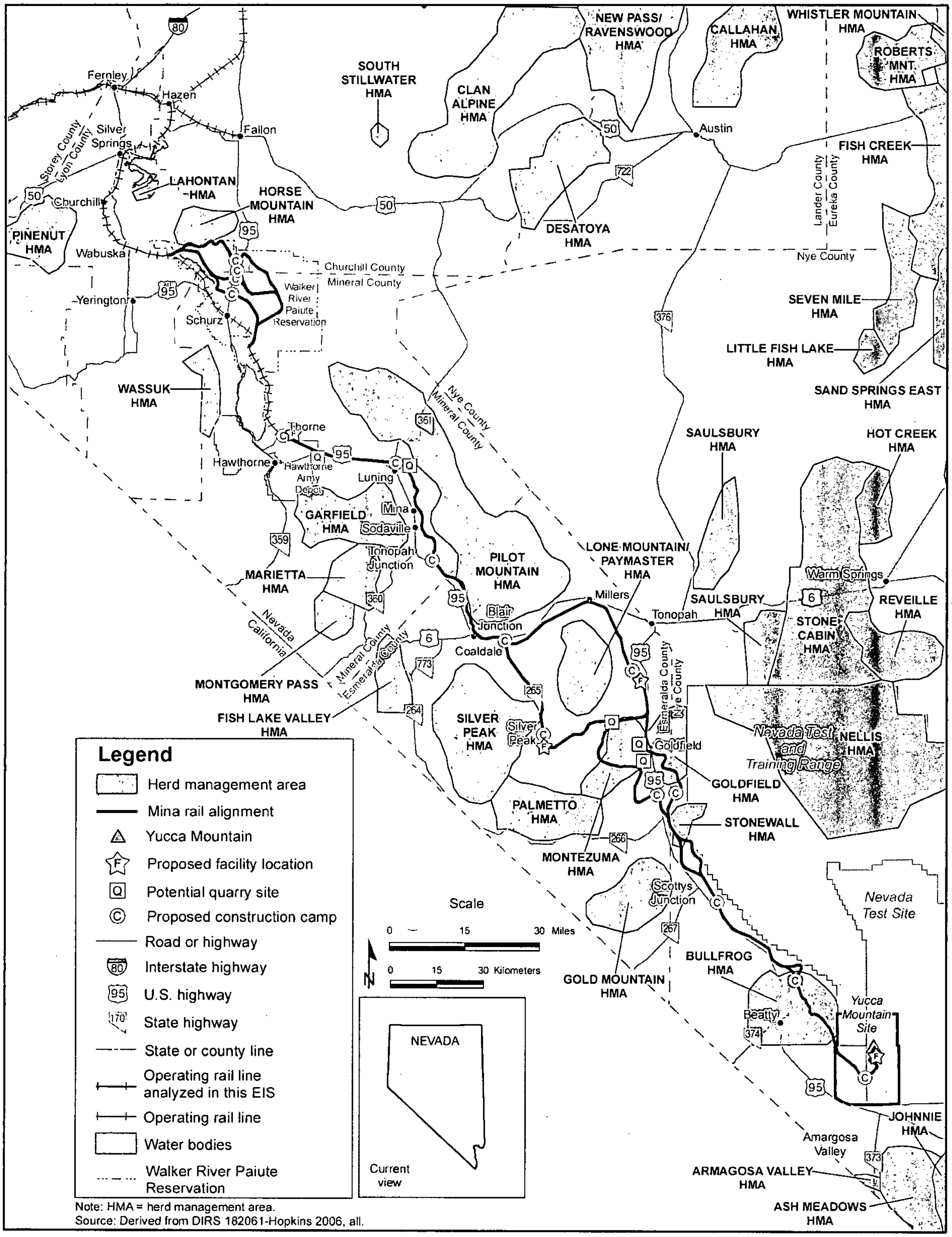


Figure 3-214. Herd management areas along the Mina rail alignment.

Table 3-128. Land-cover types and percentages within the construction right-of-way by common segment.[a]

Land-cover type	Area covered by common segment[b] (percent)			
	CS1	CS2	CS5	CS6
Barren Lands, Non-specific	0.23	0	0	0
Inter-Mountain Basins Active and Stabilized Dune	0.29	0		0
Inter-Mountain Basins Cliff and Canyon	<0.01	0		0
Great Basin Pinyon-Juniper Woodland	0	0	0.10	0
Great Basin Xeric Mixed Sagebrush Shrubland	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	0	0	0.05	0
Inter-Mountain Basins Greasewood Flat	1.87	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	93.78	93.81	0	0
Inter-Mountain Basins Playa	1.95	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	1.81	6.19	7.55	13.59
Invasive Annual and Biennial Forbland	0.06	0	0	0
Invasive Annual Grassland	0.02	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	12.46	23.92
North American Warm Desert Bedrock Cliff and Outcrop	0	0	0	0.39
North American Warm Desert Playa	0	0	<0.01	0.13
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	26.47	61.38
Sonora-Mojave Mixed Salt Desert Scrub	0	0	53.37	0.59
Totals[c]	100	100	100	100

a. Source: DIRS 174324-NatureServe 2004.
b. CS = common segment; < = less than.
c. Totals might differ from sums of values due to rounding.

DOE identified wetland and riparian habitat along the following portions of the Mina rail alignment using a combination of fieldwork and the 2004 Southwest Regional Gap Analysis Project (see Figures 3-205 to 3-211):

- Schurz alternative segments
- Mina common segment 1
- Bonnie Claire alternative segments
- Oasis Valley alternative segments

This section discusses only portions of the Mina rail alignment in which there are wetland and/or riparian habitats. Section 3.3.5, Surface-Water Resources, provides information on springs and their locations and specific information on function and value of wetlands for Section 404 compliance. Table 3-132 details the identified wetland and riparian land-cover types found in the construction right-of-way and the study area along alternative segments and common segments of the Mina rail alignment.

Table 3-129. Land-cover types and percentages within the construction right-of-way by alternative segment[a] (page 1 of 2).

	Area covered by alternative segment (percent)[b]											
	Schurz				Montezuma				Bonnie Claire		Oasis Valley	
Land-cover type	S1	S4	S5	S6	MN1	MN2	MN1/MN3	MN3	BC2	BC3	OV1	OV3
Barren Lands, Non-specific	0	0	0	0	1.12	0.03	0	0	0	0	0	0
Developed, Medium-High Intensity	0	0	0	0	0	0.08	0	0	0	0	0	0
Developed, Open Space – Low Intensity	0	0	0	0	0	0.24	0	0	0	0	0	0
Inter-Mountain Basins Active and Stabilized Dune	1.95	0.84	0.35	0.42	<0.01	0	0	0	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0.35	0.27	0.25	0.23	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	0	0	0	0	0	0	0.047	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	0	0	0	0	0.84	1.60	8.05	<0.01	0.11	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	0	0	0.04	0.04	0.56	11.40	17.87	7.38	5.04	0.80	0	0
Inter-Mountain Basins Cliff and Canyon	0	0	0	0.01	0	0	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	15.1	5.85	4.21	3.93	0	1.54	0	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	82.0	92.95	94.02	94.03	75.59	2.71	1.93	0	33.59	30.27	0	0
Inter-Mountain Basins Playa	0	0	0	0	16.53	0	0	0	0.51	0	0	0

Table 3-129. Land-cover types and percentages within the construction right-of-way by alternative segment[a] (page 2 of 2).

Land-cover type	Area covered by alternative segment (percent)[b]											
	Schurz				Montezuma				Bonnie Claire		Oasis Valley	
	S1	S4	S5	S6	MN1	MN2	MN1/MN3	MN3	BC2	BC3	OV1	OV3
Inter-Mountain Basins Semi-Desert Shrub-Steppe	0	0	0	0	0.32	2.71	1.93	0	0	0	0	0
Inter-Mountain Basins Playa	0.55	0	0	0.04	16.53	0	0	0	0	0.51	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0.09	0.07	0.10	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	0	0	0.32	2.71	1.93	0	10.66	16.53	4.88	3.13
Inter-Mountain Basins Wash	0	0	0	0	0	0	0	0	0	0	0	0
Invasive Annual Grassland	0	0	0.41	0.39	0	0	0	0	0	0	0	0
Invasive Annual and Biennial Forbland	0	0	<0.01	<0.01	0	0	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	0	0	31.44	23.43	3.61	0.45
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0	0	0	0	0	0	0	0	0	0	0.43
North American Warm Desert Playa	0	0	0	0	0	0	0	0	0	0	5.33	1.07
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	0	0	13.88	27.01	77.56	72.68
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	0	0	5.29	1.84	8.63	22.24
Totals[c]	100	100	100	100	100	100	100	100	100	100	100	100

a. Source: DIRS 174324-NatureServe 2004.
b. < = less than.
c. Totals might differ from sums of values due to rounding.

Table 3-130. Land-cover types and percentages within facility footprints by facility.[a]

Land-cover type	Area covered by facility (percent) Staging Yard at Hawthorne	Silver Peak option Maintenance-of-Way Facility	Klondike option Maintenance-of-Way Facility	Rail Equipment Maintenance Yard
Great Basin Xeric Mixed Sagebrush Shrubland		0	0	0
Inter-Mountain Basins Active and Stabilized Dune	0.14	0.05	0	0
Inter-Mountain Basins Greasewood Flat	0.93	2.65	45.35	0
Inter-Mountain Basins Mixed Salt Desert Scrub	98.93	9.40	53.40	0
Inter-Mountain Basins Playa	0	87.91	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	1.26	15.04
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	8.04
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	74.94
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	1.98

a. Source: DIRS 174324-NatureServe 2004.
b. Totals might differ from sums of values due to rounding.

Table 3-131. Land-cover types and percentages within the footprints of potential quarry sites[a] (page 1 of 2).

Land-cover type	Area covered (percent)
Garfield Hills	
Great Basin Xeric Mixed Sagebrush Shrubland	99.99
Inter-Mountain Basins Big Sagebrush Shrubland	<0.01[c]
Total[b]	100
Gabbs Range	
Inter-Mountain Basins Big Sagebrush Shrubland	0.38
Inter-Mountain Basins Mixed Salt Desert Scrub	99.62
Total	100
North Clayton	
Great Basin Xeric Mixed Sagebrush Shrubland	7.37
Inter-Mountain Basins Big Sagebrush Shrubland	20.21
Inter-Mountain Basins Mixed Salt Desert Scrub	68.43
Inter-Mountain Basins Semi-Desert Shrub Steppe	3.99
Total	100

Table 3-131. Land-cover types and percentages within the footprints of potential quarry sites[a] (page 2 of 2).

Land-cover type	Area covered (percent)
Quarry ES-7	
Great Basin Xeric Mixed Sagebrush Shrubland	29.69
Inter-Mountain Basins Big Sagebrush Shrubland	48.14
Inter-Mountain Basins Mixed Salt Desert Scrub	20.68
Inter-Mountain Basins Semi-Desert Shrub Steppe	1.48
Total	100
Malpais Mesa	
Great Basin Xeric Mixed Sagebrush Shrubland	6.58
Inter-Mountain Basins Big Sagebrush Shrubland	55.48
Inter-Mountain Basins Mixed Salt Desert Scrub	34.86
Inter-Mountain Basins Semi-Desert Shrub Steppe	3.08
Total	100

a. Source: DIRS 174324-NatureServe 2004.
b. Totals might differ from sums of values due to rounding.
c. < = less than.

Wetlands within and adjacent to the Mina rail alignment were classified as Great Basin foothill and lower mountain riparian woodland and shrubland; North American arid west emergent marsh; and North American warm desert lower montane riparian woodland and shrubland (DIRS 180889-PBS&J 2007, p. 16). Plant species considered indicators of wetland conditions that were found within and adjacent to the Mina rail alignment include bulrushes, sedges, Fremont cottonwood, willows (including sandbar willow), broadleaf cattail (*Typha latifolia*), Baltic rush (*Juncus balticus*), common reed (*Phragmites australis*), tamarisk, and Russian olive (*Eleagnus angustifolia*) (DIRS 180889-PBS&J 2007, p. 17).

Oasis Valley alternative segment 3 contains a small (approximately 0.02 square kilometer [5 acres]) wetland area within the construction right-of-way (Figure 3-210). See Section 3.3.5, Surface-Water Resources, for more specific information on wetlands.

3.3.7.3.2 Wildlife

This section describes the wildlife and wildlife communities potentially present in the Mina rail alignment construction right-of-way. Figures 3-215 through Figure 3-218 detail the manmade wildlife water sources, also called ***wildlife guzzlers***, within the study area. There are 46 wildlife guzzlers within the study area. The largest concentrations of guzzlers are located along Schurz alternative segments 5 and 6 (10 guzzlers), and along Mina common segment 1 (35 guzzlers.) The wildlife guzzlers closest to the Mina rail alignment are DM#24, which is approximately 1.6 kilometers (1 mile) north of Schurz alternative segments 5 and 6; and PI#1 and PI#4, which are both approximately 1.6 kilometers east of Mina common segment 1. Section 3.3.5, Surface-Water Resources, provides information about and locations of other sources of water available to wildlife.

A **wildlife guzzler** is a water development for wildlife that relies on rainfall or snowmelt to recharge it, rather than springs or streams. Usually used where there are no other sources of water for wildlife.

The following sections describe the most common species of mammals, birds, reptiles, amphibians, and fish potentially found within the study area or construction right-of-way of the Mina rail alignment including federally listed threatened and endangered species, and federally and state-listed sensitive or protected species, migratory birds, Nevada game species, and wild horses and burros.

Table 3-132. Wetland and riparian land-cover types within the Mina rail alignment construction right-of-way and study area.[a]

Segment/land-cover type	Amount in construction right-of-way (square kilometers)[b]	Amount in study area (square kilometers)
Schurz alternative segment 1		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0.01	20.75
North American Arid West Emergent Marsh	0	2.90
Schurz alternative segment 4		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0.01	20.04
North American Arid West Emergent Marsh	0	2.86
Mina common segment 1		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.19
North American Arid West Emergent Marsh	0	0.04
Bonnie Claire alternative segment 2		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.03
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0.03
Bonnie Claire alternative segment 3		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.02
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0.07
Oasis Valley alternative segment 1		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.08
North American Arid West Emergent Marsh	0	0.13
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	2.02
Oasis Valley alternative segment 3		
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0.02	2.02
North American Arid West Emergent Marsh	0	0.23
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.08

a. Source: DIRS 174324-NatureServe 2004, all.
b. To convert square kilometers to acres, multiply by 247.10.

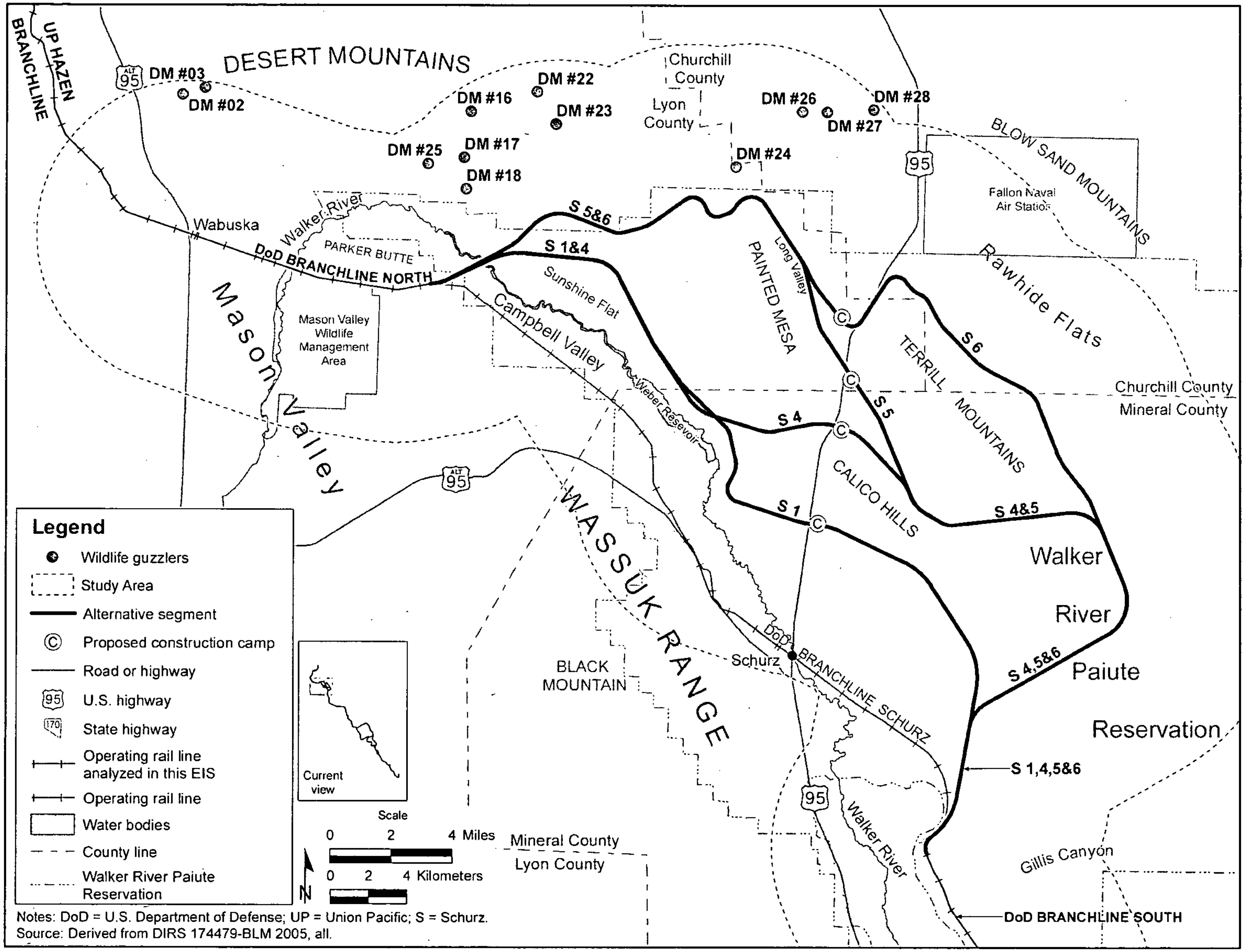


Figure 3-215. Wildlife guzzlers located along the Mina rail alignment in map area 1.

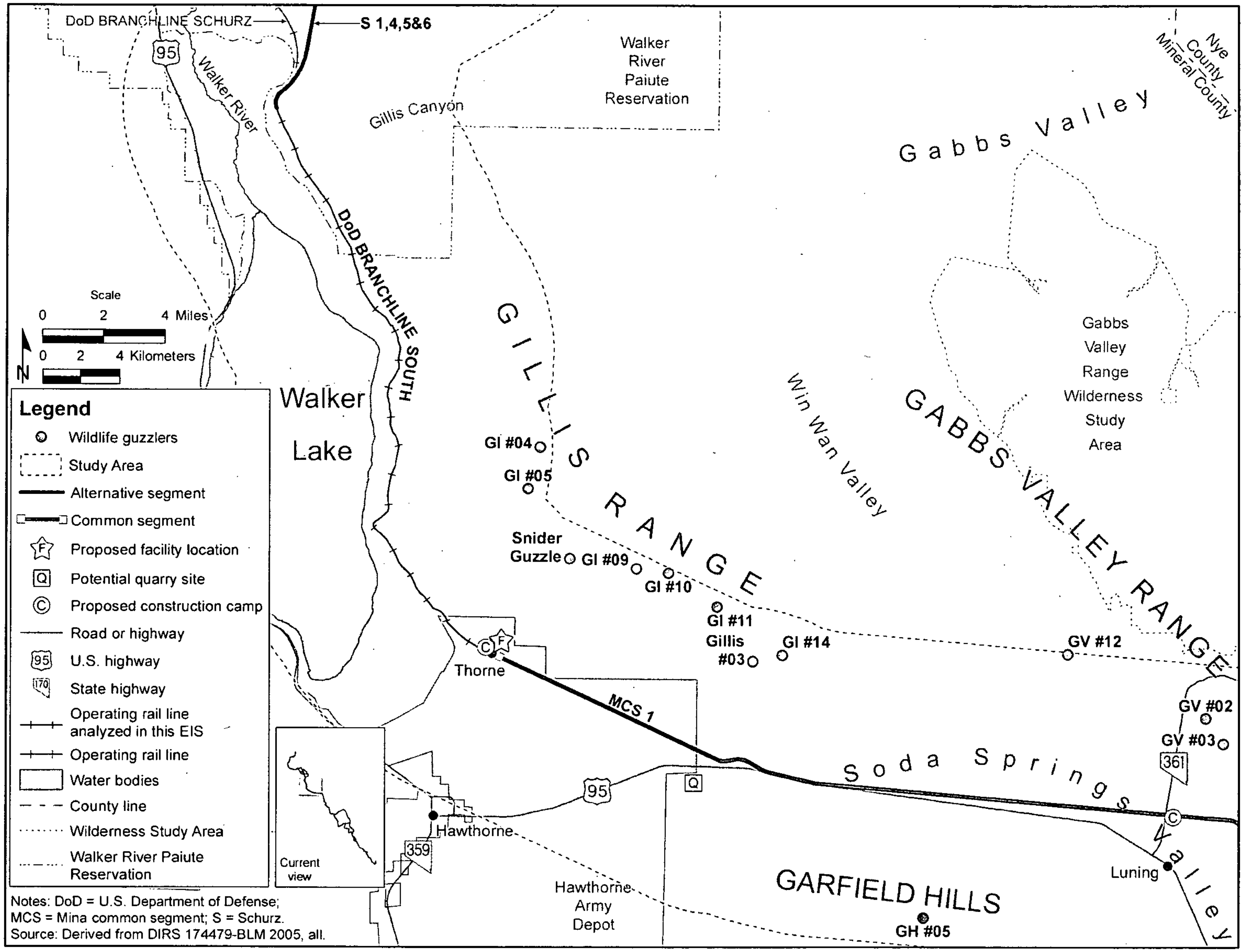


Figure 3-216. Wildlife guzzlers located along the Mina rail alignment in map area 2.

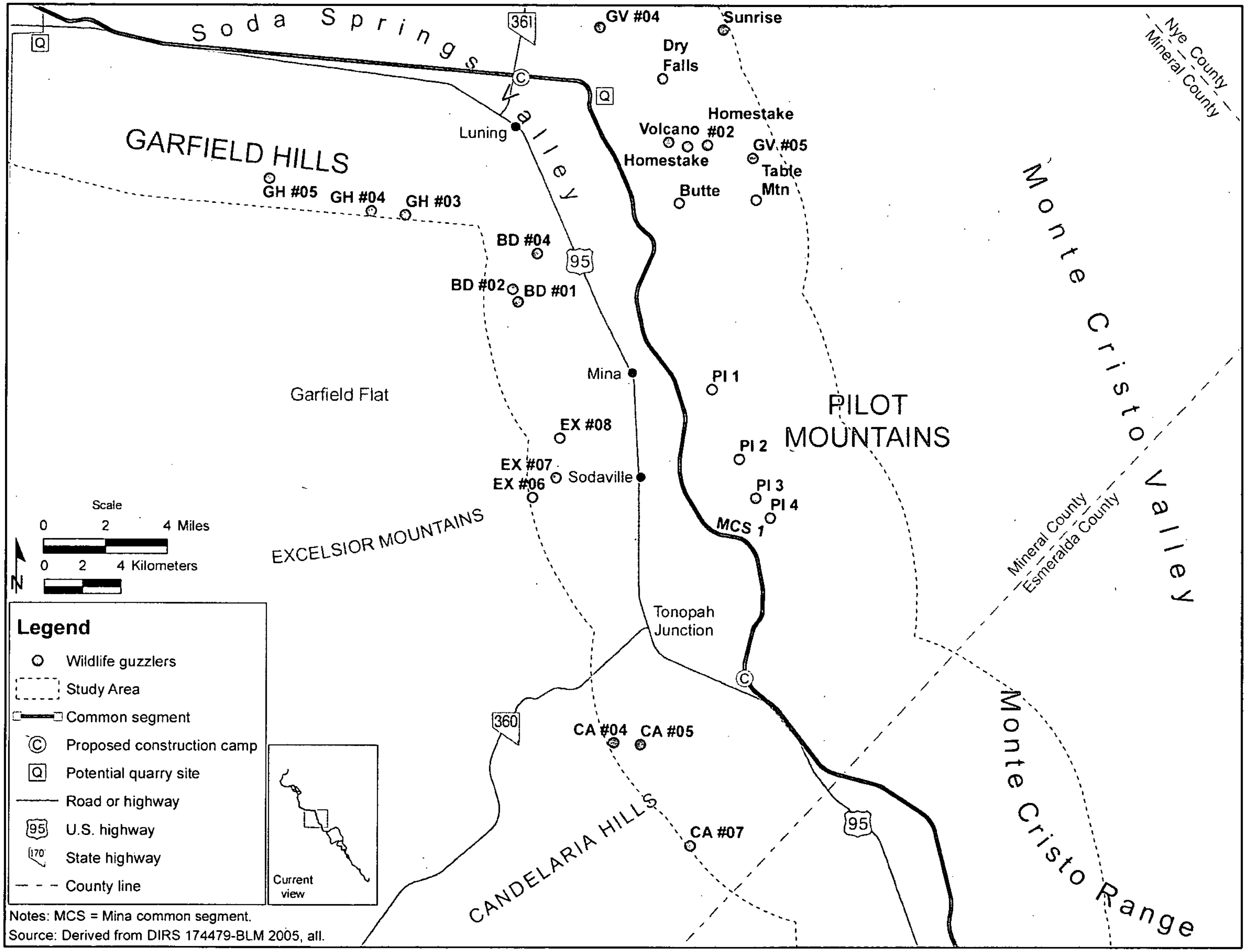


Figure 3-217. Wildlife guzzlers located along the Mina rail alignment in map area 3.

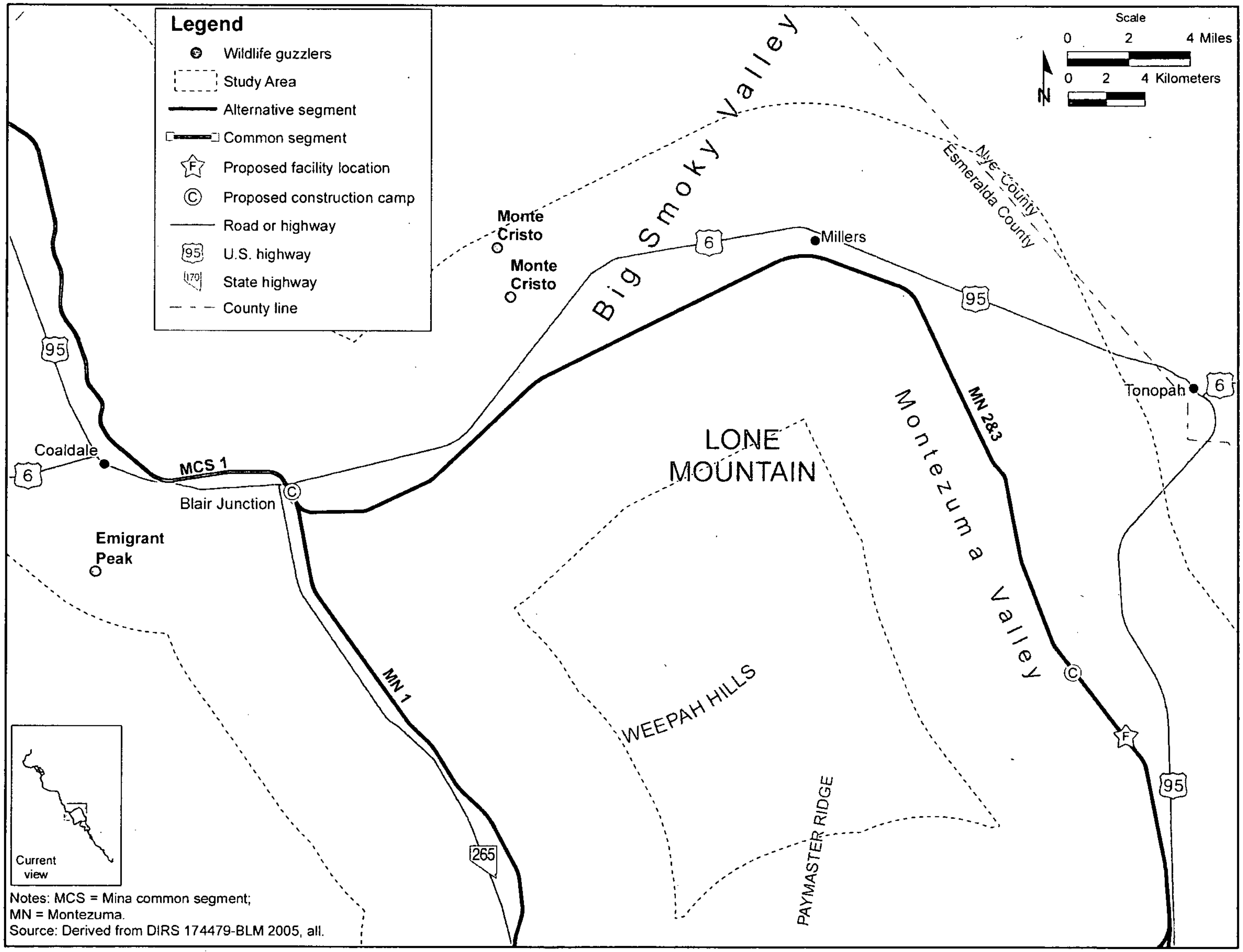


Figure 3-218. Wildlife guzzlers located along the Mina rail alignment in map area 4.

3.3.7.3.2.1 Mammals. Mammals are known to exist within the study area along the entire length of the Mina rail alignment. The types of mammals found within the study area would depend on the vegetation communities. Mammals that occur in the greater study area and the construction right-of-way of the Mina rail alignment include:

- Mountain lion *(Felis concolor)*
- Bighorn sheep *(Ovis Canadensis)*
- Kit fox *(Vulpes macrotis)*
- Coyote *(Canis latrans)*
- Bobcat *(Lynx rufus)*
- Badger *(Taxidea taxus)*
- Beaver *(Castor canadensis)*
- Raccoon *(Procyon lotor)*
- Cottontail rabbit *(Sylvilagus* spp.*)*
- Various rodents
- Pronghorn antelope *(Antilocapra americana)*
- Grey fox *(Urocyon cinereoargenteus)*
- Mule deer *(Odocoileus hemionus)*
- Black-tailed jackrabbit *(Lepus californicus)*
- Ringtail *(Bassariscus astutus)*
- Common muskrat *(Ondatra zibethicus)*
- Striped skunk *(Mephitis mephitis)*
- Various bats
- Ground squirrels (*Spermophilus* spp.)

3.3.7.3.2.2 Birds. A variety of bird species are commonly observed in central and southern Nevada, including year-round residents, summer residents, migratory species breeding in southern Nevada, winter residents that breed to the north, and seasonal migrants passing through central and southern Nevada en route to breeding ranges to the north and winter ranges to the south. Table H-4 in Appendix H lists the bird species that could occur along the Mina rail alignment. Several federal laws and state statutes protect various groups of birds. Chapter 6, Statutory, Regulatory, and Other Applicable Requirements, details these protections.

The Great Basin region of Nevada is an important migration route for waterfowl and other species of birds traveling between southern wintering areas and northern breeding territories; however, suitable habitat for waterfowl and shorebirds is limited to the Walker River, Walker Lake, and other rare open-water areas. No waterfowl or shorebirds were observed during the 2006 field surveys; however, DOE assumes that there are such birds on Walker Lake which may move through the study area and construction right-of-way. Walker Lake is approximately 1 kilometer (0.6 miles) from the Mina rail alignment.

Common species of resident and migrating birds observed along the Mina rail alignment include:

- Common raven *(Corvus corax)*
- Black-billed magpie *(Pica hudsonia)*
- Horned lark *(Eremophila alpestris)*
- Northern oriole *(Icterus galbula)*
- Red-winged blackbird *(Agelaius phoenicius)*
- American crow *(Corvus brachyrhynchos)*
- House wren *(Troglodytes aedon)*
- Killdeer *(Charadrius vociferous)*
- Loggerhead shrike *(Lanius ludovicianus)*
- Yellow warbler *(Dendroica petechia)*

Two upland game bird species are expected to occur within the Mina rail alignment construction right-of-way: chukar (*Alectoris chukar*) and Gambel's quail (*Callipepla gambelii*). Chukars were observed during surveys conducted along the rail alignment. Chukars were recorded in cliff and talus habitat in the Beatty Wash area. Mourning doves are common and were observed at multiple locations along the rail alignment. The greater sage-grouse (*Centrocercus urophasianus*) is a BLM-listed special status species and receives additional protection from the State of Nevada (see Section 3.3.7.3.3). The greater sage-grouse is an upland game bird that has historically occurred in low abundance near portions of the rail alignment, but outside of the study area (Figure 3-219).

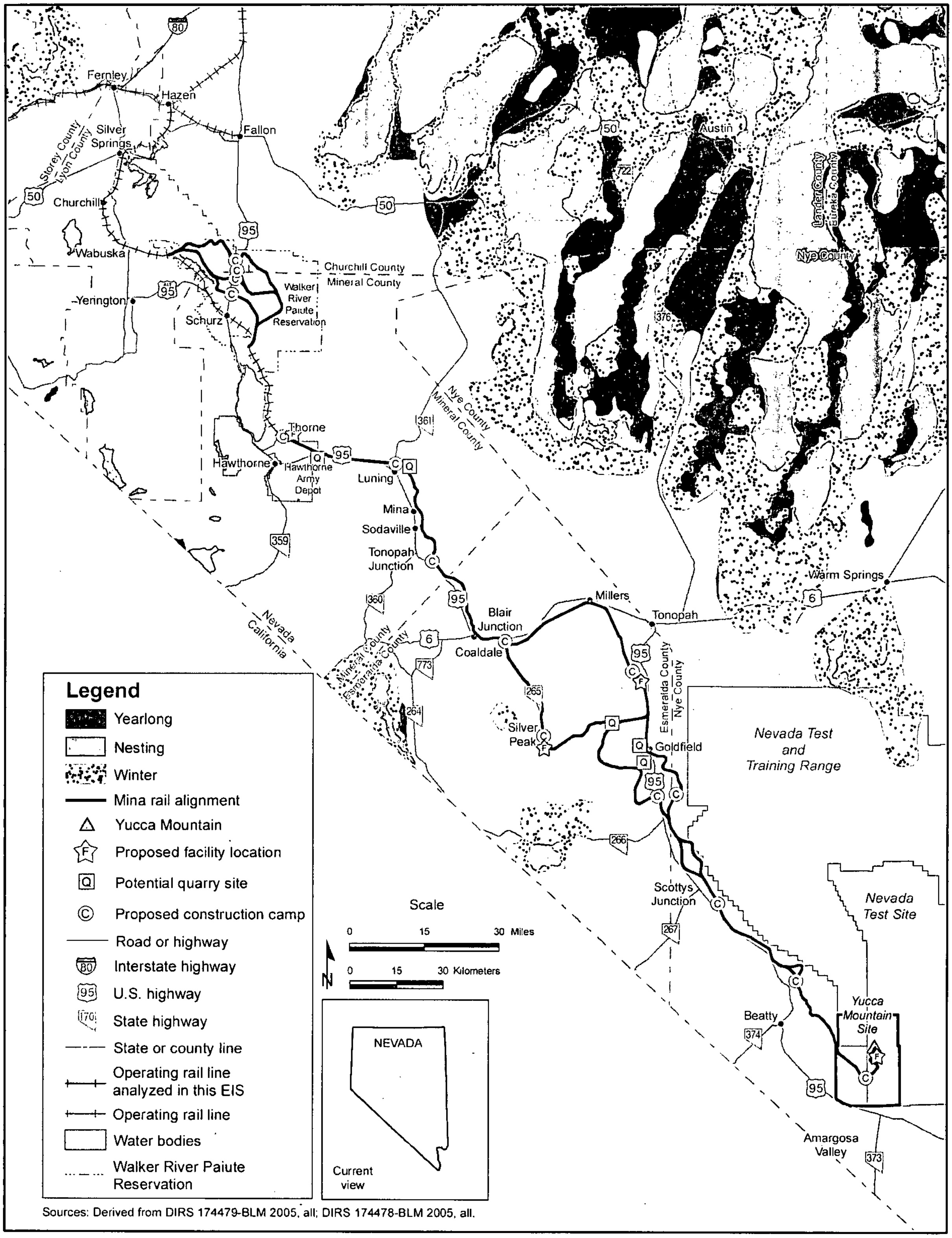


Figure 3-219. Potential greater sage-grouse habitat along the Mina rail alignment.

Populations of raptors are typically low in numbers and occurrence in the rail line construction right-of-way due to minimal roosting, nesting, and foraging potential along the alignment. Raptors observed during field surveys included prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*), northern harrier (*Circus cyaneus*), burrowing owl (*Athene cunicularia*), great-horned owl (*Bubo virginianus*), turkey vulture (*Cathartes aura*), and golden eagle (*Aquila chrysaetos)*. In addition, ferruginous hawks (*Buteo regalis*) have been reported to occupy, and in some cases nest in, areas with trees adjacent to the construction right-of-way (DIRS 174519-Bennet 2005, Plate 5).

Waterfowl are abundant within the study area in the vicinity of the Walker River. Common species include mallard (*Anas playrhynchos*), Canada goose (*Branta canadensis*), and blue-winged teal (*Anas discors*) (DIRS 182302-Miller Ecological Consultants 2005, p.3-30).

Populations of bird species that rely on sagebrush habitat in Nevada are declining because cattle grazing and the proliferation of nonnative weeds have degraded the native sagebrush habitat (DIRS 174518-BLM 2005, pp. 3.6-10 and 3.6-11). Sagebrush-dependent species that might occupy habitat along the proposed rail alignment could include sage thrasher (*Oreoscoptes montanus)*, sage sparrow (*Amphispiza belli*), Brewer's sparrow (*Spizella breweri*), and vesper sparrow (*Pooecetes gramineus*). The Mina rail alignment (Montezuma alternative segments 2 and 3) would cross sagebrush habitat in southeastern Railroad Valley and the Montezuma Range.

3.3.7.3.2.3 Reptiles. A variety of species of lizards and snakes are present throughout the southern Great Basin Desert and northern Mojave Desert and along the Mina rail alignment. Table H-6 in Appendix H lists the reptiles that could occur along the Mina rail alignment The desert tortoise *(Gopherus agassizii)* is found within the proposed rail alignment at its southern end, from the Goldfield area to Yucca Mountain. The most common lizard species observed during the 2005 and 2006 field surveys were:

- Western fence lizard (*Sceloporus occidentalis*)
- Western whiptail lizard (*Cnemidophorus tigris*)
- Long-nosed leopard lizard (*Gambelia wislezenii*)
- Side-blotched lizard (*Uta stansburiana*)
- Sagebrush lizard (*Sceloporus graciosus*)
- Desert horned lizard (*Phrynosoma platyrhinos*)

Other lizard species that were observed, but did not appear to be common, were:

- Zebra-tailed lizard (*Callisaurus draconoides*)
- Desert spiny lizard (*Sceloporus magister*)
- Desert iguana (*Dipsosaurus dorsalis*)

Great Basin collared lizards (*Crotaphytus bicinctores*) and desert night lizards (*Xantusia vigilis*) were not observed during field surveys, but probably occur in the study area and potentially in the construction right-of-way. Chuckwalla (*Sauromalus ater*) commonly occurs in the southern portion of common segment 6, although none were observed during field surveys. This species is found in rocky outcrops and is rarely seen above ground. Various other species of snakes are likely to occur in the study area and potentially in the construction right-of-way, but were not directly observed during field surveys.

3.3.7.3.2.4 Aquatic Species. Aquatic species are species that require wet environments for at least part of their life cycle. The only native fish species found within the Mina rail alignment study area are special status species and include:

- Lahontan cutthroat trout (*Onchorynchus clarki henshawii*)
- Railroad Valley springfish (*Crenichthys nevadae*)
- Oasis Valley speckled dace (*Rhinichthys osculus* ssp. 6 [unnamed])

Nine other species of amphibians may be found in the southern Great Basin Desert and northern Mojave Desert outside of the rail alignment study area or construction right-of-way and are listed in Appendix H. Potential amphibian habitat correlates with the riparian and wetland habitat found along the rail alignment. The Amargosa toad (*Bufo nelsoni*) occurs only in Oasis Valley north of Beatty. Nonnative bullfrogs (*Rana catesbeiana*) are also present in some waterways and water bodies in the Mina rail alignment study area.

3.3.7.3.3 Special Status Species

Special status species are plants or wildlife species that are afforded some level of protection or special management under federal or state laws or regulations. Sections 3.3.7.3.3.1 and 3.3.7.3.3.2 describe two categories for special status species, including threatened or endangered species and BLM special status (designated sensitive) and State of Nevada protected species. Table 3-133 lists special status species, their BLM, State, and federal status, and their likely occurrence within the Mina rail alignment study area. Figures 3-212 and 3-213 show documented locations of special status species along the rail alignment from the Nevada Natural Heritage Program database. Not all special status species listed in Table 3-133 appear on the figures because this table represents a compilation of sources including the BLM, the U.S. Fish and Wildlife Service, the Nevada Department of Wildlife, or the Nevada Division of Forestry, and the Nevada Natural Heritage Program database (DIRS 182061-Hopkins 2006, all). The review of the Nevada Natural Heritage Program database for the study area revealed 54 special status species that occur or may occur within the study area and potentially within the construction right-of-way.

Table 3-133. Special status species potentially within the Mina rail alignment study area[a] (page 1 of 5).

Common name	Species name	Status			Portion of the Mina rail alignment where species could be found
		BLM[b]	State[c]	FWS[d]	
Plants					
Bodie Hills rockcress	*Arabis bodiensis*				
Eastwood milkweed	*Asclepias eastwoodiana*	N		xC2	Montezuma alternative segments 2 and 3
Cima milkvetch	*Astragalus cimae* var. *cimae*				Schurz alternative segments 4 and 5
Sodaville milkvetch	*Astragalus lentiginosus var. sesquimetralis*		P		Mina common segment 1
Black woollypod	*Astragalus funereus*	N		xC2	Common segment 6; Oasis Valley alternative segments 1 and 3
Tiehm buckwheat	*Eriogonum tiehmii*	N		xC2	Mina common segment 1
Dune sunflower	*Helianthus deserticola*				All
Oryctes	*Oryctes nevadensis*				Department of Defense Branchline South; Staging Yard at Hawthorne; Mina common segment 1

Table 3-133. Special status species potentially within the Mina rail alignment study area[a] (page 2 of 5).

Common name	Species name	Status BLM[b]	State[c]	FWS[d]	Portion of the Mina rail alignment where species could be found
Plants (continued)					
Nevada dune beardtongue	*Penstemon arenarius*	N		xC2	Mina common segment 1; Schurz alternative segments 1, 4, and 5; Montezuma alternative segments 2 and 3; common segment 5
Pahute Mesa beardtongue	*Penstemon pahutensis*	N		xC2	Montezuma alternative segments 1 and 3
Rock purpusia	*Ivesia arizonica var. saxosa*	N			Common segment 6
Wassuk beardtongue	*Penstemon rubicundus*				All
Mono County phacelia	*Phacelia monoensis*	N		xC2	
Lone Mountain tonestus	*Tonestus graniticus*	N		xC2	Montezuma alternative segments 1 and 3
Invertebrates					
Oasis Valley pyrg	*P. micrococcus*	N		xC2	Oasis Valley alternative segments 1 and 3; common segments 5 and 6
Nevada viceroy	*Limenitis archippus lahontani*	N		xC2	
Early blue	*Euphilotes enoptes primavera*	N			Department of Defense Branchline South
White Mountains icarioides blue	*Icaricia icarioides albihalos*			xC2	Mina common segment 1
Fish					
Railroad Valley springfish	*Crenichthys nevadae*	--	T	LT	Schurz alternative segments 1 and 6
Oasis Valley speckled dace	*Rhinichthys osculus* spp. 6	N	P	--	Common segments 5 and 6; Oasis Valley alternative segments 1 and 3
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	--	G	LT	Schurz alternative segments 1 and 6; Department of Defense Branchline South
Amphibians and reptiles					
Amargosa toad	*Bufo nelsoni*	N	P	--	Oasis Valley alternative segments 1 and 3; common segments 5 and 6
Southwestern toad	*Bufo microscaphus*	N			Common segment 6
Desert tortoise (Mojave Desert pop.)	*Gopherus agassizii*	N	T	LT	Common segment 6
Chuckwalla	*Sauromalus ater*	N	--	xC2	Common segment 6
Birds					
Common loon	*Gavia immer*	--	P	--	Department of Defense Branchline South
Western snowy plover	*Charadrius alexandrinus nivosus*	N	P	LT*	Department of Defense Branchline South
Western least bittern	*Ixobrychus exilis hesperis*	N	P	xC2	Montezuma alternative segments 1, 2 and 3; common segment 5

Table 3-133. Special status species potentially within the Mina rail alignment study area[a] (page 3 of 5).

Common name	Species name	Status BLM[b]	State[c]	FWS[d]	Portion of the Mina rail alignment where species could be found
Birds (continued)					
White-faced ibis	*Plegadis chihi*	N	P	xC2	Union Pacific Railroad Hazen Branchline; Department of Defense Branchline South; Mina common segment 1; Oasis Valleyalternative segments 1 and 3; common segment 6
Western burrowing owl	*Athenes cunicularia*	N		xC2	All
Flammulated owl	*Otus flammeolus*	N	P	--	None
California spotted owl	*Strix occidentalis occidentalis*	N	P	xC2	None
Greater sage-grouse	*Centrocercus urophasianus*	N	G	--	Union Pacific Railroad Hazen Branchline; Montezuma alternative segment 1
Western yellow-billed cuckoo	*Coccyzus americanus*		P	C	Montezuma alternative segments 2 and 3
Southwestern willow flycatcher	*Empidonax traillii extimus*		E	LE	Montezuma alternative segments 2 and 3; Oasis Valley alternative segments 1 and 3
Ferruginous hawk	*Buteo regalis*	N		xC2	Montezuma alternative segments 2 and 3; common segment 5
Swainson's hawk	*Buteo swainsoni*	N		--	Schurz alternative segment 2; Oasis Valley; common segment 6
Peregrine falcon	*Falco peregrinus*	N	E	NL	Oasis Valley; common segment 6
Bald eagle	*Haliaeetus leucocephalus*	N	E	Delisted 2007	Union Pacific Railroad Hazen Branchline; Schurz alternative segments 1 and 4; Department of Defense Branchline South
Loggerhead shrike	*Lanius ludovicianus*	N	S	xC2	All
Sage thrasher	*Oreoscotes montanus*	N	S	--	Oasis Valley; Montezuma alternative segments 2 and 3
Phainopepla	*Phainopepla nitens*	N		--	Oasis Valley; common segment 6
Brewer's sparrow	*Spizella breweri*	N	S	--	Oasis Valley; Montezuma alternative segments 2 and 3; common segment 6
Mammals					
Pygmy rabbit	*Brachylagus idahoensis*	N	G	xC2	Montezuma alternative segments 1 and 3
Pale kangaroo mouse	*Microdipidops pallidus*	--	P	--	Montezuma alternative segments 2 and 3
Dark kangaroo mouse	*Microdipodops megacephalus albiventer*	N	P	xC2	Montezuma alternative segments 2 and 3
Desert bighorn sheep	*Ovis canadensis*	N	G	--	Mina common segment 1; Montezuma alternative segments 2 and 3; Mina common segment 2; Bonnie Claire alternative segment 2; common segment 5; common segment 6

Table 3-133. Special status species potentially within the Mina rail alignment study area[a] (page 4 of 5).

Common name	Species name	Status BLM[b]	State[c]	FWS[d]	Portion of the Mina rail alignment where species could be found
Mammals (continued)					
Townsend's big-eared bat	*Corynorhinus townsendii*	N	S	--	Schurz alternative segments 1 and 4; Department of Defense Branchline South; Goldfield alternative segment 4; Oasis Valley alternative segments 1 and 3; common segment 6
Spotted bat	*Euderma maculatum*	--	T	xC2	Schurz alternative segments 1 and 4; Department of Defense Branchline South
Western red bat	*Lasiurus blossivillii*	N	S	--	Schurz alternative segments 1 and 4; Department of Defense Branchline South; Goldfield alternative segments 4; common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6
California myotis	*Myotis californicus*	N	--	--	Union Pacific Railroad Hazen Branchline; Schurz alternative segments 1 and 4; Department of Defense Branchline South; Goldfield alternative segment 4; common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6
Little brown myotis	*Myotis lucifugus*	N	--	--	Union Pacific Railroad Hazen Branchline; Schurz alternative segments 1 and 4; Department of Defense Branchline South; Goldfield alternative segment 4; common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6
Small-footed myotis	*Myotis ciliolabrum*	N	--	xC2	Union Pacific Railroad Hazen Branchline; Schurz alternative segments 1 and 4; Department of Defense Branchline South; Goldfield alternative segment 4; common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6
Fringed myotis	*Myotis thysanodes*	N	P	xC2	Union Pacific Railroad Hazen Branchline; Schurz alternative segments 1 and 4; Department of Defense Branchline South; common segment 6
Big brown bat	*Eptesicus fuscus*	N			All segments
Greater western mastiff bat	*Eumops perotis*	N	S	xC2	All segments
Allen's lappet-browed bat	*Idionycteris phyllotis*	N	P	xC2	All segments
Hoary bat	*Lasiurus cinereus*	N			All segments
Pallid bat	*Antrozous pallidus*		P		All segments
Silver-haired bat	*Lasionycteris noctivagans*	N			All segments
California leaf-nosed bat	*Macrotus californicus*	N	S	xC2	All segments
Long-eared myotis	*Myotis evotis*	N			All segments
Cave myotis	*Myotis velifer*	N		xC2	All segments
Long-legged myotis	*Myotis volans*	N			All segments

Table 3-133. Special status species potentially within the Mina rail alignment study area[a] (page 5 of 5).

Common name	Species name	Status BLM[b]	Status State[c]	Status FWS[d]	Portion of the Mina rail alignment where species could be found
Mammals (continued)					
Yuma myotis	*Myotis yumanensis*	N			All segments
Western pipistrelle	*Pipistrellus hesperus*	N			All segments
Brazilian free-tailed bat	*Tadariada brasilliansis*	N	P		All segments

a. Source: DIRS 182061-Hopkins 2006, all.
b. BLM = U.S. Bureau of Land Management. Status definitions: N = designated sensitive by the BLM state office.
c. State = State of Nevada Protected Species (under NAC 503). Status definitions: G = game; P = protected; T = threatened; E = endangered; S = sensitive; CE = critically endangered plant; CY = state-protected cactus and yucca; CE# = recommended for listing as CE.
d. FWS = U.S. Fish and Wildlife Service. Status definitions: LE = listed endangered; LT = listed threatened; C = candidate, xC2= former Category-2 Candidate, now "species of concern;" NL = not listed (removed from list); * = not listed part of range that overlaps project.
e. Numbers refer to unnamed subspecies.

3.3.7.3.3.1 Threatened and Endangered Species. Table 3-133 identifies six federally listed fish and wildlife species, or candidates for listing, with the potential to occur along the Mina rail alignment, including two fish, one reptile, and three bird species. However, in 2007, the U.S. Fish and Wildlife Service de-listed the bald eagle and the golden eagle. These two species are protected under the Bald and Golden Eagle Protection Act, but are no longer federally listed (see Section 3.3.7.3.3.2). There are no federally listed mammals or plant species along the Mina rail alignment.

Fish The Lahontan cutthroat trout was listed as threatened in 1970 under the Endangered Species Act. This species is found in Walker Lake and its associated tributaries, including the Walker River up to the Weber Dam. Currently no Lahontan cutthroat trout are within the area proposed for the crossing of the Walker River due to the passage barrier of Weber Dam. In 2005 the Bureau of Reclamation completed the Record of Decision to repair and modify Weber Dam and include a fish passage structure. This structure is consistent with the recovery plan and will provide passage into the Walker River to the site where the rail line crossing would take place. The analysis for Lahontan cutthroat trout for the Mina rail alignment is based on the future foreseeable action of the Bureau of Reclamation's Record of Decision.

The Lahontan cutthroat trout is an inland subspecies of cutthroat trout belonging to the Salmonidae family. Life history characteristics are greatly influenced by stream conditions. Stream-dwellers generally live less than 5 years, and lake-dwellers live between 5 and 9 years. Lahontan cutthroat trout range between 25 and 38 centimeters (10 and 15 inches) in length, and feed on terrestrial and aquatic insects (DIRS 181900-USFWS 1995, p.22). Lahontan cutthroat trout, like other trout species, are found in a wide variety of cold-water habitats including large terminal alkaline lakes, such as Walker Lake. Generally, Lahontan cutthroat trout occur in cool flowing water with available cover, velocity breaks, well-vegetated and stable stream banks, and relatively silt free, rocky ***substrate*** in riffle-run areas. Spawning occurs in spring or early summer, the timing depending on stream flow and temperature.

Lacustrine Lahontan cutthroat trout populations have adapted to a wide variety of lake habitats from small alpine lakes to large desert waters.

The Railroad Valley springfish was listed as threatened in 1986 under the Endangered Species Act. The Railroad Valley springfish is the only fish species native to the thermal spring systems of Railroad Valley, Nye County, Nevada, and have been introduced into four other springs in Nevada. This species is typically found in warm spring pools, outflow streams, and adjacent marshes. Railroad Valley springfish have been documented to occur at the southernmost of two spring groups near Sodaville, Nevada. Railroad Valley springfish are uniquely adapted to survive in an environment of high water temperature (30° to 38° Centigrade [86° to 100° Fahrenheit] at the spring source) and low dissolved-oxygen content

(1.5 to 6.0 parts per million). In their natural environment, Railroad Valley springfish will occupy habitats with water temperatures at the extremes of their tolerance limits for limited amounts of time. There are no known springfish within the construction right-of-way or habitat that supports them that would be impacted by the Mina alignment.

Amphibians and Reptiles The desert tortoise, which is listed as threatened under the Endangered Species Act and by the State of Nevada (Mojave Desert population only), is found along the southern end of the Mina rail alignment from approximately Beatty Wash to Yucca Mountain (DIRS 101830-Bury et al. 1994, pp. 57 to 72). The desert tortoise's range in this portion of Nevada extends approximately 16 kilometers (10 miles) north of Beatty near Springdale (DIRS 176649-Williams 2003, all). Approximately 48 kilometers (30 miles) of the rail alignment is within potentially suitable desert tortoise habitat (Figure 3-220). Mojave Desert tortoises are generally confined to warm, creosote bush and shadscale (*Atriplex confertafolia*) scrub habitats with well-drained sandy loam soils. These soils are composed of sand or sandy gravel that permit the tortoises to burrow and nest (DIRS 102475-Brussard et al. 1994, p.15). The area through which common segment 6 would pass and the location of the Rail Equipment Maintenance Yard are not designated as critical habitat for the desert tortoise. This area is primarily considered low-density for the desert tortoise, with the population of tortoises at a low level in relation to other areas within the range of this species in Nevada. There are 12 records of this species along common segment 6; the closest record is approximately 0.2 kilometer (0.12 mile) away from common segment 6, which is outside of the construction right-of-way (Figure 3-220).

Birds The southwestern willow flycatcher, listed as endangered under the Endangered Species Act, is potentially present in Nevada from May through September, where it breeds in dense riparian habitat. This species' preferred habitat is typically dominated by willows, cottonwood, or invasive tamarisk. Southwestern willow flycatchers have been documented to occur approximately 19 kilometers (12 miles) north of Beatty, near Oasis Valley (DIRS 182061-Hopkins 2006, all). This recorded occurrence was approximately 4.4 kilometers (2.7 miles) southwest of Oasis Valley alternative segment 1 and well outside the Mina rail alignment construction right-of-way. Potentially suitable foraging and roosting habitat exists along Schurz alternative segments 1 and 4, where it passes within 0.8 kilometer (0.5 mile) of the Walker River. The nearest documented occurrence of this species is approximately 4.5 kilometers (2.8 miles) away from Oasis Valley alternative segment 1, outside the construction right-of-way (DIRS 182061-Hopkins 2006, all). There is no suitable breeding habitat for southwestern willow flycatchers within the construction right-of-way and this species has not been documented within the construction right-of-way. The area with the greatest potential for southwestern willow flycatchers is the area where the new construction would be on the old rail roadbed and where the river crossings would require some of the trees and surrounding riparian vegetation to be removed. However, this habitat is marginal and only a small amount would be affected by construction.

The yellow-billed cuckoo is a federal ***candidate species*** under the Endangered Species Act. The nearest documented nest site for this species was recently located near the City of Caliente and approximately 260 kilometers (160 miles) east of the Mina rail alignment (DIRS 173227-Micone and Tomlinson 2000; DIRS 173228-Gallagher et al. 2001, p. 10; DIRS 173229-Furtek et al. 2002, p. 13-21; DIRS 173230-Furtek et al. 2003, p. 18-23; DIRS 173231-Furtek and Tomlinson 2003, p. 16-22). Yellow-billed cuckoos nest in tall cottonwood trees and willow riparian woodlands in the West and require patches of an average of 0.17 square kilometer (42 acres) of dense riparian habitat with at least 0.03 square kilometer (7 acres) of it closed canopy (DIRS 175505-Laymon and Halterman 1987, pp. 19-25). There is no suitable breeding habitat for yellow-billed cuckoos within the Mina rail alignment construction right-of-way. Potential suitable foraging and roosting habitat for this species is limited to riparian habitat along the Carson and Walker Rivers. These areas of riparian vegetation would not be disturbed during the construction phase. The lack of confirmed records for this species throughout Nevada and the lack of sufficient breeding habitat within the Mina rail alignment construction right-of-way suggest that it is highly unlikely that the yellow-billed cuckoo would occur within the project area.

3.3.7.3.3.2 BLM Special Status and State of Nevada Protected Species. The BLM State Office and the State of Nevada have identified a number of species as requiring conservation and protection. The BLM State Office designates species as sensitive and the State of Nevada designates species as protected. Many of the species designated as sensitive by the BLM are also designated as protected by the State of Nevada. Additionally, a few ***BLM-designated sensitive species*** and State of Nevada-designated protected species are also listed as threatened, endangered, proposed, or candidate under the Endangered Species Act. Federally listed species are addressed above in Section 3.3.7.3.3.1. Table 3-133 lists BLM-designated sensitive and State of Nevada-designated protected species and provides information on their status and known or potential locations along the Mina rail alignment. These species are described below by plant and animal categories.

Plants DOE performed field surveys in June 2006 to confirm the presence of BLM-designated sensitive species and to identify potential habitat for such species along the Mina rail alignment. Appendix H contains detailed survey information.

In addition to location records for BLM-designated sensitive species obtained from the Nevada Natural Heritage Program (DIRS 182061-Hopkins 2006, all), these species were passively observed in other locations with habitat characteristics of the species. Because the field surveys did not cover the entire construction right-of-way, and there is both seasonality to the presence or absence of visible signs of plants and annual variability among plant species, the fact that a BLM-designated sensitive species was not documented at a specific location does not indicate a definitive absence of the species.

Bodie Hills rockcress is found growing in dry, rocky granitic sites associated with sagebrush within pinyon-juniper and mountain sagebrush communities in the range of 2,048-3,039 meter (6,720-9,970 feet) elevations (DIRS 181868-NNHP 2001). This species' known population in Nevada is limited to Mineral county within the Walker River watershed (DIRS 182068-NatureServe 2007). Potential habitat for this species occurs within the Wassuk Range and White Mountains west of Schurz but is not found within the construction right-of-way.

The Eastwood milkweed has been documented approximately 8 kilometers (5 miles) east of Montezuma alternative segments 2 and 3, near Mud Lake (DIRS 182061-Hopkins 2006, all), outside the construction right-of-way. It is also known to occur west of Tonopah and north of Silver Peak, 4.6 kilometers (2.9 miles) east of Montezuma alternative segment 1. Typical habitat for this species consists of sandy soils in mixed desert shrub or salt desert scrub, and sagebrush from 1,400 to 2,150 meters (4,600 to 7,000 feet) elevation (DIRS 181869-NNHP 2001, all).

Typical habitat for Cima milkvetch includes dry, barren calcareous slopes at elevations ranging from 1,554 to 1,956 meters (5,100 to 6,416 feet) (DIRS 181870-NNHP 2001). There are several areas along the Mina rail alignment that support potential habitat for this species, including the Calico Hills within the Terrill Mountain Range on the Walker River Paiute Reservation (Schurz alternative segments 4 and 5) and the southeast-facing side of the Montezuma Mountain Range (Montezuma alternative segments 1 and 3). There is a documented occurrence about 7 kilometers (4 miles) east of Department of Defense Branchline South on the west side of Highway 95 (DIRS 182061-Hopkins 2006, all) but no occurrences within the construction right-of-way for all segments.

Sodaville milkvetch has a limited range in Nevada and is associated with moist, alkaline drainages within the *Sarcobatus* ssp. community type and is wetland-dependent (DIRS 181871-NNHP 2001). This species was proposed to be listed under the Endangered Species Act in 1992 but the proposal was withdrawn in 1998 due to insufficient evidence of its habitat being threatened, and because one population occurs

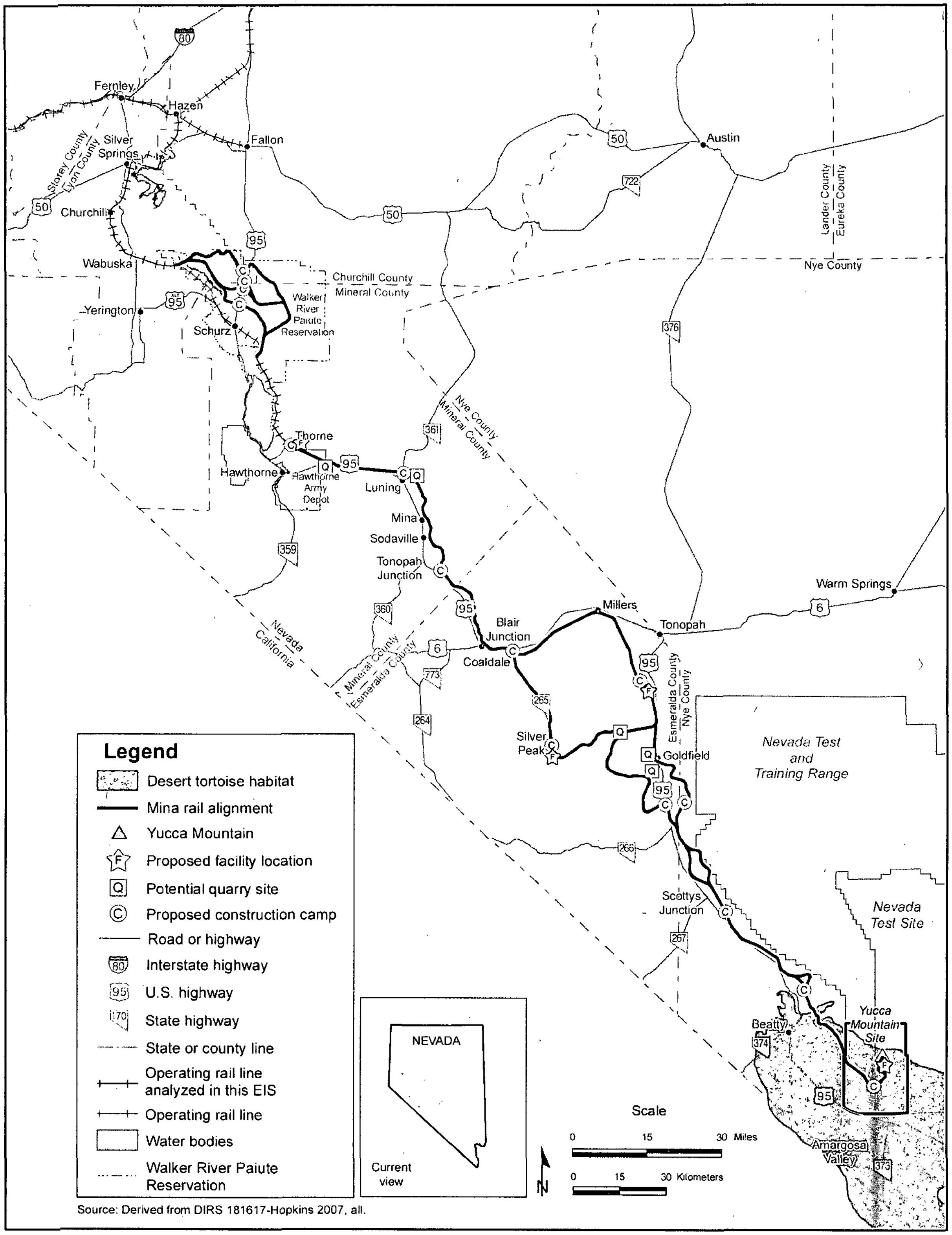


Figure 3-220. Estimated northern extent of potential desert tortoise habitat in relation to the Mina rail alignment.

within lands designated as wilderness, where potential threats are minimized (Death Valley National Monument (*Endangered and Threatened Wildlife and Plants; Withdrawal of Proposed Rule to List the Plants Astragalus Lentiginosus var. micans (shining milk-vetch) and Astragalus Lentiginosus var. sesquimetralis (Sodaville milk-vetch) as Threatened* [63 *FR* 53631, October 6, 1998]). One population has been documented near Sodaville, 2.5 kilometers (1.5 miles) west of Mina common segment 1 (DIRS 182061-Hopkins 2006, all) outside the construction right-of-way. Habitat for this population is associated with Soda Springs.

The black woollypod has been observed approximately 6 kilometers (4 miles) east of U.S. Highway 95, near Beatty Wash (Figure 3-216). The closest occurrence to the alignment is 240 meters (790 feet) southeast of the centerline of common segment 6, within the construction right-of-way. Field surveys along common segment 6 in Beatty Wash confirmed the presence of this species. This plant is common locally on very steep, gravelly slopes of light-colored volcanic tuff in the area where there is little competition from other species. Habitat for this species is characterized by open, talus, or gravelly slopes on alluvium soils composed of volcanic tuff around 975 to 2,340 meters (3,200 to 7,700 feet) elevation (DIRS 181872-NNHP 2001).

Tiehm buckwheat is known to occur within a small distribution range in Nevada in the Silver Peak Range. This species' preferred habitat consists of light-colored clay soils on steep slopes within the *Atriplex confertifolia* community type (DIRS 181873- NNHP 2001). Potential habitat occurs on the slopes within Soda Spring Valley, in the vicinity of Mina common segment 1. However, there are no documented occurrences of this species within the study area or construction right-of-way.

The Dune sunflower is dependent on stabilized vegetated sand dunes or deep, loose sand on flats or slopes, associated with *Tetradymia* ssp. and *Sarcobatus* ssp. community types (DIRS 182786-NNHP 2001). This species has been found just north of the Terrill Mountains, 1.8 kilometers (1 mile) north of Schurz alternative segment 6 and 0.8 kilometer (0.5 mile) southwest of Schurz alternative segment 1. Potential habitat for this species occurs throughout the Mina rail alignment construction right-of-way where deep sandy soils and sand dunes are present, but no species were found.

Oryctes is dependent on sand dunes or deep, loose sand within washes or flats and is associated with various salt desert shrubs (DIRS 181874-NNHP 2001). This species is widely distributed in Nevada but population density at known locations were found to be low (DIRS 181883- NatureServe 2006). Potential habitat occurs on the eastside of Walker Lake at the base of the Agai Pah Hills. There is a known occurrence just northeast of Walker Lake about 4 kilometers (2.5 miles) from Department of Defense Branchline South, and another occurrence 1.4 kilometers (0.8 mile) northeast of Department of Defense Branchline South and 1.2 (0.7 mile) kilometers northwest from the proposed Hawthorne Staging Yard. An additional occurrence is located within Soda Spring Valley, 0.5 kilometer (0.3 mile) from Mina common segment 1 (DIRS 182061-Hopkins 2006, all).

Nevada dune beardtongue is known to occur within sandy soils associated with *Sarcobatus vermiculatus* and *Atriplex canescens* at elevations between 1,195 to 1,817 meters (3,920 to 5,960 feet) (DIRS 181875-NNHP 2001). Potential habitat for this species occurs throughout the proposed Mina rail alignment construction right-of-way, primarily within the areas associated with Mina common segment 1 and Montezuma alterative segments 2 and 3. It has been documented 0.8 kilometer (0.5 mile) west of common segment 5 (DIRS 182061-Hopkins 2006, all).

Potential habitat for the Pahute Mesa beardtongue occurs within juniper-pinyon or sagebrush communities at elevations between 1,634 to 2,512 meters (5,360 to 8,240 feet) in rocky or loose soils (DIRS 181876- NNHP 2001). This species is known to occur within the Montezuma Range, 5.5 kilometers (3.4 miles) from Montezuma alternative segments 1 and 3 (DIRS 182061-Hopkins 2006, all).

Wassuk beardtongue potential habitat occurs within the entire Mina rail alignment. This species prefers rocky to gravelly soils with ephemeral washes, roadsides, and recently disturbed areas (DIRS 181877-NNHP 2001). This species is documented within the east side of the Wassuk Range. The closest recorded occurrence is 6.8 kilometers (4.2 miles) from the Department of Defense Branchline South (DIRS 182061-Hopkins 2006, all). However, several barriers (preventing population expansion and any potential impacts) occur between the rail alignment and this occurrence, including Walker Lake and Highway 95.

Mono County phacelia is typically found within sparsely vegetated disturbed soils or road berms associated with alkaline or clay-like soils at elevations between 1,804 to 2,760 meters (5,920 to 9,055 feet). Documented populations occur within the Wassuk Range (DIRS 181873-NNHP 2001). However, there are no documented occurrences of this species within the study area or construction right-of-way.

Lone Mountain tonestus or granite serpent weed grows within crevices or rock outcrops of granite at high elevations, 2,377 meters (7,800 feet), in the pinyon-juniper zone (DIRS 181878- NNHP 2001). One occurrence has been documented within the Weepah Hills, south of Montezuma alternative segments 2 and 3, and north of Montezuma alternative segment 1, but these occurrences are outside of the study area. There is potential habitat for this species within the Montezuma Peak area within the study area of Montezuma alternative segments 1 and 3, but no individuals were observed within the construction right-of-way during the 2006 and 2007 field surveys.

As defined in Section 3.3.7.3.3, special status species are species that are afforded some level of protection or special management under federal or state laws or regulations. As such, all cacti and yucca are considered special status because they are protected by the State of Nevada and the BLM. All cacti, yucca, and Christmas trees have special consideration under Nevada Revised Statutes Section 527.050, and are protected from unauthorized removal. Removal or possession of any cactus, yucca, or Christmas tree for commercial purposes on any state, county, or privately owned lands is regulated by the State Forester Fire Warden. Removal of such species from private lands would require a permit requisition from the State Forester Fire Warden. DOE would salvage cacti and yucca in accordance with this law and the requirements of applicable land management agencies during the construction phase. Stipulations for salvage are outlined in BLM Manual 6840, *Special Status Species Management* (DIRS 172901-BLM 2001).

Invertebrates The Oasis Valley pyrg, a snail, is known to occur in the Amargosa River drainage in Oasis Valley. Specifically, this snail has been documented to occur in an unnamed spring near Fleur de Lis Spring 12 kilometers (7.5 miles) from the community of Springdale (see Figure 3-220) (DIRS 104593-CRWMS M&O 1999) and potentially inhabits other springs in the Amargosa River drainage. It has been documented to occur approximately 2 kilometers (1.2 mile) southeast of the Oasis Valley alternative segment 1 (DIRS 182061-Hopkins 2006, all). This snail inhabits small springs and stream outflows where it is typically found on stone, travertine, watercress, and plant debris (DIRS 175029-NatureServe Explorer 2005, all).

The larval host plant for the colonial early blue butterfly is wild buckwheat (*Eriogonum* spp.) (DIRS 182785-UC Davis). The closest documented occurrence of this colonial butterfly is approximately 10.5 kilometers (6.5 miles) west of Department of Defense Branchline South (DIRS 182061-Hopkins 2006, all).

In Nevada, the White Mountains Icarioides blue is currently known from Esmeralda and Mineral counties (DIRS 181845- NatureServe 2007) where it feeds primarily on lupine (*Lupinus* spp.). The closest documented occurrence of this rare butterfly is approximately 7.9 kilometers (5 miles) from Mina common segment 1 (DIRS 182061-Hopkins 2006, all).

Fish The Oasis Valley speckled dace occurs in the Amargosa River drainage and Fleur de Lis Spring near Springdale and Beatty, approximately 3 kilometers (1.8 mile) southeast from Oasis Valley alternative segment 1 (see Figure 3-220). This subspecies has a very limited range and is only known from the watershed in Oasis Valley. Specific distribution of this fish varies with available water.

Amphibians and Reptiles The Amargosa toad is found in or near riparian habitats associated with the Amargosa River drainage (Oasis Valley) and at Fleur de Lis Spring, Crystal Spring, Indian Spring, and other springs and seeps near the towns of Springdale and Beatty (DIRS 174414-Stebbins 2003, pp. 209 and 210; DIRS 104593-CRWMS M&O 1999, p. 3-20). Vegetation bordering this toad's habitat includes cottonwood trees, cattails, and sedges. Adult toads hide and rest under bushes and in rodent burrows, and generally hibernate from November to March. If moist soil is available, open water might not be necessary for the adult toad to survive (DIRS 176795-BLM n.d.). The nearest documented occurrence of this species is approximately 2.7 kilometers (1.7 miles) away from Oasis Valley alternative segment 1. This species has also been documented along common segment 6 (DIRS 182061-Hopkins 2006, all).

The chuckwalla has been documented in the southeastern foothills of Yucca Mountain, adjacent to common segment 6. This area represents the chuckwalla's northern-most range in southern Nevada. This large lizard is typically found among talus slopes, large rocky outcrops and boulders, which provide cover and basking sites (DIRS 174414-Stebbins 2003, p. 269-270). This species has not been documented within the study area.

Birds Western burrowing owls are known to occur throughout the Mojave and Great Basin Deserts (DIRS 176455-Dickinson 1999, p. 256). DOE identified one burrowing owl burrow, which appeared to be active, near the Mina rail alignment in the vicinity of Yucca Mountain. Typical burrowing owl habitat is characterized by well-drained, level-to-gently sloping areas in arid or semi-arid environments. This species has been known to overwinter throughout Nevada; however, they are predominantly encountered during their breeding season from mid-March through September (DIRS 176361-Klute et al. 2003, p. 1-12).

Bald eagles almost exclusively occupy habitat associated with large bodies of water during the breeding season, but occasionally use upland areas for food and roost sites. They usually nest in tall trees and they feed opportunistically on fish, waterfowl and seabirds, various mammals, and carrion. In the winter, bald eagles preferentially roost in large, shelter-providing trees (DIRS 180967-NatureServe 2006, all). Nevada's only nesting pair of bald eagles has been documented at the Lahontan Reservoir and approximately 0.97 kilometer (0.6 mile) east of the existing Union Pacific Hazen Branchline (DIRS 181844-Jeffers 2007). In addition to using the Lahontan Reservoir, this species is likely to forage in the Carson and Walker Rivers and Walker Lake and Weber Reservoir.

Ferruginous hawks have been reported to occupy and, in some cases, nest in areas adjacent to the Mina rail alignment (DIRS 174519-Bennet 2005, plate 5). The ferruginous hawk is a relatively rare breeder in the study area. This species prefers to nest in trees; however, in Nevada tall trees are scarce, so the species is often found in pinyon-juniper associations or occasionally on shrubs or rocks on the ground. Potentially suitable habitat for this species is present in higher elevation woodlands near Montezuma alternative segments 1 and 3. No ferruginous hawks or nests were observed during the 2005 or 2006 field surveys, although they have been previously reported in the area.

Peregrine falcons are found in a wide variety of habitats during the breeding season, from tundra, moorlands, steppe, and seacoasts to mountains, open forested regions, and human population centers. They typically nest on rocky cliffs. Outside the breeding season, the falcons occur in areas where prey (primarily birds) concentrate, including farmlands, marshes, lakeshores, river mouths, tidal flats, dunes and beaches, broad river valleys, cities, and airports (DIRS 180966- NatureServe 2006, all). There is potential nesting habitat for peregrine falcons on cliffs throughout the Mina rail alignment but outside the construction right-of-way for all segments.

Loggerhead shrikes have been documented along the Mina rail alignment where suitable habitat is present. Habitat used by this species during the breeding season includes open country with scattered trees and shrubs, savanna, desert scrub (southwestern U.S.) and, occasionally, open woodlands (DIRS 180963- NatureServe 2006, all). They typically nest in thick brush, shrubs, or small trees in open areas. Potentially suitable habitat for loggerhead shrikes occurs along all segments of the Mina rail alignment.

Sage thrashers are known to occur in sagebrush habitat within the Mina rail alignment construction right-of-way. Habitat for this bird species consists of large stands of sagebrush, which can be found in areas where the rail alignment would cross mountain ranges, including the Blow Sand Mountains, Wassuk Range, Clayton Ridge, Goldfield Hills, and Montezuma Range. There is potential sagebrush habitat within the Railroad Valley.

Phainopepla is known to occur in the southern portion of the Mina rail alignment at Oasis Valley and common segment 6. This species inhabits desert scrub and desert woodland habitats (DIRS 176455-Dickinson 1999, p. 364).

Brewer's sparrows are strongly associated with sagebrush over most of their range, in areas with scattered shrubs and short grass (DIRS 180959- NatureServe 2006, all). Sagebrush habitat can be found in areas where the rail alignment would cross mountain ranges, including Blow Sand Mountains, Wassuk Range, Clayton Ridge, Goldfield Hills, and Montezuma Range. Brewer's sparrows are likely to occur in sagebrush habitat within the Mina rail alignment construction right-of-way.

Mammals The State of Nevada classifies desert bighorn sheep as a game species. As further discussed in Section 3.3.7.3.5, the State of Nevada manages the desert bighorn sheep as a game species throughout the state.

The pygmy rabbit (*Brachylagus idahoensis*), a small sagebrush-dependent rabbit, is well distributed throughout the Great Basin; however, overall the populations tend to be locally clustered in areas of high-density sagebrush, which they use for both cover and food. Field surveys did not indicate the presence of pygmy rabbit habitat in the study area of the Mina rail alignment (DIRS 174519-Bennett 2005, Plate 3). The nearest documented sign (scat) of a pygmy rabbit is from the Kawich Range in Nye County and more than 120 kilometers (75 miles) east of the Mina rail alignment study area (DIRS 181899-USAF 2007, pp. 50 and 51. There is no known suitable pygmy rabbit habitat within the construction right-of-way or study area of the Mina alignment.

The dark kangaroo mouse and the closely related pale kangaroo mouse are known to occur in appropriate habitat near Goldfield (DIRS 174519-Bennett 2005, plate 1 and 2). Habitat for these two mice species is characterized by alkali (salt) sinks and desert scrub dominated by shadscale or big sagebrush. These rodents usually prefer soft sand accumulated at bases of shrubs for burrow sites (DIRS 176370-O'Farrell and Blaustein 1974, p. 1-2; DIRS 176372-O'Farrell and Blaustein 1974, p. 1).

There are 23 species of bats in Nevada. In general, bats are highly mobile and all of the 23 species could at some time of the year fly over or, if appropriate habitat exists, roost and forage near the Mina rail alignment. Twenty-one of the 23 species of bats that occur in Nevada are considered BLM-sensitive (DIRS 172900-BLM 2003, p. 2) and nine are State of Nevada protected. Of these bat species, seven have a strong probability of utilizing habitat along the rail alignment (DIRS 181865-Bradley et al. 2006), as follows:

- Pallid bat
- Townsend's big-eared bat
- Small-footed myotis bat
- Western pipistrelle bat

- Big brown bat
- California myotis bat
- Brazilian free-tailed bat

All of these bat species are commonly found throughout the Mojave and southern Great Basin Deserts. These species are known to roost in cliff faces, caves, rocky outcrops, and man-made structures where available. Bats are also known to forage over natural or artificial water sources.

3.3.7.3.4 Migratory Birds

More than 300 species of birds are commonly observed in southern Nevada, including year-round residents, seasonal migrants that breed in southern Nevada, winter residents that breed in the north, and seasonal migrants that pass through southern Nevada while traveling in spring and fall between breeding ranges to the north and winter ranges to the south. All of the migratory birds found along the Mina rail alignment are protected under the Migratory Bird Treaty Act (16 U.S.C. 703 *et seq.*) and Executive Order 13186. Appendix H, Table H-4, lists bird species that could occur in the construction right-of-way.

3.3.7.3.5 State of Nevada Game Species

The Mina rail alignment would cross several areas designated as game habitat (DIRS 173224-BLM 1997, Maps 9-13; DIRS 174518-BLM 2005, Maps 3.6-1 to 3.6-4). As shown in Table 3-133, three game species that occur, or have the potential to occur, within or near the construction right-of-way are cross-listed as BLM-designated sensitive, are state protected, or both. The game species that are also BLM-designated sensitive include greater sage-grouse, pygmy rabbit, and desert bighorn sheep. The Nevada Department of Wildlife actively manages the desert bighorn sheep as a big game animal. Its distribution is shown on Figure 3-221. Other game species that could be affected by the proposed railroad construction and operation include mule deer, pronghorn antelope, and mountain lion. Figures 3-222 and 3.3.7-28 indicate the general habitat locations for mule deer and pronghorn antelope, respectively. Mountain lions occur throughout the State of Nevada in canyon, mountain, and forested areas; therefore, no distribution map is included for this species.

3.3.7.3.5.1 Desert Bighorn Sheep. Desert bighorn sheep are found predominantly in lower foothills and grasslands of mountain ranges, often where terrain is rough, rocky and steep, and broken up by canyons and washes. Desert bighorn sheep require access to freestanding water, especially during the summer, and distribution of water holes significantly influences patterns of home-range movement (DIRS 176363-Shackleton 1985, p. 4). Any natural or artificial water sources within this species' range could be subject to desert bighorn use. Year-round habitat for this species is found throughout much of the Mina alignment from south of Schurz to the Yucca Mountain Site. Common segment 6 would cross a ***movement corridor***, or an area of high use at certain times of the year, in the Beatty Wash area (Figure 3-221). The Mina rail alignment does not cross any crucial habitat for this species.

3.3.7.3.5.2 Mule Deer. Mule deer are fairly common in southern Nevada and throughout the western United States, and are found in a variety of habitats from coniferous forests at high elevations to desert shrub, chaparral, and grasslands at lower elevations (DIRS 176454-Whitaker 1992, p. 652). Mule deer are often associated with successional vegetation, especially near agricultural lands. Mule deer are found along the entire Mina rail alignment (Figure 3-222), but would most likely be encountered near the communities of Wabuska and Silver Peak. The rail alignment would not cross any mule deer crucial habitat.

3.3.7.3.5.3 Pronghorn Antelope. Most of the Mina rail alignment would abut year-round pronghorn antelope habitat located east of the rail alignment from Schurz to Beatty (Figure 3-223). The only areas of the rail alignment that would cross year-round pronghorn habitat would be between Churchill and Wabuska and also between Mills and Goldfield. Pronghorn antelope are generally found at lower elevations in open desert grasslands, salt desert scrub, or bunchgrass-sagebrush vegetation in the valleys and foothills throughout the western United States. This species also occurs in dense sagebrush communities at higher elevations during the breeding season (DIRS 176454-Whitaker 1992, pp. 662 and 663). The Nevada Department of Wildlife did not identify these areas as pronghorn antelope augmentation sites.

3.3.7.3.5.4 Mountain Lion. Mountain lions occur throughout the State of Nevada in low numbers in canyon, mountainous, and forested areas (DIRS 103439- Hall 1995, pp. 269 to 271) and are known to occur within the study area of the Mina rail alignment. Adult mountain lions are generally tawny in color with a white underbelly and are approximately 6 to 8 feet long (DIRS 103439- Hall 1995, pp. 269 to 271). The mountain lion's diet consists mostly of deer; however, they will also feed on rabbits and large rodents. This species is shy, solitary, secretive, and active mostly at night (DIRS 103439-Hall 1995, pp. 269-271).

Section 3.3.7.3.5 provides more information on this species and the other game mammals present in the study area.

3.3.7.3.6 Wild Horses and Burros

Wild horses are generally presumed to descend from horses that were released by, or escaped from, settlers of western North America, possibly dating as far back as Spanish settlers in the 1600s. The size, color, and confirmation of the horses depend on the type of stock or breed from which the wild horses descended (DIRS 174518-BLM 2005, p. 3.8-1).

Generally, burros live in the lower elevations year-round, while wild horses reside in the higher elevations in summer and migrate to the lower elevations in winter. Both wild horses and burros will travel as far as 16 kilometers (10 miles) away from permanent water sources. Their diets vary–burros prefer shrubs, horses tend to prefer grasses (DIRS 103079-BLM 1998, p. 3-48).

Wild horse herd areas were originally identified by federal agencies in 1971, with passage of Public Law 92-195, the Wild Free-Roaming Horses and Burros Act. The BLM has delineated herd management areas within the wild horse herd areas. Each herd management area has an appropriate management level determined by the BLM through a rangeland assessment and a public review process. The appropriate management level is the number of wild horses and burros the herd management area population is managed to, and it is established to avoid the ecological degradation of the herd management area and any riparian areas within each herd management area (DIRS 176364-State of Nevada [n.d.], all)

The Mina rail alignment would cross approximately 7 designated wild horse and burro herd management areas (Figure 3-214). Appendix H provides detailed information on the individual herd management areas. Table 3-134 identifies each Mina rail alignment alternative segment and common segment that would cross or lie within herd management areas and describes the location, size, and management level of each herd management area.

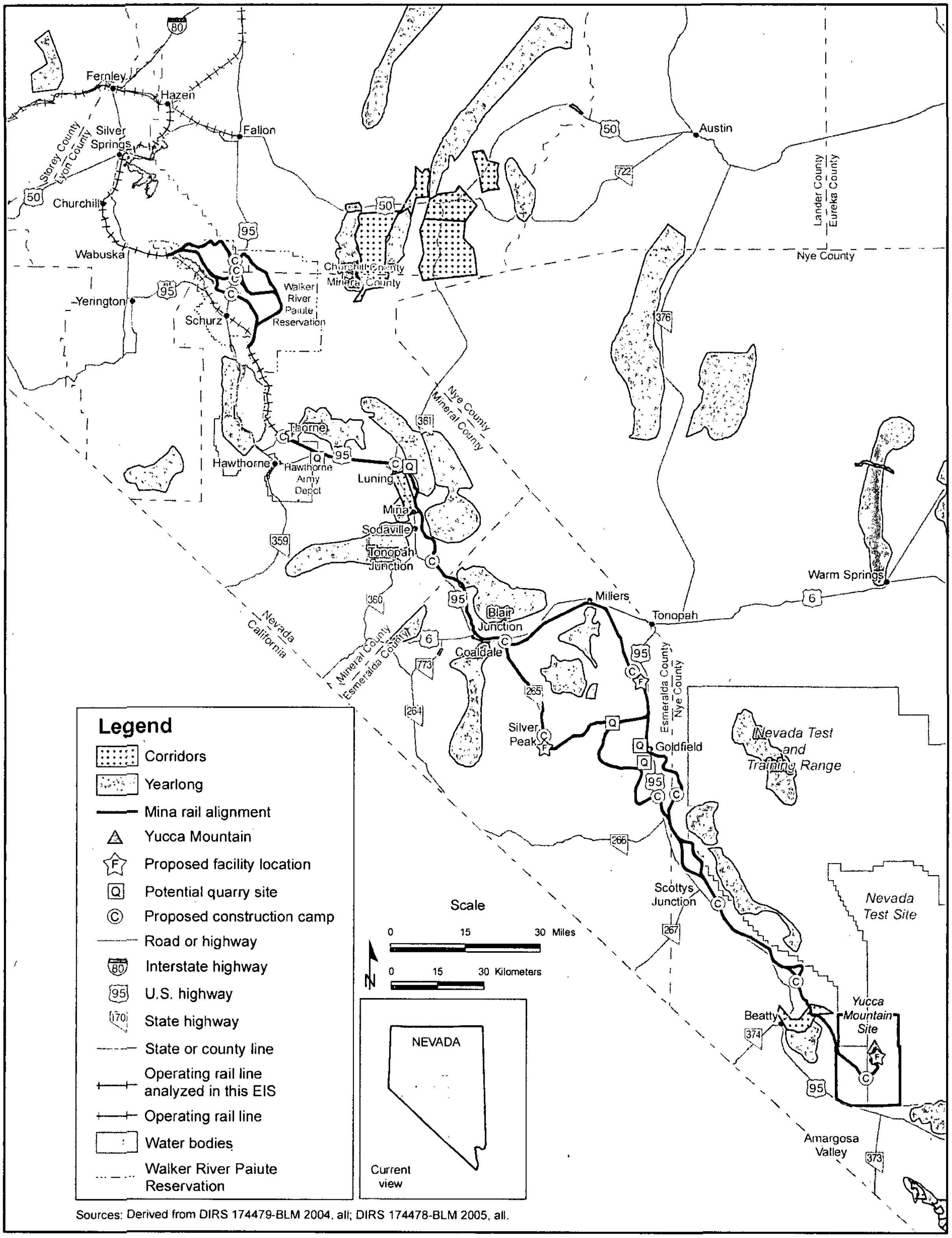


Figure 3-221. Desert bighorn sheep habitat along the Mina rail alignment.

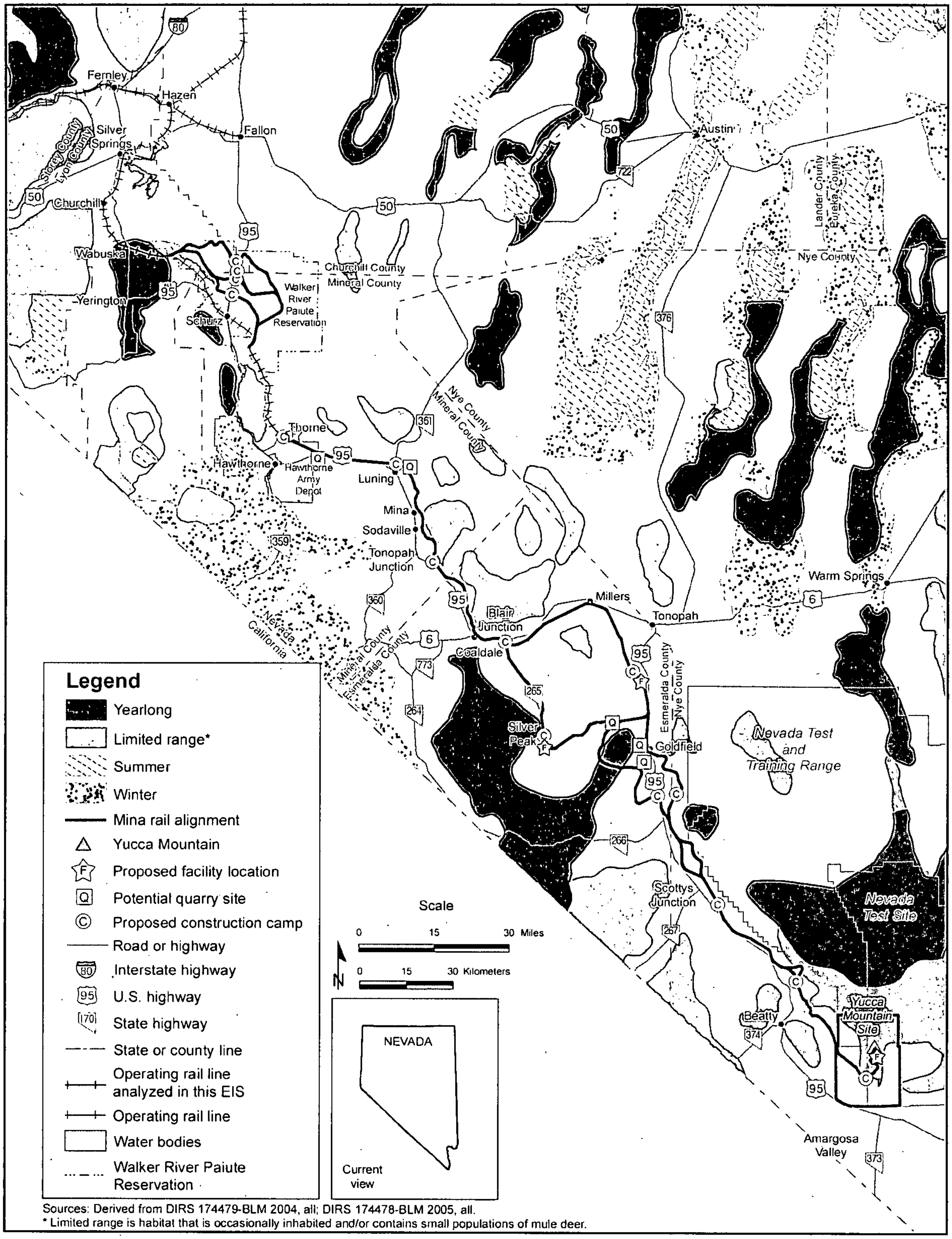


Figure 3-222. Mule deer habitat along the Mina rail alignment.

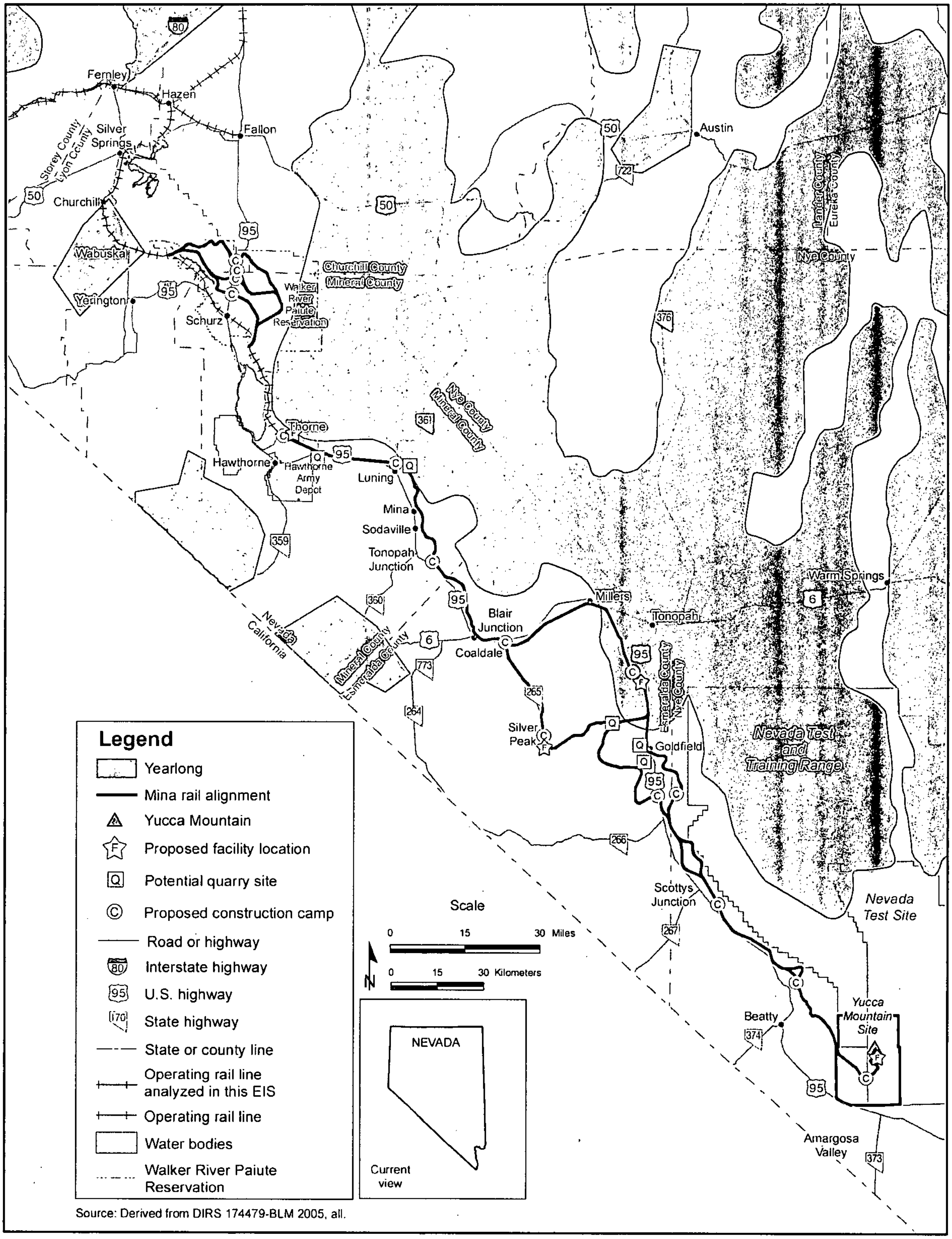


Figure 3-223. Pronghorn antelope habitat along the Mina rail alignment.

Table 3-134. Herd management areas the Mina rail alignment would cross.[a]

Herd management area	Location[b]	Area (square kilometers)[c]	Appropriate management level	Segment that would cross area
Horse Mountain	North of Schurz	193	0	Schurz alternative segment 6
Pilot Mountain	North-northeast of U.S. Highway 95, from Thorne to Blaire Junction	1,937	346 horses 0 burros	Mina common segment 1
Silver Peak	East of Silver Peak	970	61 horses 15 burros	Montezuma 1
Goldfield	East of Goldfield	260	125 horses 50 burros	Montezuma 2
Montezuma Peak	West of Goldfield	310	146 horses 10 burros	Montezuma alternative segments 1, 2, and 3
Stonewall	West of Lida Junction and south of Goldfield	100	50 horses 25 burros	Mina common segment 2; Bonnie Claire alternative segments 2 and 3
Bullfrog	Surrounds Beatty	520	12 horses 185 burros	Oasis Valley alternative segments 1 and 3; common segment 6

a. Sources: DIRS 174047-Bennett 2005; DIRS 174046-Bennett 2005; DIRS 174479-BLM 2003; DIRS 174478-BLM 2005; DIRS 174329-BLM n.d.; DIRS 174333-BLM n.d.; DIRS 174332-BLM n.d.; DIRS 174330-BLM n.d.; DIRS 173064-BLM 2007; DIRS 173063-BLM 2005; DIRS 173062-BLM 2005; DIRS 173061-BLM 2005; DIRS 173060-BLM 2005; DIRS 173059-BLM [n.d.]; DIRS 173057-BLM 2005; DIRS 174518-BLM 2005, DIRS 181843 Axtell 2007.

b. To convert kilometers to miles, multiply by 0.62137.

c. To convert square kilometers to acres, multiply by 247.10.

3.3.8 NOISE AND VIBRATION

This section describes existing noise and vibration in the Mina rail alignment region of influence. Section 3.3.8.1 describes the region of influence; Section 3.3.8.2 describes general regional characteristics for noise and vibration; and Section 3.3.8.3 describes the existing noise and vibration in more detail for the Mina rail alignment alternative segments and common segments.

Noise is considered a source of pollution because it can be a human health hazard. Potential health hazards range from hearing impairment at very high noise levels to annoyance at moderate to high noise levels. Sound waves are characterized by frequency and measured in ***hertz***; sound pressure is expressed as ***decibels*** (dB). Appendix I, Noise and Vibration Assessment Methodology, provides more information on the fundamentals of analyzing noise.

With the exception of prohibiting nuisance noise, neither the State of Nevada nor local governments have established numerical noise standards. Nevertheless, many federal agencies use ***day-night average noise levels*** (DNL) as guidelines for land-use compatibility and to assess the impacts of noise on humans.

> **Day-night average noise level (DNL):** The energy average of A-weighted decibels (dBA) sound level over 24 hours; includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the day.
>
> **A-weighted decibels (dBA):** A measure of noise level used to compare noise from various sources. A-weighting approximates the frequency response of the human ear.

For the operation of trains during proposed railroad construction and operations, DOE analyzed noise impacts under established STB criteria. The STB has environmental review regulations for noise analysis (49 CFR 1105.7e(6)), with the following criteria:

- An increase in noise exposure as measured by DNL of 3 ***A-weighted decibels*** (dBA) or more.
- An increase to a noise level of 65 DNL or greater.

If the estimated noise level increase at a location exceeds either of these criteria, the STB then estimates the number of affected noise-***sensitive receptors*** (such as schools, libraries, residences, retirement communities, nursing homes). The two components (3 dBA increase, 65 DNL) of the STB criteria are implemented separately to determine an upper bound of the area of potential noise impact. However, current noise research indicates that both criteria components must be met to cause an adverse impact from noise (DIRS 173225-STB 2003, p. 4-82). That is, noise levels would have to be greater than or equal to 65 DNL <u>and</u> increase by 3 dBA or more for an adverse noise impact to occur.

There are three potential ground-borne vibration (vibration propagating through the ground) impacts of general concern: annoyance to humans, damage to buildings, and interference with vibration-sensitive activities. To evaluate potential impacts of vibration from construction and operations activities, DOE used Federal Transit Administration building vibration damage and human annoyance criteria. Under these criteria, if vibration levels exceeded 80 VdB (human annoyance criterion for infrequent events) or if the vibration levels (measured as ***peak particle velocity***) exceeded 0.20 inches per second for fragile buildings or 0.12 inches per second for extremely fragile historic buildings, then there could be an impact from vibration (DIRS 177297-Hanson, Towers, and Meister 2006, all). Appendix I provides more information on the vibration metrics used in this study.

3.3.8.1 Region of Influence

> **Ambient noise:** The sum of all noise (manmade and natural) at a specific location over a specific time is called ambient noise.

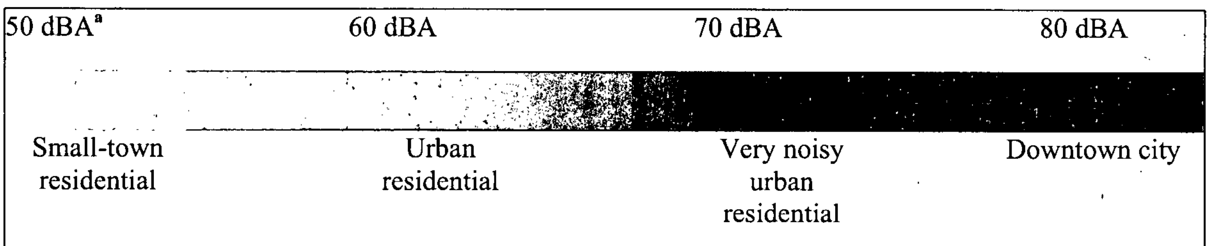
The region of influence for noise and vibration for construction and operation of a rail line along the Mina rail alignment includes the construction right-of-way out to variable distances, depending on several analytical factors (***ambient noise*** level, train speed, number of trains per day, and number of railcars). Similarly, the region of influence for the railroad construction and operations support facilities depends on the magnitude of noise that would be generated and ambient noise levels, which would affect how far away the noise might be heard.

The region of influence for the Mina rail alignment also includes the existing Union Pacific Hazen Branchline from Hazen to Wabuska and the existing Department of Defense Branchlines (North, through Schurz, and South) from Wabuska to Hawthorne. These existing rail lines are included in the region of influence because under the Proposed Action, rail traffic on these lines would increase substantially above existing levels. STB regulations at 49 CFR Part 1105.7(e)(6) require analysis of potential noise impacts where a proposed action would result in an increase in rail traffic of at least 100 percent (measured in gross ton miles annually).

In areas with low ambient noise conditions along the Mina rail alignment, project-related noise might be heard farther away. Therefore, the region of influence varies along the rail alignment. In addition, DOE has reviewed recent aerial photographs along the entire rail alignment to identify the locations of receptors in the region of influence that might be affected by noise, vibration, or both.

3.3.8.2 General Regional Characteristics for Noise and Vibration

The Mina rail alignment is primarily in a quiet desert environment where natural phenomena such as wind, rain, and wildlife account for most of the ambient noise. Manmade noise in some areas of the region of influence is caused by vehicles traveling along public highways and high altitude commercial jets. At present, there is train activity on the existing Union Pacific Hazen Branchline from Hazen to Wabuska and on the existing Department of Defense Branchline from Wabuska to Hawthorne. Baseline noise conditions vary somewhat along the rail alignment and are site-specific. Most of the region of influence for the Mina rail alignment is typical of other desert environments in which the DNL values range from 14 decibels on a calm day to 38 decibels on a windy day (DIRS 102224-Brattstrom and Bondello 1983, p. 170). Areas within the region of influence are sparsely populated and, in general, ambient noise levels are low. The noise level at a specific location depends on nearby and distant sources of noise. Noise levels in populated areas tend to be higher than in unpopulated areas because of human activity and higher levels of transportation noise (Figure 3-224).



a. dBA = A-weighted decibels.
b. Source: DIRS 101821-EPA 1974, p. 23.

Figure 3-224. Typical DNLs for residential areas.[b]

Ground-borne vibration occurs as a result of both natural phenomena (such as seismic activity) and manmade activities (such as construction and transportation activities). Human activities that can create perceptible levels of ground-borne vibration are important when sensitive sites, structures, or activities could be affected. Background vibration exists as a component of the overall effects of ground-borne vibration, higher in areas with more human activity, lower in areas more distant from human activities. Vibration levels in populated areas tend to be higher than in unpopulated areas because of human activity and higher levels of transportation vibration. Background levels of ground-borne vibration along the Mina rail alignment are low.

3.3.8.3 Existing Environments for Noise and Vibration at Four Measurement Locations along the Mina Rail Alignment

DOE evaluated existing noise and vibration conditions along the Mina rail alignment and compiled the detected ranges of noise and vibration levels at different locations under different conditions. Up to four trains per week travel on the existing track in Silver Springs and two trains per week in Schurz. Locomotive horns are currently sounded at three grade crossings in Silver Springs. Because existing rail traffic volume is low, DOE measured existing noise and vibration to represent existing conditions. Most of the region of influence for the rail alignment is sparsely populated and, in general, ambient noise levels are low and there are no detectable vibrations. DOE measured ambient noise and vibration levels from March 5 to March 6, 2007, at two locations along the Mina rail alignment (Silver Peak and Mina) and two locations along the existing Union Pacific Hazen Branchline and Department of Defense Branchlines (Schurz and Silver Springs). DOE had also taken ambient noise and vibration measurements at Goldfield on January 12, 2005. DOE selected these locations for ambient noise and vibration measurements because they are representative of the few populated areas within the region of influence. The ambient noise measurements at these representative locations along the rail alignment ranged from 34 to 48 DNL and ambient vibration levels were so low that they were essentially unmeasurable for Silver Springs, Schurz, Mina, and Silver Peak. The measured ambient vibration level in Goldfield was 25 VdB. Table 3-135 summarizes the measured ambient noise levels in Goldfield, Silver Peak, Mina, Schurz, and Silver Springs.

Table 3-135. Ambient noise measurements along the Mina rail alignment.

Location	DNL dBA[a]
Silver Springs	47
Schurz	48
Mina	44
Silver Peak	34
Goldfield	47

a. DNL dBA = day-night average noise level in A-weighted decibels.

3.3.8.3.1 Silver Peak

DOE took noise measurements for a 24-hour period in Silver Peak, Nevada, on March 5, 2007. The measured DNL was 34 dBA. Because there was almost no observable human activity in this area during the measurements, noise levels were very low. Measured noise levels at Silver Peak are substantially lower than the "small-town residential" category shown on Figure 3-224.

Figure 3-225 shows measured noise levels taken at Silver Peak over a 24-hour period. Hourly ***equivalent sound levels*** ranged from 17 to 39 dBA. There was little observable human activity during the measurements, except for very infrequent car passbys and occasional high-altitude commercial jet aircraft. Figure 3-226 shows the location where DOE took the ambient noise measurements in Silver Peak.

> **Equivalent sound level (Leq):** A single value of sound level for any desired duration (such as 1 hour), which includes all of the time-varying sound energy in the measurement period. Leq correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns. It is used when only the durations and levels of sound, and not their times of occurrence (day or night), are relevant.

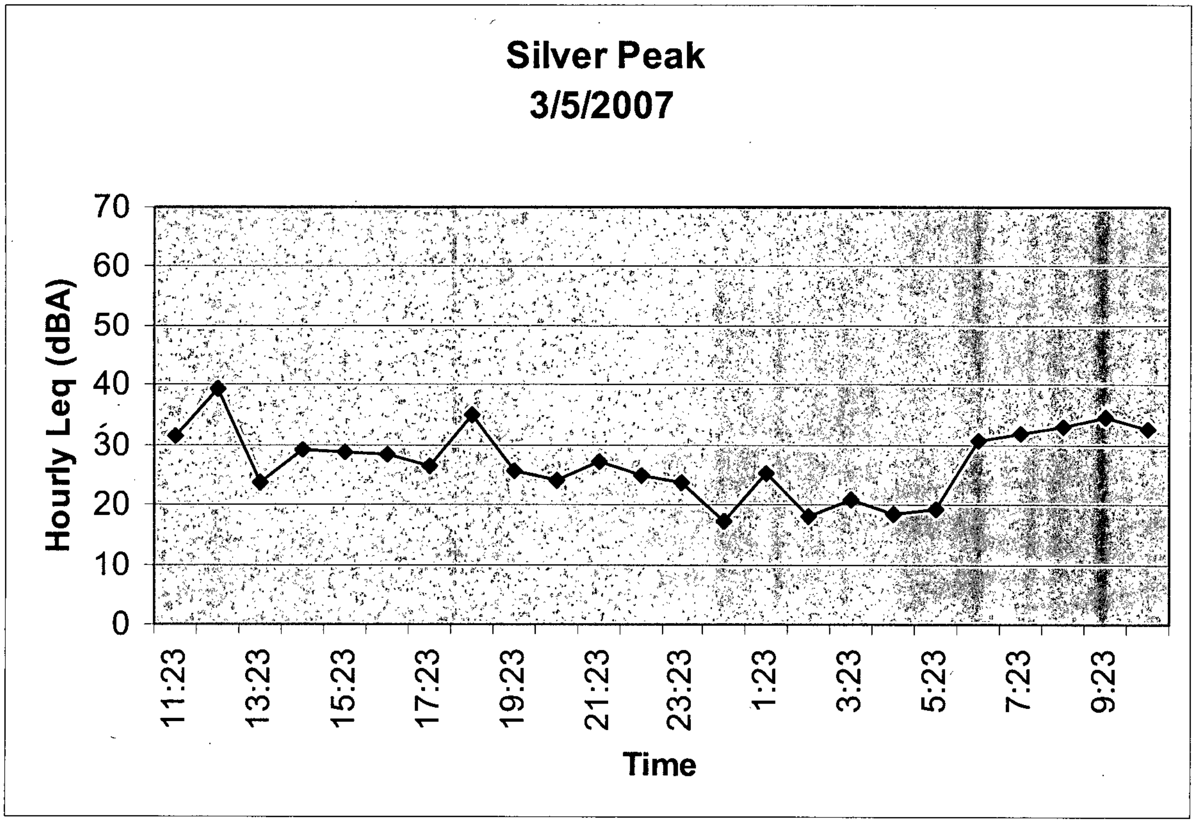


Figure 3-225. Measured noise levels over a 24-hour period in Silver Peak, Nevada.

DOE also took ambient ground-borne vibration measurements at Silver Peak on March 5, 2007. Ground-borne vibration was not measurable at this location because the vibration level was very low. Ambient vibration levels were very low at this location because of the lack of vibration producing activities. Ambient vibration levels of this magnitude are lower than human perception levels.

3.3.8.3.2 Mina

DOE took noise measurements for 24 hours on March 6, 2007, in Mina, Nevada. Hourly equivalent sound level values ranged from 30 to 40 dBA, as shown on Figure 3-227. Noise sources included occasional traffic on U.S. Highway 95, which passes through Mina. Figure 3-228 shows where DOE took the ambient noise measurements in Mina. The measured DNL in Mina was 44 dBA, which is lower than the “small town residential” category shown on Figure 3-224.

DOE also took ambient ground-borne vibration measurements at Mina on March 5, 2007. Ground-borne vibration was not measurable at this location because the vibration level was very low. Ambient vibration levels were very low at this location because of the lack of vibration producing activities. Ambient vibration levels of this magnitude are lower than human perception levels.

3.3.8.3.3 Schurz

DOE measured noise in Schurz near the existing Department of Defense Branchline on the Walker River Paiute Reservation for 24 hours on March 5, 2007. Hourly equivalent sound level values ranged from 32 to 56 dBA, as shown on Figure 3-229.

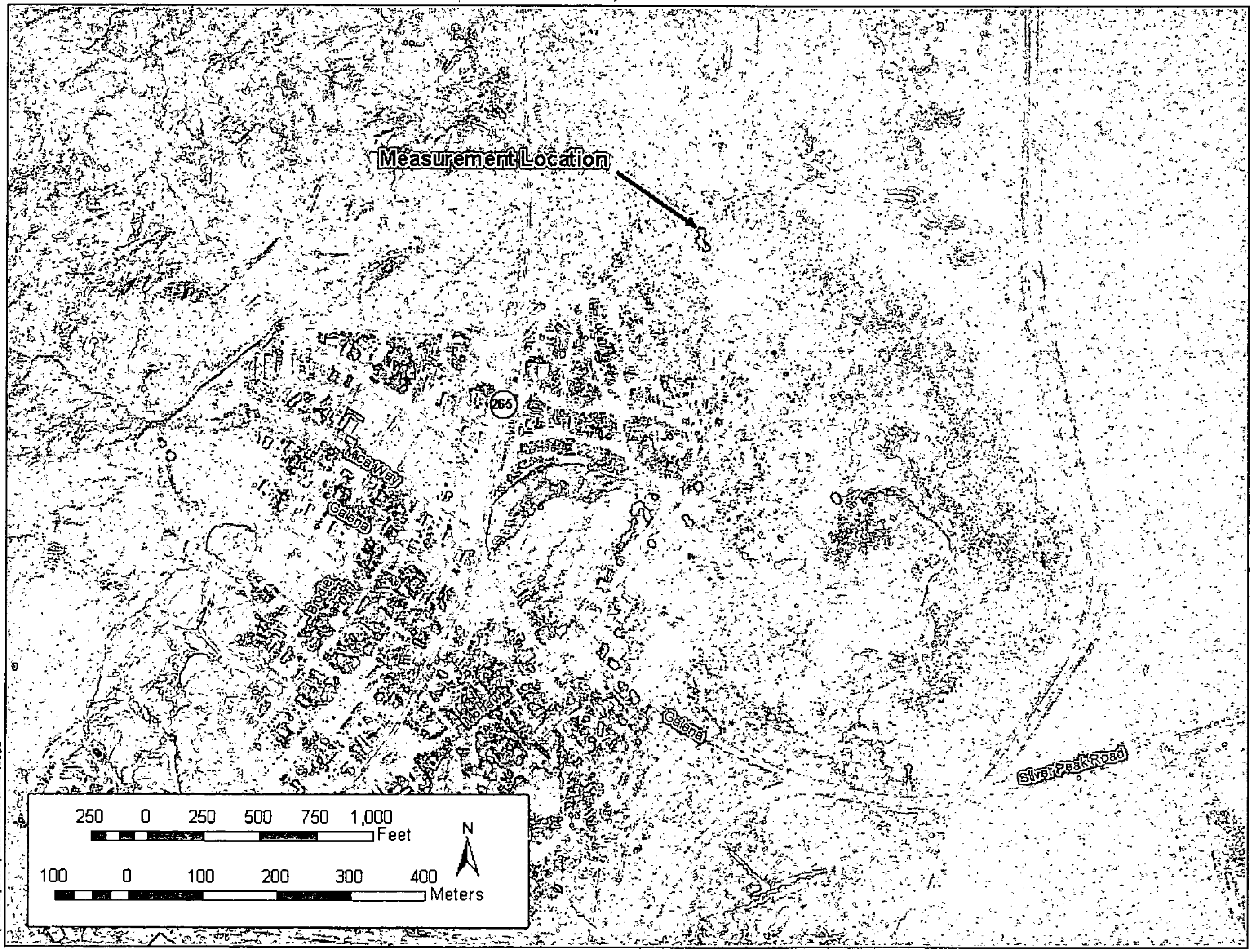


Figure 3-226. Ambient noise monitoring location at Silver Peak, Nevada.

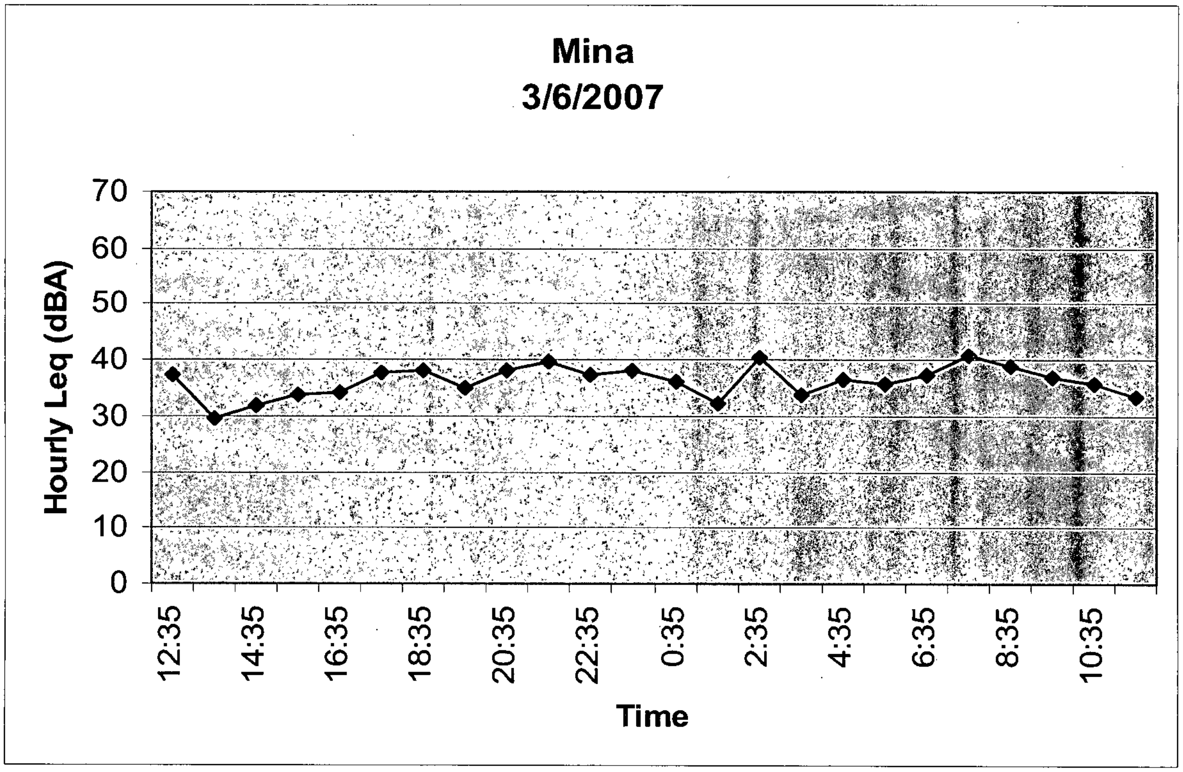


Figure 3-227. Measured noise levels over a 24-hour period in Mina, Nevada.

Noise sources included traffic on nearby local streets, and horses, dogs, and other animals on a nearby farm. Figure 3-230 shows where DOE took the ambient noise measurements in Schurz. The measured DNL in Schurz was 48 dBA, which is very close to the "small-town residential" category shown on Figure 3-224.

DOE also took ambient ground-borne vibration measurements at Schurz on March 5, 2007. Ground-borne vibration was not measurable at this location because the vibration level was very low. Ambient vibration levels were very low at this location because of the lack of vibration-producing activities. Ambient vibration levels of this magnitude are lower than human perception levels.

3.3.8.3.4 Silver Springs

DOE took noise measurements near the existing Union Pacific Hazen Branchline in Silver Springs for 24 hours on March 5, 2007. Hourly equivalent sound level values ranged from 23 to 60 dBA, as shown on Figure 3-231. Noise sources included traffic on local streets. Figure 3-232 shows where DOE took the ambient noise measurements in Silver Springs. The measured DNL in Silver Springs was 47 dBA, which is lower than the "small-town residential" category shown on Figure 3-224.

DOE also took ambient ground-borne vibration measurements at Silver Springs on March 5, 2007. Ground-borne vibration was not measurable at this location because the vibration level was very low. Ambient vibration levels were very low at this location because of the lack of vibration-producing activities. Ambient vibration levels of this magnitude are lower than human perception levels.

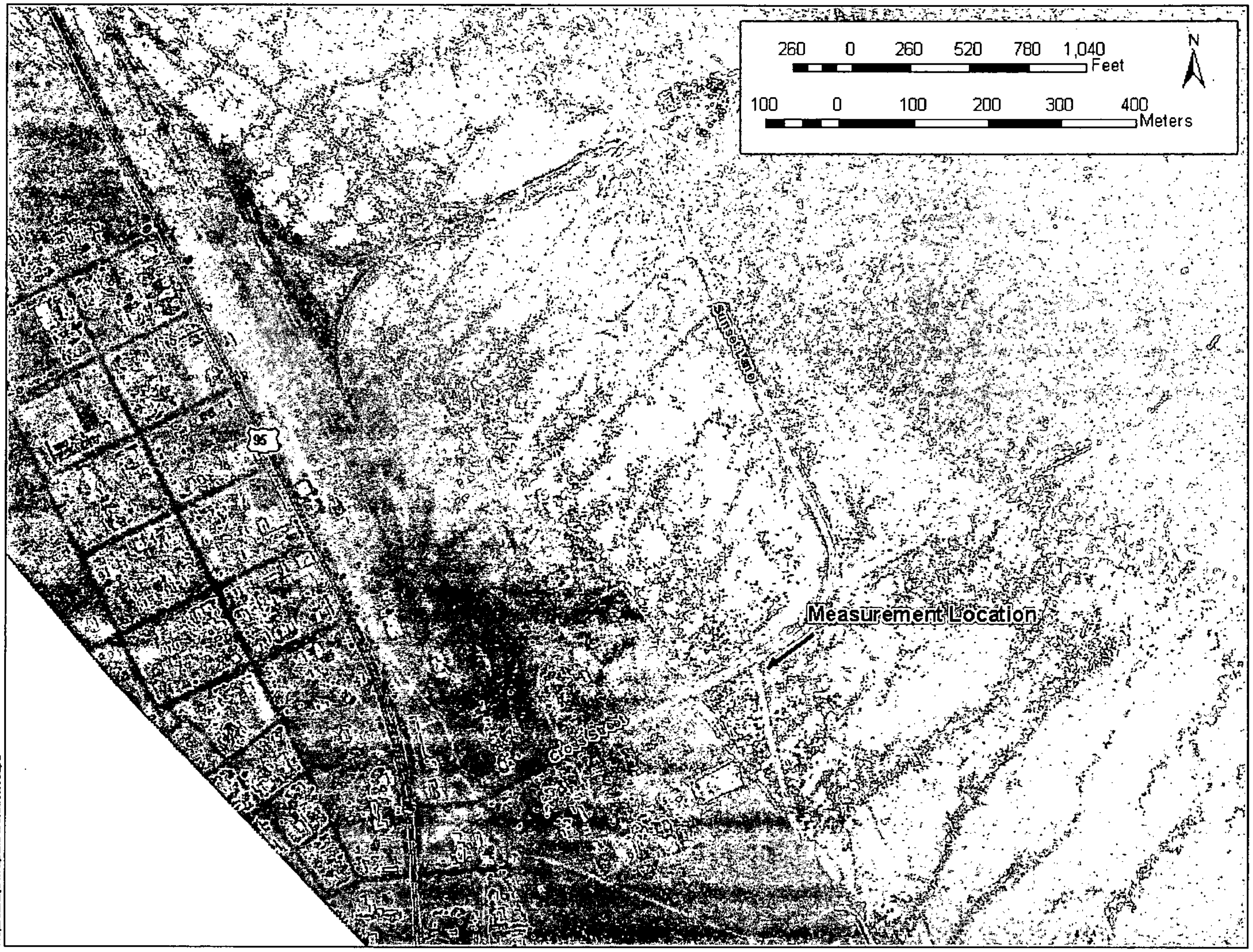


Figure 3-228. Ambient noise monitoring location at Mina, Nevada.

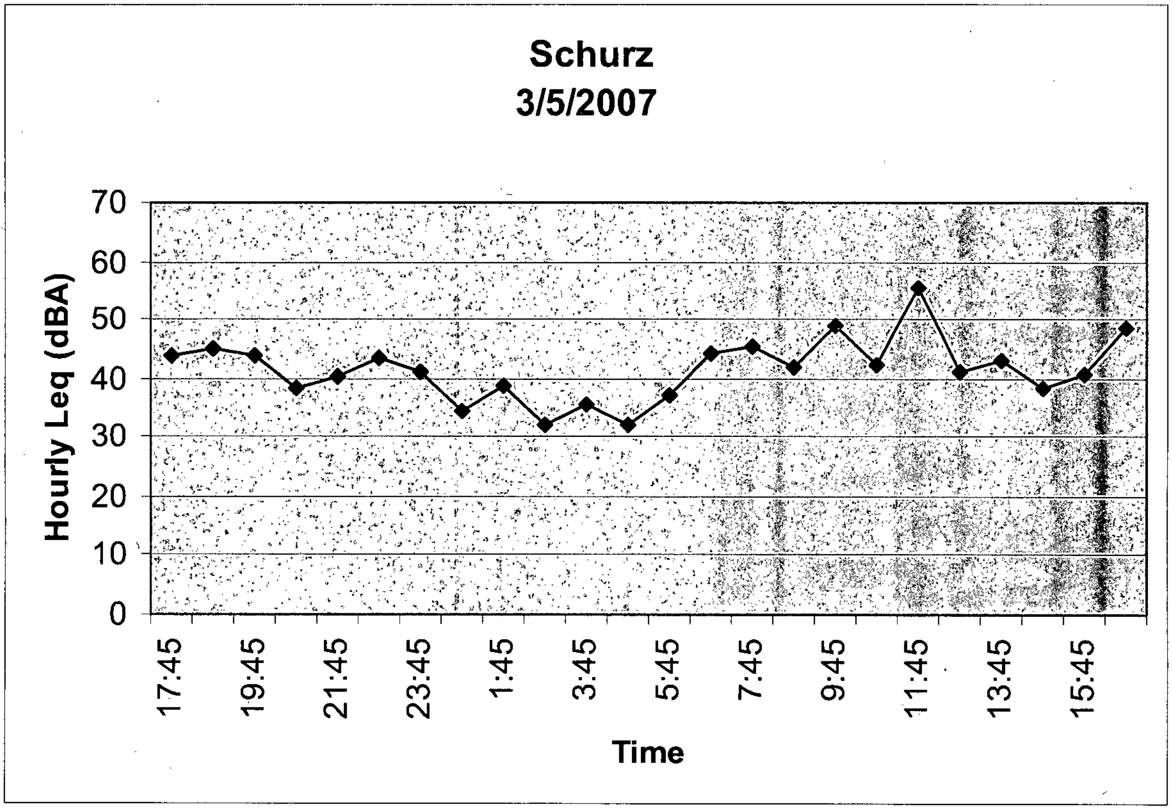


Figure 3-229. Measured noise levels over a 24-hour period in Schurz, Nevada.

3.3.8.3.5 Goldfield

DOE conducted noise measurements for 24 hours in Goldfield on January 12, 2005. Hourly equivalent sound level values ranged from 30 to 44 dBA, as shown on Figure 3-233. The DNL at this location measured 47 dBA. Noise sources included occasional vehicular traffic on U.S. Highway 93, barking dogs, wind, and occasional front-end-loader noise from the U.S. Department of Transportation maintenance station. Figure 3-234 shows where DOE took ambient noise measurements in the

Goldfield area. Measured noise levels at Goldfield are lower than values associated with the "small-town residential" category, which is consistent with the low population density and desert environment. DOE also took ambient ground-borne vibration measurements at Goldfield on January 12, 2005. The ground-borne vibration measurement was 25 VdB. Ambient vibration levels are low because of low population density and the resulting lack of ***ground vibration***-producing activity. Ambient vibration levels of this magnitude are lower than human perception levels.

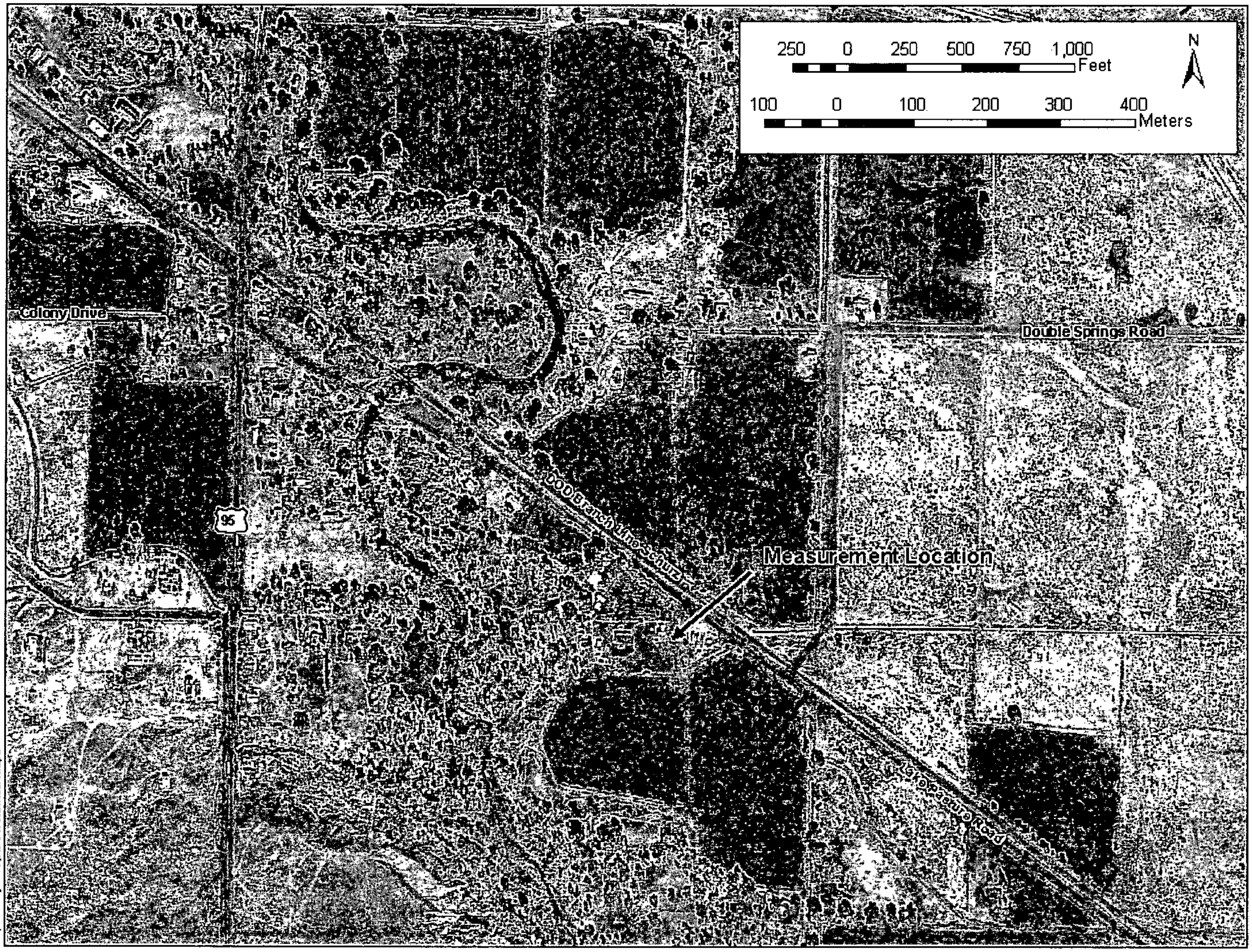


Figure 3-230. Ambient noise monitoring location at Schurz, Nevada.

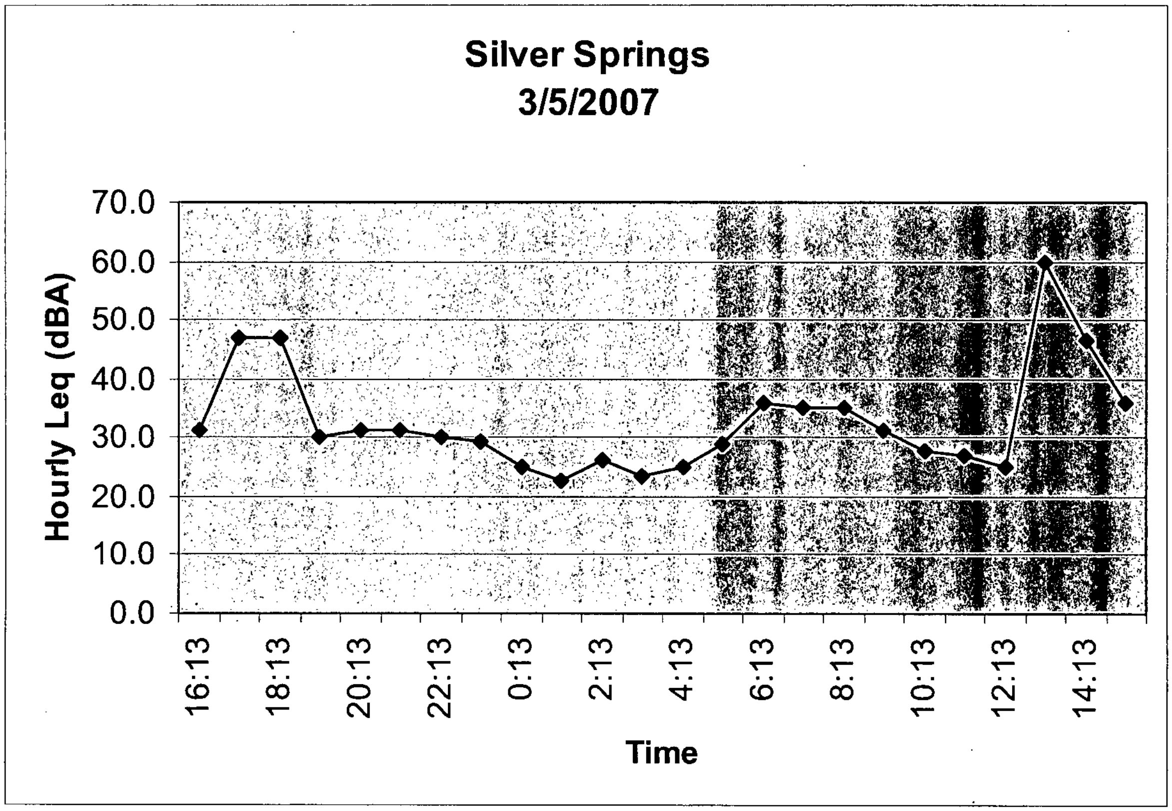


Figure 3-231. Measured noise levels over a 24-hour period in Silver Springs, Nevada.

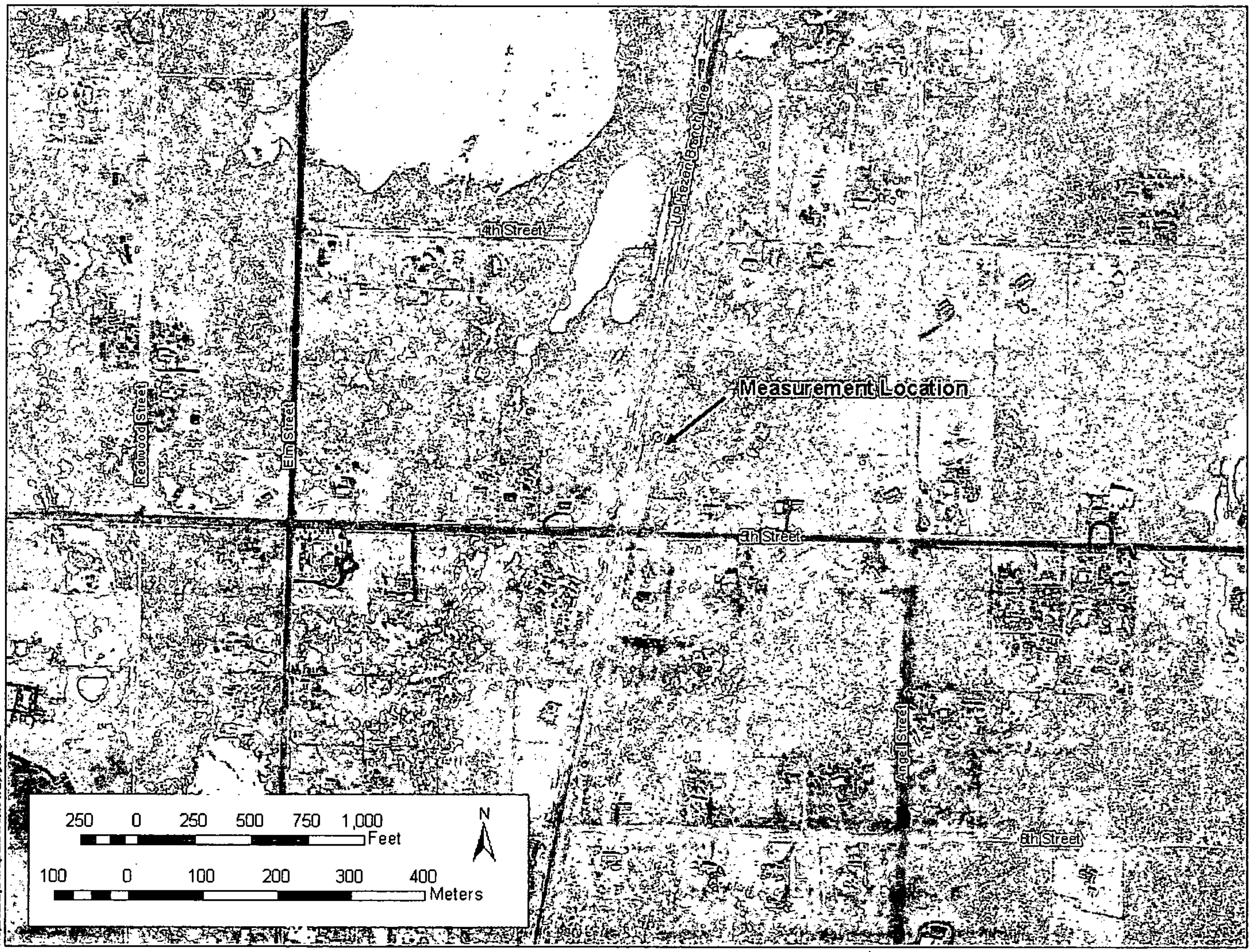


Figure 3-232. Ambient noise monitoring location at Silver Springs, Nevada.

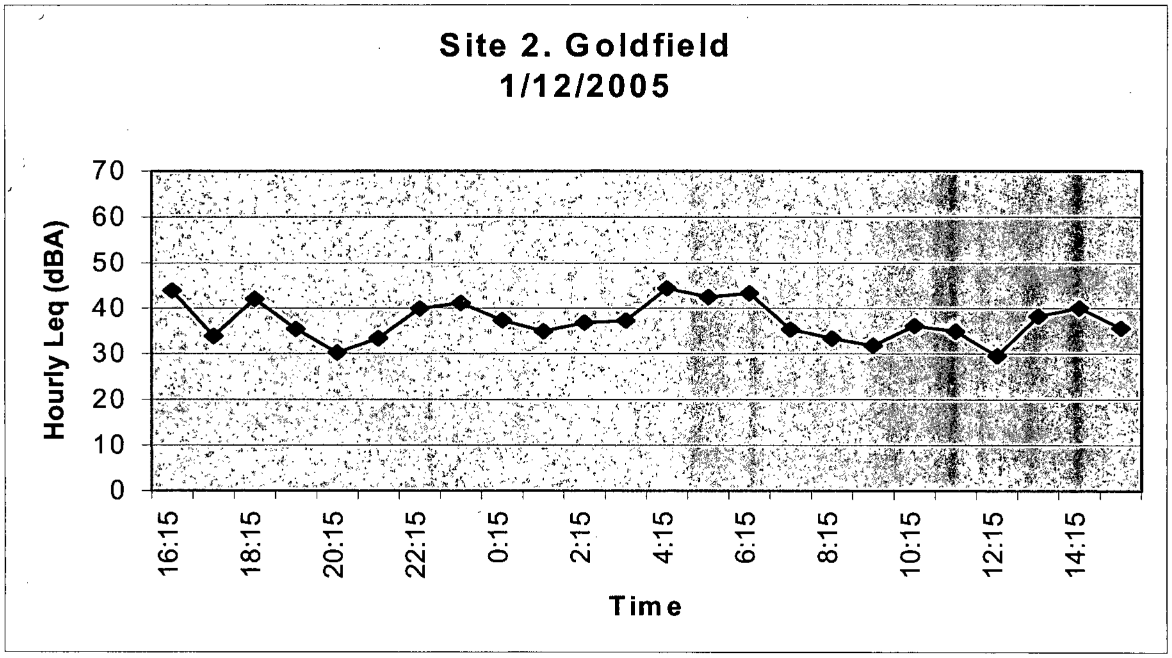


Figure 3-233. Measured noise levels over a 24-hour period in Goldfield, Nevada.

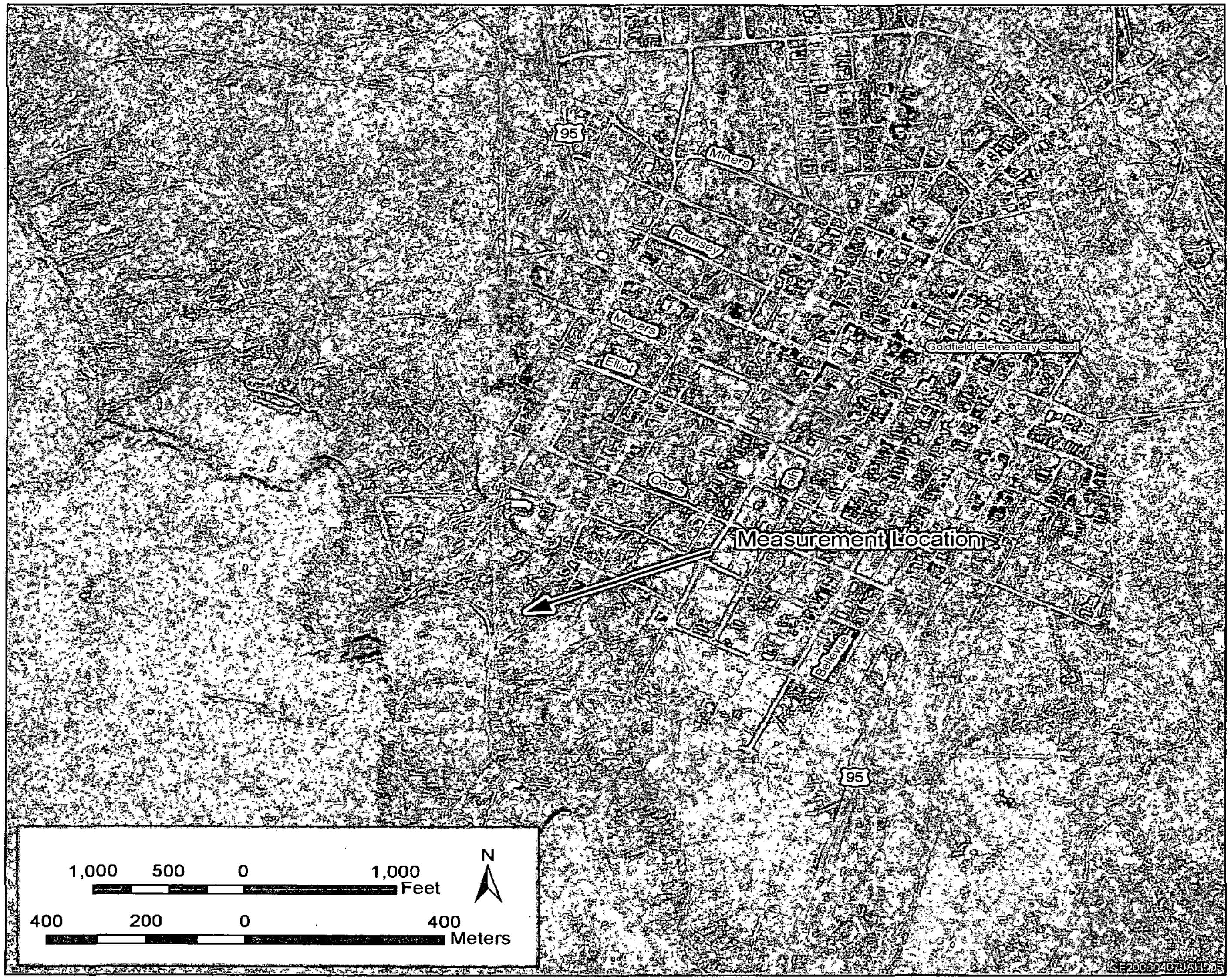


Figure 3-234. Ambient noise monitoring location on the southwestern edge of Goldfield, Nevada.

(Source: Basemap derived from DIRS 174497-Keck 2004, filename 37117F21.sid.)

3.3.9 SOCIOECONOMICS

This section describes the existing socioeconomics conditions (population, housing, employment and income, public services, and transportation) along the Mina rail alignment. Section 3.3.9.1 defines the region of influence for socioeconomics; Section 3.3.9.2 summarizes the method DOE used to establish baseline socioeconomic conditions in the region of influence; and Section 3.3.9.3 describes general regional socioeconomic characteristics.

3.3.9.1 Region of Influence

The region of influence for the Mina rail alignment socioeconomics analysis is Lyon, Mineral, Nye, Esmeralda, and Clark Counties, and the Walker River Paiute Reservation (Figure 3-235). The figure also shows Washoe County and Carson City as part of the region of influence, for reasons described below.

Construction and operation of a railroad along the Mina rail alignment could affect social and economic activities and public services in these areas. This section examines baseline socioeconomic conditions for the counties and selected communities in the counties that would likely be affected during construction and operation of the proposed railroad. This socioeconomics analysis does not include Churchill County, except for transportation effects, because DOE expects that Churchill County would not experience any other noticeable socioeconomic impacts during construction and operation of the proposed railroad. The main analysis presents some socioeconomics detail for Clark County because, even though the rail line would not cross Clark County, construction workers for construction of the rail and associated facilities (except those in Nye County) are assumed to come from Clark County. This is because Clark is the only county with a sufficient workforce. DOE assumes that 80 percent of construction and operations workers for facilities in Nye County would reside in Clark County and 20 percent would reside in Nye County, reflecting historical patterns.

DOE also considers an alternative analysis in which the Department assumes that half of the construction workers for the Mina rail alignment reside in the combined Washoe County-Carson City area, and the other half reside in Clark County. DOE considered this alternative analysis because Washoe County and Carson City might be more likely than Clark County to supply construction workers for the northern portions of the Mina rail alignment. Therefore, for the purposes of this alternative analysis this section presents some socioeconomic detail for Washoe County and Carson City.

Operations workers for facilities outside Nye County are assumed to reside in the county of the facility. Furthermore, Clark County medical facilities could receive medical cases from the construction camps and construction sites. The region of influence does not extend beyond these counties in Nevada because there is no indication of a regional or national socioeconomic effect from goods and services purchased outside the region of influence, and demand for goods and services would not be likely to adversely affect regional or national supplies. The Yucca Mountain FEIS examined the possibility that socioeconomic effects from purchasing construction materials could be felt beyond the region of influence and concluded that there would be little or no impact (DIRS 155970-DOE 2002, Section 4.1.11.2, p. 4-77).

The region of influence for the analysis of transportation resources includes public roadways in the vicinity of the Mina rail alignment, and the rail alignment itself.

During rail line construction, new access roads to construction camps, quarries, and water wells would originate from nearby intersections with existing public roadways. Most of the rail alignment would be within Nevada Department of Transportation District 1, crossing Nye and Esmeralda Counties, with a portion in District 2 crossing Churchill County, Lyon County and Mineral County northwest of Luning.

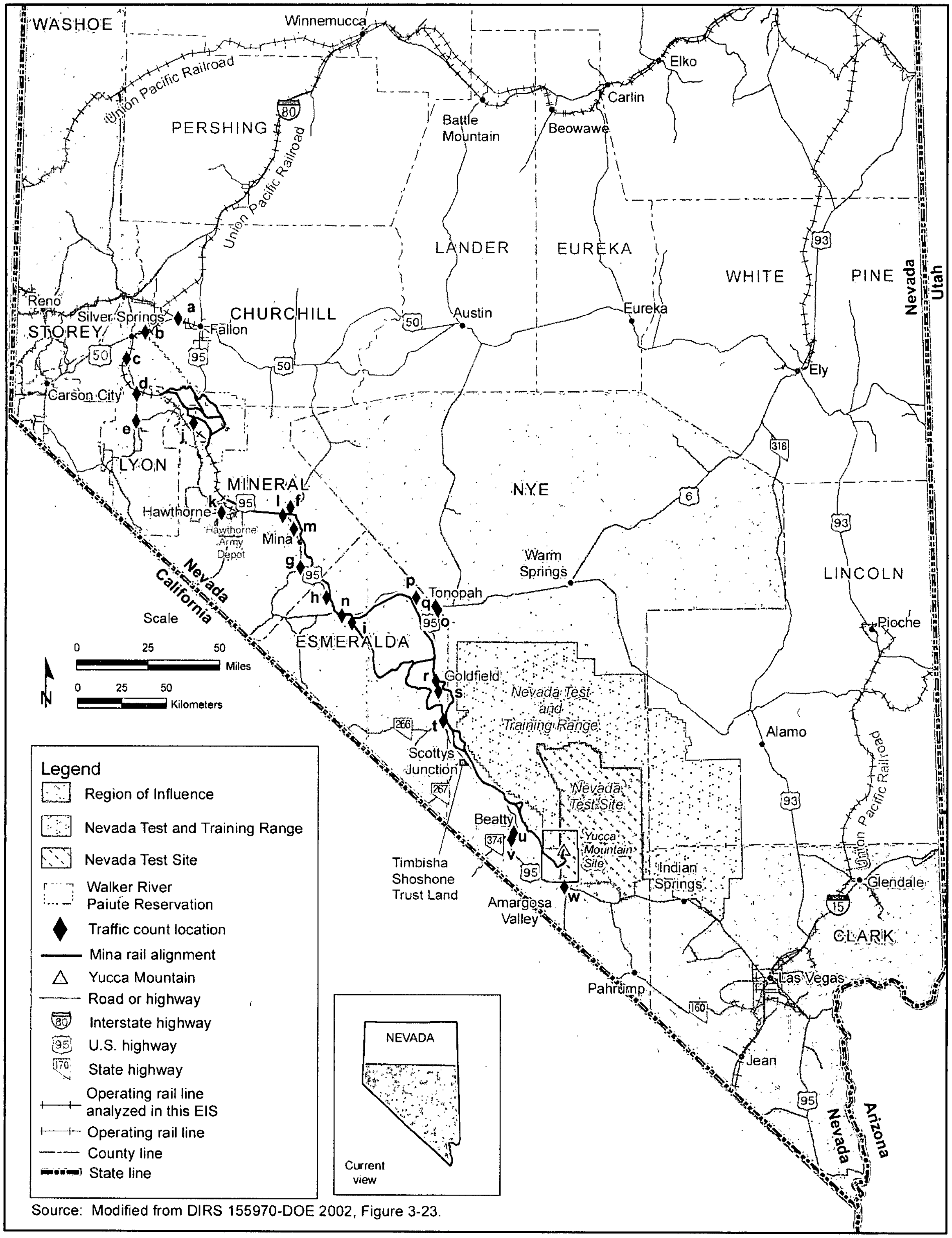


Figure 3-235. Mina rail alignment socioeconomics region of influence.

There are two operating railroads along the Mina rail alignment: the Union Pacific Railroad Hazen Branchline and branchlines operated by the Department of Defense from near Wabuska to Hawthorne. Churchill County is included in the transportation region of influence because it has grade crossings that would be affected by the additional rail traffic along the existing Union Pacific Railroad Hazen and Department of Defense Branchlines from Hazen to Hawthorne.

3.3.9.2 Methodology for Determining Existing Socioeconomic Conditions

DOE characterized socioeconomic activities and resources in the region of influence with a particular emphasis on community-level resources, as appropriate.

For this analysis, DOE used the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 3) as a basic source of data, and supplemented that data where possible with current community-level data for the Walker River Paiute Reservation and Lyon, Mineral, Nye, and Esmeralda Counties. DOE used an economic-demographic forecasting model known as *Policy Insight*, developed by Regional Economic Models, Inc. (DIRS 178610-Bland 2007, all), to generate employment, ***real disposable income***, and ***gross regional product*** data for Lyon, Mineral, Clark, Nye, Esmeralda and Washoe Counties and Carson City. *Policy Insight* is an eight-region model, six of the regions being Lyon, Mineral, Clark, Nye, Esmeralda Counties and Washoe County-Carson City. Due to a limitation in the structure of the model, Carson City and Washoe County are considered as a single economic entity. Therefore, the analysis presents the *Policy Insight* data for these areas as one, combined result. The model forecast for Mineral County includes the Walker River Paiute Reservation. Due to data limitations, the model is unable to provide a forecast for the Walker River Paiute Reservation alone. Appendix J, Socioeconomics, contains the results of the *Policy Insight* model runs.

The description of existing economic conditions in the region of influence of the Mina Rail Alignment and the forecast values of populations, gross regional product, and real disposable income draw on data from version 9.0 of *Policy Insight* (DIRS 182251-REMI 2007, all). The description includes revenue from DOE's Payments Equal to Taxes program, described in detail in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 3-90), and the Repository SEIS. Revenue from this program is not described separately. Because the model is based on nationally collected data for which there is a lag between collection and issuance by the national agencies, and another lag before the data are incorporated into the *Policy Insight* model, there is always a gap of approximately 2 to 3 years between the current year and the last history year. The year 2004 is the last history year for the *Policy Insight* model (version 9.0) used in this baseline forecast. To compensate for this time lag, the model's employment update feature is specifically designed to accommodate new historical data provided by users, which update the model's growth-rate assumptions. *Policy Insight* version 9.0 uses an employment update module that relies on years 2004 to 2006 data from the Nevada Department of Education, Training, and Rehabilitation (DIRS 180712-NDETR 2006, all; DIRS 180740-DETR [n.d.], all; DIRS 180741-DETR 2005, all; DIRS 180742-DETR [n.d.], all). This version also incorporates information from the latest Clark County population projections prepared by the University of Nevada, Las Vegas (DIRS 178806-CBER 2006, all) and the latest population projections developed by the Nevada State Demographer (DIRS 178807-Hardcastle 2006, all).

Data for the affected environment (both those taken from the Yucca Mountain FEIS and supplemental information included here) come from various state, federal, community, and proprietary sources. Current and historical population data were drawn from a report prepared for the Nevada Small Business Development Center (DIRS 177656-Nevada State Demographer's Office 2006, all). The Department obtained housing data, including information on housing stock, vacancy rates, median housing values, and gross rents, from the Nevada Small Business Development Center, which compiled the information from U.S. Census Bureau data (DIRS 180476-Nevada Small Business Development [n.d.], all;

DIRS 180475-Nevada Small Business Development Center [n.d.], all; DIRS 180477-Nevada Small Business Development Center [n.d.], all; DIRS 180478-Nevada Small Business Development Center 2003, all; DIRS 180479-Nevada Small Business Development Center [n.d.], all; DIRS 173564-Nevada Small Business Development Center 2003, all; DIRS 173566- Nevada Small Business Development Center 2003, all; DIRS 173567-Nevada Small Business Development Center 2003, all). DOE uses the U.S. Census Bureau housing data because county-collected housing data can be inconsistent across counties due to unique county assessment practices. In addition, the Census Bureau's housing data contain characteristics that county housing data sources do not, such as whether a property is a rental property or owner-occupied and whether a property is occupied or vacant.

Income, poverty, and unemployment data come from the U.S. Census Bureau (DIRS 176856-U.S. Census Bureau 2003, all). DOE obtained current values for employment, real disposable income, and gross regional product for Lyon, Mineral, Nye, Esmeralda, and Clark Counties from the *Policy Insight* model, as previously described. DOE compiled business-establishment data from the *Nevada Workforce Informer, Data Analysis* (DIRS 173545-Nevada Department of Employment, Training & Rehabilitation 2005, all; DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all). DOE obtained data on public services mainly from interviews with county representatives in the region of influence and from the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 3), augmented in some instances with information from other sources cited in the text herein. Yucca Mountain Oversight Office in Esmeralda County provided contact information for county agencies and suggested data sources for this section. The County Manager provided similar assistance for Nye County. DOE obtained health data from the Nevada State Health Division (DIRS 173560-State of Nevada [n.d.], all); education data from Nevada District Accountability Reports (DIRS 180463-Lyon County School District [n.d.], all; DIRS 180465-Mineral County School District [n.d.], all; DIRS 177759-Nye County School District [n.d.], all; DIRS 177760-Esmeralda County School District [n.d.], all); and law enforcement data from the Department of Public Safety (DIRS 173399-State of Nevada 2004, all; DIRS 177747-State of Nevada 2005, all; DIRS 177748-State of Nevada 2006, all).

DOE based the description of the affected transportation environment on existing traffic volumes on the roadways (measured as average daily traffic counts) and on the Union Pacific Railroad Hazen Branchline. The Department obtained traffic volumes for roads from the Nevada Department of Transportation traffic report for 2005 (DIRS 178749-NDOT [n.d.], all), and then estimated levels of service for the affected roadways using the Highway Capacity Manual guidelines (DIRS 176524-Transportation Research Board 2001, all). DOE based rail traffic estimates on personal communication with Union Pacific Railroad and U.S. Army representatives (DIRS 178017-Holder 2006, all).

3.3.9.3 General Regional Socioeconomic Characteristics

DOE examined baseline socioeconomic conditions for selected communities within the region of influence that would likely be affected by railroad construction and operations. These communities include Yerington in Lyon County; Hawthorne, Mina, and Luning in Mineral County; Schurz on the Walker River Paiute Reservation; Tonopah, Beatty, the Town of Amargosa Valley, and Pahrump in Nye County; and Goldfield in Esmeralda County. Baseline conditions for Clark County are presented at the county level, primarily in relation to economic measures and health-care capacity. DOE assumes that there would be an overall income effect on Clark County from the workers residing there and commuting to work on the proposed railroad project, but because of the large population of Clark County, the effect would be minimal. For the alternative analysis, baseline conditions for the combined area of Washow County-Carson City are presented.

3.3.9.3.1 Employment and Income

Due to the lack of data, DOE is unable to characterize the local economy of the Walker River Paiute Reservation.

Lyon County's economy is smaller than Nye County's, with a total estimated employment count of 15,591 in 2007, according to the *Policy Insight* (DIRS 181908-Bland 2007, all) baseline projections listed in Table 3-136. As discussed in Section 3.3.9.2, these projections are from county and state baseline data sources, together with employment-trend information also taken from county and state sources. The three largest employment sectors in Lyon County are services (with 34 percent of the employed population), retail trade (16 percent), and state and local government (14 percent). Construction is also an important employment sector, with 12 percent of the employed population. According to *Policy Insight* baseline projections, the gross regional product of the county in 2007 is projected to be $840.1 million, and the real disposable income $1.04 billion. Large employers include Amazon.com, which employs between 1,000 and 1,499 people in the area, and local government agencies such as the Lyon County School District (DIRS 181908-DETR [n.d.], all).

Mineral County's economy is the second smallest in the region of influence, with a total estimated employment count of 2,352 projected for 2007, according to the *Policy Insight* (DIRS 178610-Bland 2007, all) baseline projections listed in Table 3-136. The three largest employment sectors in Mineral County are services (with 42 percent of the employed population), state and local government (22 percent), and retail. Major employers include the Day and Zimmerman Hawthorne Corporation, which employs between 400 and 499 people; El Capitan Casino, which employs between 100 and 199 people; and local government, such as the Mineral County School District (DIRS 181907-DETR [n.d.], all).

Mina County's economy is the second smallest in the region of influence, with a total estimated employment count of 2,352 in 2007, according to the *Policy Insight* (DIRS 178610-Bland 2007, all) baseline projections listed in Table 3-136. The three largest employment sectors in Mineral County are services (with 42 percent of the employed population), state a local government (22 percent), and retail trade (10 percent). According to *Policy Insight* baseline projections, the gross regional product of the county in 2007 was $131.0 million, and the real disposable income was $108.8 million.

Nye County has the third largest economy in the region of influence. Total estimated employment in Nye County in 2007 is projected to be 18,184 people (Table 3-136). The largest employment sectors were services (44 percent of the employed population), followed by retail trade (12 percent), and then transportation warehousing, information, and finance and insurance (11 percent collectively). State and local government and construction are also important sectors. The importance of construction reflects the county's population growth rates from 1990 to 2003 because new residents and businesses require construction materials and labor, and a range of services. Large employers include National Security Technologies, LLC (NSTec), the management and operating contractor for DOE at the Nevada Test Site, which employs between 1,000 and 1,500 people in the area, although many Nevada Test Site employees live in Clark County (DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all). Local government agencies such as the Nye County School District and Nye County, and mining companies such as the Round Mountain Gold Corporation, are also major employers (DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all).

Nye County employment rebounded after a 15 percent decrease between 1990 and 1995 (DIRS 155970-DOE 2002, p. 3-87). According to *Policy Insight* baseline projections, the gross regional product of Nye County in 2007 will be $1.16 billion, and the real disposable income will be $1.12 billion.

Table 3-136. Lyon, Mineral, Esmeralda, Nye, and Clark County employment by industry, 2007.[a,b]

	County					
Industry sector	Lyon	Mineral	Nye	Esmeralda	Clark	Washoe-Carson City
Private sector						
Forestry and fisheries	53	6	67	3	306	320
Mining	249	150	1,094	84	1,420	2,607
Construction	1,814	61	1,793	32	124,771	27,805
Utilities	84	26	185	0	3,798	1,067
Manufacturing	582	18	342	1	28,737	17,997
Wholesale trade	722	37	186	12	26,567	12,843
Retail trade	2,439	237	2,140	30	121,883	32,992
Transportation and warehousing, information, and finance and insurance	1,304	210	1,975	23	158,506	45,084
Farm	717	16	283	67	312	599
Services	5,329	987	8,088	112	577,086	129,099
Public sector						
Federal Government–civilian	72	77	161	6	11,409	3,852
Federal Government–military	95	12	79	4	12,663	887
State and local government	2,132	515	1,792	101	83,135	33,470
Totals[c]	15,591	2,352	18,184	475	1,150,594	308,623

a. Source: DIRS 178610-Bland 2007, all.
b. Model does not discriminate non-county regions, such as the Walker River Paiute Reservation.
c. Totals might differ from sums of values due to rounding.

Esmeralda County has the smallest economy of the other counties in the region of influence. The county's three largest employment sectors are services, state and local government, and mining, which account for 24, 21, and 18 percent of the employed population, respectively (Table 3-136). Employers include government agencies such as the State of Nevada and the Esmeralda County School District, and mining companies such as the Chemetall Foote Corporation, which runs Silver Peak Mine and Lode Star Gold, Inc. (DIRS 173545-Nevada Department of Employment, Training & Rehabilitation 2005, all). According to *Policy Insight* baseline projections, the gross regional product of Esmeralda County in 2007 will be $25.7 million, and the real disposable income will be $29.3 million.

Clark County's economy dominates southern Nevada. The largest employment sectors are services (50 percent of the employed population; 46 percent of services employment is within the Accommodations and Food Services sectors); transportation warehousing, information, and finances and insurance (14 percent); construction (11 percent); and retail trade (11 percent). According to *Policy Insight* baseline projections, Clark County surpasses the other counties with a gross regional product of $95.4 billion, which is more than 80 times that of Nye County. According to *Policy Insight* baseline projections, Clark County residents had $60.7 billion in ***real disposable personal income*** in 2007.

Washoe County-Carson City's largest employment sectors are services; transportation and warehousing, information, and finance and insurance; and state and local government. These sectors account for 42, 15, and 11 percent of the employed population, respectively. According to *Policy Insight* baseline projections, the gross regional product of Washoe County-Carson City in 2007 will be $24.4 billion, and the real disposable income will be $16.8 billion.

3.3.9.3.1.1 Mining and Agriculture. This section describes existing conditions for mining and agricultural activities, because a railroad along the Mina rail alignment would be likely to affect these interests more than other economic activities.

Mining In 2007, the mining industry employed nearly 18 percent of the 475 workers in Esmeralda County and 6 percent of workers in Nye County. Mining also constitutes a large part of the total personal income generated in the region of influence counties. In Esmeralda County in 2002, almost 18 percent of personal income came from mining, making it the single largest source of personal income in the County (DIRS 173546-BEA 2004, Table CA05N). Almost 7 percent of personal income in Nye County came from the mining industry in 2002 (DIRS 173548-BEA 2005, Table CA05N).

Mined minerals in the study area include gold, silver, aggregate (consisting of crushed stone, natural sands, and gravel), salt, and a wide range of other nonmetallic minerals. Gold is central to Nevada's mining industry, and at $2.4 billion in revenue (DIRS 169127-Driesner and Coyner 2003, all; DIRS 173554-Price and Meeuwig 2003, all), it brings in more revenue than any other type of mining. Silver production is also important and was Nevada's fourth leading mineral commodity in 2002, valued at $62 million.

The Mina rail alignment would cross some mining areas and districts in Mineral, Nye, and Esmeralda Counties. Schurz alternative segment 1 would pass through the very southern portion of the Calico Hills Mining District. Schurz alternative segment 4 would pass through the Calico Hills, Double Springs Marsh, and Buckley Mining Districts. Schurz alternative segment 5 would pass through the Benway, Calico Hills, Double Springs Marsh, and Buckley Mining Districts. Schurz alternative segment 6 would pass through the Holy Cross, Double Springs Marsh, and Buckley Mining Districts.

Mina common segment 1 would pass through the Santa Fe, Rock Hill, and Coaldale Mining Districts. The construction right-of-way would also intersect the outermost boundaries of the Pilot Mountains, Rhodes Marsh, and Candelaria Mining Districts.

Montezuma alternative segment 1 would pass through the Silver Peak Marsh, Montezuma, and Cuprite Mining Districts. Montezuma alternative segment 2 would pass through the Goldfield and Stonewall Mining Districts. Montezuma alternative segment 3 would pass through the Montezuma and Cuprite Mining Districts.

Mina common segment 2, the Bonnie Claire alternative segments, common segment 5, and the Oasis Valley alternative segments would not cross any mining districts.

Common segment 6 would cross the northeastern portion of the Bare Mountain Mining District, although the vast majority of past mining activity occurred more than 3 kilometers (2 miles) south of this common segment. The district contains gold-bearing veins, and some veins contain silver. The district also contains a variety of minerals and semi-precious stones, including opal, malachite, galena, pyrite, hematite, fluorite, fluorspar, and gypsum.

Agriculture The primary agricultural activity that would be intersected by the Mina rail alignment would be grazing. As discussed in Section 3.3.2, Land Use and Ownership, there are 12 active grazing allotments, and three inactive allotments along the proposed rail alignment. In Section 3.3.2, Land Use and Ownership, Tables 3-84 and -85 list and describe these grazing allotments, and Figures 3-143 through 3-152 show the locations of the allotments.

The permitted grazing operations support employment and provide income for ranchers and their workers, and income for the respective counties. BLM-issued grazing permits authorize these operations, and specify the total number of animal unit months apportioned (an animal unit month represents enough dry forage for one mature cow for 1 month). For those allotments with information available (see Table 3-85), animal unit months range from 303 to 7,900, and land area ranges from 21 to 2,074 square kilometers (5,124 to 512,000 acres). The BLM established the property base for each allotment based on land or water rights.

In addition to grazing, farming is an important source of both income and employment for the counties in the region of influence. As discussed in Section 3.3.1.2.3, less than 1 percent of soils along the proposed rail alignment are classified as prime farmlands. Less than 1 percent, or approximately 0.04 square kilometer (9.2 acres), of the entire Mina rail line construction right-of-way contains soils the Natural Resources Conservation Service considers prime farmland (see Section 3.3.1, Physical Setting, Figure 3-128). The prime farmland soils the proposed alignment would cross are concentrated on the Walker River Paiute Reservation, which has a total of 5.5 square kilometers (1,400 acres) of prime farmland soil.

3.3.9.3.1.2 Personal Income, Poverty, and Unemployment. As shown in Table 3-137, Washoe and Clark Counties have the highest median income in the region of influence, followed by Carson City, Lyon, Nye, Esmeralda, and Mineral Counties and the Walker River Paiute Reservation. While Washoe, Lyon, Nye, and Clark Counties and Carson City showed the highest incomes and the lowest percentage of residents in poverty in 1999 (see note on Table 3-137 for information on poverty thresholds), the unemployment rates in these counties were higher than Esmeralda County in 2000. The unemployment rates in Lyon, Mineral, Clark, Washoe, and Nye Counties decreased between 2000 and 2005, while Esmeralda County's unemployment rate increased over the same period. The Walker River Paiute Reservation had the highest unemployment rate in the region of influence in 2000.

At the community level, Beatty has the highest median income ($41,076), although its poverty rate (13 percent) is third highest after Yerington in Lyon County (18 percent) and the Town of Amargosa Valley (15 percent). Schurz, on the Walker River Paiute Reservation, has the highest unemployment rate (15.8 percent) of all communities in the region of influence. Tonopah and Beatty in Nye County have higher median incomes, and lower poverty and unemployment rates, than Yerington in Lyon County.

3.3.9.3.2 Population

Table 3-138 lists the county and community populations in the Mina rail alignment region of influence in 1990, 2000, and 2005.

According to Census data from 2000, the Walker River Paiute Reservation had a population of 850. The Reservation's population increased by 5 percent between 1990 and 2000.

According to the Nevada State Demographer's Office Nevada 2000 census data (DIRS 180476-Nevada Small Business Development Center [n.d.], p. 1), Lyon County is approximately 50-percent rural. It has a population density of only 6.7 people per square kilometer (17.3 people per square mile). Yerington isthe largest Lyon County town that is close to the Mina rail alignment. The population of Yerington in 2005 was 2,980.

Mineral County has the second smallest county in the region of influence. In 2005, Mineral County's population was 4,629. Mineral County has a population density of 0.54 people per square kilometer (1.4 people per square mile). Thirty-one percent of the population in Mineral County is considered rural, according to population estimates and rural figures from the Nevada State Demographer's Office.

Table 3-137. County and place-level personal income, poverty, and unemployment.[a]

County, city/community	Median household income in 1999 (dollars)[b]	Poverty in 1999 (percent)[b]	Unemployment in 2000 (percent)[b]	Unemployment in 2005 (percent)[c]
Walker River Paiute Reservation	24,412	33	22.6	Not available
County				
Lyon	40,699	10	6.9	5.3
Mineral	32,891	15	12.9	5.9
Esmeralda	33,203	15	3.3	5.3
Nye	36,024	11	7.1	5.2
Clark	44,616	11	6.6	4.0
Washoe County	45,815	10	4.9	4.0
Carson City	41,809	10	4.6	4.7
City/community				
Schurz	24,265	27	15.8	Not available
Yerington	31,151	18	9.1	Not available
Hawthorne	34,413	11	11.1	Not available
Tonopah	38,029	11	7.9	Not available
Pahrump	35,313	9	7.5	Not available
Goldfield	32,969	12	3.2	Not available
Amargosa Valley	34,432	15	3.2	Not available
Beatty	41,076	13	5.6	Not available

a. The U.S. Census Bureau defines poverty based on estimates of how much money families need to meet their nutritional needs for 1 year. Poverty thresholds and a more thorough definition of poverty are available from the U.S. Census Bureau at http://www.census.gov/acs/www/UseData/Def/Poverty.htm, all.
b. Source: DIRS 176856-Census Bureau 2003, Tables 7, 13, 15, 36, 37, and 40.
c. Source: DIRS 177755-BLS [n.d.], all.

Table 3-138. County and community populations, Mina rail alignment, 1990 to 2005[a] (page 1 of 2).

County	City/ community	1990 population[b]	2000 population	2005 population	1990 to 2000 change (percent)	2000 to 2005 change (percent)
Walker River Paiute Reservation		811	850	Not available	5	Not available
	Schurz	617	711[c]	Not available	15	Not available
Lyon		20,590	35,685	48,860	73	37
	Yerington	2,380	2,938	2,980	23	1
Mineral		6,470	5,071	4,629	-22	-9
	Hawthorne	4,162	3,134	2,956	-25	-6
	Mina	484	307	276	-37	-10
	Luning	Not available	86	87	Not available	1

Table 3-138. County and community populations, Mina rail alignment, 1990 to 2005[a] (page 2 of 2).

County	City/ community	1990 population[b]	2000 population	2005 population	1990 to 2000 change (percent)	2000 to 2005 change (percent)
Nye		18,190	32,978	41,302	81	25
	Tonopah	3,616	2,833	2,607	-23	-8
	Amargosa Valley	761	1,167	1,383	61	19
	Beatty	1,623	1,152	1,032	-31	-10
	Pahrump	7,424	24,235	33,241	226	37
Esmeralda		1,350	1,061	1,276	-21	20
	Goldfield	672	424	438	-37	3
	Silver Peak	Not available	161	126	Not available	-22
Clark		770,280	1,394,440	1,815,700	81	29
Washoe County		257,120	341,935	396,844	33	16
Carson City		40,950	53,208	57,104	30	7

a. Source: DIRS 177656-Nevada State Demographer's Office 2006, all.
b. 1990 estimates for Tonopah, Amargosa Valley, Beatty, Pahrump, and Goldfield were not available through the Nevada State Demographer's Office; therefore, subdivision-level data for these locations were taken from the U.S. Census DP-1 (DIRS 179132-Bureau of Census [n.d.], all). The Census data reflect a different time series than the Governor's Certified Estimates.
c. Schurz is on the Walker River Paiute Reservation. However, the Nevada State Demographer and the U.S. Census Bureau categorize the town's population within Mineral County.

The largest town in Mineral County is Hawthorne, with a 2005 population of 2,956, which accounts for more than 60 percent of the population in Mineral County. Mineral County also includes Schurz, Mina, and Luning, which are along the Mina rail alignment. Schurz, on the Walker River Paiute Reservation, is the most populated of these communities.

Nye County is the second most populous county in the region of influence. According to the U.S. Bureau of Census (DIRS 173530-Bureau of Census 2005, all), in 2005 the county had a population density of 0.69 people per square kilometer (1.8 people per square mile); according to population estimates and rural figures from the Nevada State Demographer's Office (DIRS 173564-Nevada Small Business Development Center 2003, p. 1), 55 percent of the population is considered rural. The largest town in Nye County is unincorporated Pahrump, which accounts for 80 percent of the county's population. Although Pahrump is not in the immediate vicinity of the Mina rail alignment, it is reasonably foreseeable that some construction and operations workers would live in Pahrump, based on historical and current patterns of workers at the Nevada Test Site and the Yucca Mountain Site. Nye County also includes the communities of Tonopah, Beatty, and the Town of Amargosa Valley, all of which are near the Mina rail alignment. Tonopah is the most populated of these communities.

Esmeralda County is the least populated of the counties in the Mina rail alignment region of influence. Esmeralda is also the least densely populated county, with a density of 0.11 people per square kilometer (0.3 people per square mile) (DIRS 173534-Bureau of Census 2005, all) and a 100-percent rural population (DIRS 173566-Nevada Small Business Development Center 2003, p. 1). The community of Goldfield is close to the Mina rail alignment, and its population accounts for more than one-third of Esmeralda County's population.

Clark County, which includes Las Vegas, is the most populated county in Nevada. It has a population density of 67 people per square kilometer (173.9 people per square mile) (DIRS 173533-Bureau of Census 2005, all), and a rural population of only 2 percent (DIRS 173567-Nevada Small Business

Development Center 2003, p. 1). No part of the Mina rail alignment is in or near Clark County; the closest part of the alignment would be common segment 6, 48 kilometers (30 miles) west of the Clark County boundary, in Nye County. However, a substantial proportion of the railroad construction workforce would probably come from Clark County.

In terms of population change, southern Nevada has been and continues to be among the fastest-growing areas in the United States (DIRS 155970-DOE 2002, p. 3-84). In the region of influence, Lyon and Nye Counties both experienced population increases from 1990 to 2000, with Nye County's growth of 81 percent being similar to Lyon County's growth of 73 percent. The populations of Esmeralda and Mineral Counties decreased between 1990 and 2000 by 21 and 22 percent, respectively. The growth and overall population count of Clark County is substantial, with an increase of 81 percent during the same years.

Communities within these counties have also been undergoing population changes, though these shifts have not necessarily been in the same direction as the respective county. For example, Nye County experienced a substantial population increase of 8,324 people (25 percent) between 2000 and 2005. The increase was largely fueled by population growth in Pahrump, while Tonopah's population declined by 226 people (8 percent), and Beatty's declined by 120 people (10 percent) during the same period. The population of Goldfield in Esmeralda County increased by 14 people (3 percent) between 2000 and 2005, which is consistent with the county's increase in population of 215 people (20 percent).

According to *Policy Insight* model baseline projections shown in Table 3-139, most of the counties in the region of influence are expected to grow through 2067, independent of potential project-related effects. These projections assume that current trends continue and incorporate county and state (Nevada State Demographer's Office) demographic and economic data sources. Population projections for Lyon, Mineral, Nye, and Esmeralda Counties through 2026 are from the Nevada State Demographer's Office (DIRS 178807-Hardcastle 2006, all); population projections for these areas after 2026 assume constant growth at 2026 rates. Clark County projections to 2035 are from the University of Nevada Las Vegas Center for Business and Economic Research projections (DIRS 178806-CBER 2006, all), and projections to 2067 assume constant growth at 2035 rates. Because these projections assume a constant rate of growth over the period, rather than a growth rate that increases at a decreasing rate (which would be expected for population projections for Clark and Nye Counties), the projected populations are high estimates.

This is a conservative assumption when analyzing for total radiological ***dose*** to resident populations, which is another use of the projections by the Yucca Mountain Project. By 2067, the population of Nye County is projected to increase to 131,074 people (187 percent over 2007 levels). Lyon County's population is also projected to increase during the same period, to 172,376 people (220 percent increase over 2007 levels). Esmeralda County's population is projected to decline to 1,083 people by 2067 (11 percent decrease from 2007 levels). Mineral County's population is expected to decrease to 3,715 people (20 percent decrease from 2007 levels). Clark County is projected to increase to approximately 5 million people (151 percent increase over 2007 levels). Washoe County-Carson City's combined population is expected to increase by approximately 625,737 people (132 percent increase over 2007 levels).

3.3.9.3.3 Housing

Table 3-140 lists housing characteristics in the Mina rail alignment region of influence in 2000. The housing stock in Lyon County is 14,279 units, consisting mostly of single-family homes. In Yerington, single-family, multiple-family, and mobile (manufactured) homes make up 65 percent, 22 percent, and 14 percent of the total housing units, respectively. More than 10 percent of the housing in Yerington is vacant.

Table 3-139. Projected values for population, employment, and economic variables, 2010 to 2067[a,b] (page 1 of 3).

Economic parameter	Year													
	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
Population														
Lyon County	53,832	60,939	71,795	80,930	88,548	95,811	103,724	112,292	121,567	131,609	142,480	154,249	166,990	172,376
Mineral County	4,626	4,667	4,759	4,566	4,398	4,309	4,224	4,140	4,058	3,977	3,898	3,898	3,744	3,715
Nye County	45,737	51,971	60,803	67,707	73,155	78,364	84,005	90,053	96,535	103,484	110,933	118,919	127,480	131,074
Clark County	1,990,481	2,258,748	2,652,070	2,946,350	3,169,797	3,358,455	3,544,362	3,739,880	3,946,181	4,163,863	4,393,553	4,635,913	4,891,642	4,997,841
Esmeralda County	1,215	1,147	1,069	1,012	997	1,007	1,016	1,027	1,038	1,048	1,058	1,068	1,079	1,083
Washoe County-Carson City	475,172	508,629	565,044	615,124	657,701	698,856	743,091	790,139	840,182	893,410	950,008	1,010,192	1,074,189	1,100,909
All of Nevada	2,745,469	3,064,179	3,539,284	3,902,058	4,185,507	4,431,901	4,680,591	4,943,171	5,221,096	5,515,255	5,826,285	6,155,203	6,503,050	6,647,735
Employment														
Lyon County	15,591	16,697	18,273	19,411	20,435	21,490	22,739	24,323	26,040	28,087	30,407	32,919	35,638	36,787
Mineral County	2,352	2,407	2,460	2,339	2,295	2,267	2,253	2,256	2,254	2,259	2,214	2,170	2,127	2,110
Nye County	18,184	19,194	20,585	21,683	22,628	23,706	24,923	26,310	27,732	29,274	31,381	33,640	36,062	37,079
Clark County	1,150,594	1,239,364	1,325,133	1,391,701	1,453,024	1,524,248	1,601,285	1,692,833	1,778,852	1,860,856	1,963,506	2,071,818	2,186,105	2,233,566
Esmeralda County	475	466	451	442	436	434	432	435	438	443	447	452	456	458
Washoe County-Carson City	315,776	332,279	356,087	370,019	382,854	397,125	412,807	432,986	452,149	472,506	502,440	534,270	568,116	582,248
All of Nevada	1,609,884	1,719,682	1,834,877	1,918,883	1,996,005	2,085,078	2,182,024	2,299,188	2,409,726	2,518,704	2,659,417	2,808,145	2,965,352	3,030,717

Table 3-139. Projected values for population, employment, and economic variables, 2010 to 2067[a,b] (page 2 of 3).

Economic parameter	Year													
	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
Gross regional product[b, c]														
Lyon County	0.840	0.956	1.165	1.358	1.557	1.775	2.026	2.328	2.672	3.081	3.335	3.611	3.909	4.034
Mineral County	0.131	0.140	0.159	0.163	0.176	0.191	0.208	0.228	0.249	0.271	0.266	0.261	0.256	0.254
Nye County	1.164	1.302	1.550	1.798	2.052	2.340	2.664	3.037	3.447	3.903	4.184	4.485	4.808	4.943
Clark County	95.392	109.494	131.517	151.836	172.974	197.204	224.494	256.596	291.013	327.876	345.963	365.047	385.184	393.546
Esmeralda County	0.026	0.027	0.029	0.032	0.035	0.039	0.042	0.046	0.050	0.056	0.057	0.057	0.058	0.058
Washoe County-Carson City	24.39	27.70	33.94	39.29	44.82	50.97	57.79	65.77	74.26	83.59	88.89	94.52	100.51	103.01
All of Nevada	129.036	147.283	177.133	204.369	232.647	264.813	300.888	343.229	388.550	437.450	461.921	487.785	515.120	526.484
Government spending[c,d]														
Lyon County	0.208	0.242	0.303	0.355	0.398	0.443	0.490	0.544	0.598	0.652	0.706	0.764	0.827	0.854
Mineral County	0.037	0.039	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.040	0.039	0.039	0.038
Nye County	0.174	0.202	0.252	0.291	.323	0.356	0.390	0.427	0.466	0.503	0.539	0.578	0.620	0.637
Clark County	7.269	8.460	10.543	12.146	3.427	14.617	15.780	17.043	18.266	19.411	20.482	21.612	22.804	23.299
Esmeralda County	0.007	0.007	0.007	0.007	.007	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Washoe County-Carson City	1.98	2.17	2.56	2.89	.17	3.46	3.77	4.10	4.43	4.74	5.04	5.36	5.70	5.85
All of Nevada	10.592	12.085	14.762	16.841	8.541	20.159	21.769	23.523	25.226	26.830	28.335	29.925	31.607	32.307

Table 3-139. Projected values for population, employment, and economic variables, 2010 to 2067[a,b] (page 3 of 3).

Economic parameter	Year													
	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
Real disposable income[b, c]														
Lyon County	1.040	1.169	1.367	.547	.737	1.938	2.177	2.465	2.788	3.194	3.458	3.744	4.053	4.184
Mineral County	0.109	0.116	0.122	.119	.122	0.125	0.128	0.132	0.136	0.144	0.141	0.138	0.135	0.134
Nye County	1.117	1.250	1.439	.605	.775	1.969	2.203	2.466	2.768	3.132	3.358	3.599	3.858	3.967
Clark County	60.731	68.974	79.836	9.500	9.788	111.517	124.864	140.518	156.612	173.027	182.571	192.642	203.269	207.682
Esmeralda County	0.029	0.030	0.033	.035	.037	0.041	0.043	0.047	0.050	0.054	0.054	0.055	0.055	0.056
Washoe County-Carson City	16.81	18.52	21.29	3.64	6.19	28.84	31.70	35.13	38.60	42.43	45.12	47.98	51.02	52.29
All of Nevada	85.032	95.636	110.205	23.098	36.861	152.183	169.418	189.600	210.290	232.015	245.035	258.799	273.350	279.400

a. Sources: DIRS 178610-Bland 2007, all; DIRS 178806- CBER 2006, all; DIRS 178807- Hardcastle 2006, all.
b. Model does not discriminate non-county regions, such as the Walker River Paiute Reservation.
c. Values from *Policy Insight* (DIRS 182251-REMI 2007, all), converted to 2006 dollars using the ratio of the 2000 annual Consumer Price Index (CPI) and the annual CPI from 2006.
d. 2006 dollars in billions.

Table 3-140. Housing characteristics in the Mina rail alignment region of influence, 2000.[a]

Geographic area	Total housing units	Single-family homes	Multiple-family homes	Mobile homes	Occupied housing units	Vacant housing units	Vacancy rate (percent)	
							Homeowner	Rental
Walker River Paiute Reservation[b]	348	308	6	34	304	44	NA[c]	NA
Schurz Census Designated Place[d]	320	280	6	34	276	44	0.5	6.7
Lyon County[e]	14,279	8,046	1,161	5,072	13,007	1,272	3.0	11.5
Yerington City[f]	1,328	861	286	181	1,182	146	2.3	14.0
Mineral County[g]	2,866	1,803	307	756	2,197	669	3.6	28.1
Hawthorne Census Designated Place[h]	1,813	1,177	219	417	1,470	343	3.8	28.6
Nye County[i]	15,934	6,383	1,014	8,537	13,309	2,625	3.4	17.9
Tonopah Census County Division[j]	1,608	766	385	457	1,152	456	3.6	32.3
Beatty Census County Division[j]	746	181	97	468	548	198	2.6	33.0
Amargosa Census County Division[j]	536	73	7	456	422	114	2.4	17.9
Pahrump[j]	8,206	3,660	479	4,067	7,234	972	3.2	11.8
Esmeralda County[k]	833	269	121	443	455	378	4.4	40.5
Goldfield Census County Division[j]	429	162	61	206	224	205	5.7	43.8
Clark County[l]	559,799	321,801	203,411	34,587	512,253	47,546	2.6	9.7
Washoe County	143,908	84,327	46,735	12,386	132,084	11,824	NA	NA
Carson City	21,283	12,872	5,364	2,985	20,171	1,112	NA	NA

a. Total Housing Units, Occupied Housing Units, and Vacant Housing Units counts were taken from Summary File 1 U.S. Census Bureau data, and Single Family Homes, Multiple Family Homes, and Mobile Homes counts were taken from Summary File 3 U.S. Census data. Because Summary File 1 data are collected from all households, while Summary File 3 data are compiled from a sample of approximately 19 million housing units (approximately 1 in 6 households), total housing counts differ slightly from the sum of "Single Family Homes, Multiple Family Homes, and Mobile Homes."
b. Source: DIRS 176856-U.S. Census Bureau 2003, Tables 41 and 43.
c. NA = not available.
d. Source: DIRS 180475-Nevada Small Business Development Center [n.d.], p. 55.
e. Source: DIRS 180476- Nevada Small Business Development Center [n.d.], p. 55.
f. Source: DIRS 180479-Nevada Small Business Development Center [n.d.], p. 55.
g. Source: DIRS 180477-Nevada Small Business Development Center [n.d.], p. 55.
h. Source: DIRS 180478-Nevada Small Business Development Center 2003, p. 55.
i. Source: DIRS 173564-Nevada Small Business Development Center 2003, p. 55.
j. Source: DIRS 173535-Bureau of Census 2000, all.
k. Source: DIRS 173566-Nevada Small Business Development Center 2003, p. 55.
l. Source: DIRS 173567-Nevada Small Business Development Center 2003, p. 55.

Compared to Lyon County, Mineral County has a much smaller housing stock at 2,866 units (DIRS 180477-Nevada Small Business Development Center [n.d.], p. 55). Most of these units are single-family homes (63 percent). The Hawthorne Census Designated Place consists of 1,813 housing units with single-family homes, multiple-family homes, and mobile (manufactured) homes totaling 65 percent, 12 percent, and 23 percent of the housing stock, respectively. The Schurz Census Designated Place has 320 housing units which are predominantly single-family homes. The Walker River Paiute Reservation's housing stock is nearly identical to Schurz. In Hawthorne, nearly 30 percent of the rental units are vacant.

Nye County has similar housing stock to Lyon County, with 15,934 units, as indicated by Census 2000 data (DIRS 173564-Nevada Small Business Development Center 2003, all). Most of these units are mobile homes; the housing stock in the Beatty Census County Division and the Amargosa Census County Division consists of 63 percent and 85 percent mobile homes, respectively (DIRS 173564-Nevada Small Business Development Center 2003, all). In Tonopah, almost one-third of the housing units are vacant, particularly in the rental segment.

Esmeralda County has the smallest housing stock. More than half of the county's 833 units are in Goldfield, where 48 percent are mobile homes, and 49 percent of all units were vacant in 2000. The housing stock of Clark County in 2000 was 559,799, which reflects an increase of slightly more than 75 percent over the 1990 count (DIRS 173531-Bureau of Census 2000, Table DP-5 STF3). This increase is accounted for by the large population and employment growth in Clark County, which has spurred housing construction. Vacancy rates in both the homeowner and rental segments in Clark County tend to be lower than the rates in the other counties in the region of influence.

The housing stock in Washoe County in 2000 was 143,908. Only 8 percent of these housing units are vacant. Similarly, the occupancy rate in Carson City's housing stock is relatively low. Only 1,112 housing units are vacant, or just over 5 percent. As shown in Table 3-141, the median values of housing on the Walker River Paiute Reservation ($57,300), in Mineral County ($59,500), and Esmeralda County ($75,600), as listed by the U.S. Census Bureau in 2000, were considerably below the median values in Lyon County ($119,200), Nye County ($122,100), Carson City ($136,300), Clark County ($139,500), and Washoe County ($149,500). Similarly, rent levels in Mineral and Esmeralda Counties were approximately half those for Clark County and approximately two-thirds those of Nye County. Additionally, housing values in all of Southern Nevada rose rapidly since the 2000 Census. A Las Vegas-based housing research firm, Home Builders Research Inc., reported that the median price of the recorded new homes in the area in November 2005 was $301,519, which was a 5.9 percent annual increase. Omitting apartment conversions, the median price for new homes was $336,645, or an 18.2 percent annual increase (DIRS 176007-Home Builders Research 2005, all).

There are lodging options along U.S. Highway 95 in and around Yerington, Hawthorne, Walker Lake, Mina, Goldfield, Beatty, and Town of Amargosa Valley. In Yerington, there are four hotels with 118 total rooms and four recreational vehicle parks with 109 total spaces.

Visitors to Hawthorne may stay at any of the eight hotels (which have a total of 243 rooms). In addition, Hawthorne has two recreational vehicle parks with a total of 46 spaces. Walker Lake, Nevada, has one hotel with 20 rooms, while Mina has one recreational vehicle park with 26 spaces. Visitors to Goldfield can stay in the Goldfield recreational vehicle park, which has 20 spaces (DIRS 182379-Nevada Commission on Tourism 2007, all). Beatty has a much higher accommodation capacity. The town has six motels with a total 275 rooms, and three recreational vehicle parks with a total 63 spaces (DIRS 182381-Nevada Commission on Tourism 2007, all; DIRS 182384-Nevada Commission on Tourism 2007, all).

Table 3-141. Median housing values and gross rents in the region of influence, 2000.[a]

Geographic area	Median value (dollars)[b]	Median monthly gross rent (dollars)
Walker River Paiute Reservation	57,300	200
Schurz Census Designated Place	56,800	200
Lyon County	119,200	591
Yerington City	99,200	436
Mineral County	59,500	398
Hawthorne County Designated Place	58,700	426
Nye County	122,100	541
Tonopah Census County Division	78,200	478
Beatty Census County Division	93,700	368
Amargosa Valley Census County Division	80,800	380
Pahrump	135,100	614
Esmeralda County	75,600	381
Goldfield Census County division	71,300	389
Clark County	139,500	716
Washoe County	149,500	675
Carson City	136,300	650

a. Source: DIRS 176856-U.S. Census Bureau 2003, Tables 25, 29, 45, and 47.
b. Median value applies to owner-occupied units.

Town of Amargosa Valley features a combined 60-room hotel and 51-space recreational vehicle park, one additional motel (17 rooms), and one additional recreational vehicle park (97 spaces) (DIRS 182380-Nevada Commission on Tourism 2007, all; DIRS 182383-Nevada Commission on Tourism 2007, all).

3.3.9.3.4 Public Services

This section summarizes conditions for health care, education, fire protection, and law enforcement. Section 3.3.11, Utilities, Energy, and Materials, describes utilities-related public services.

3.3.9.3.4.1 Health Care. While Lyon, Mineral, Nye, and Esmeralda Counties have some health care facilities, all four counties are federally designated as health professional shortage areas for primary, dental, and mental health care (DIRS 180466-State of Nevada 2005, all; DIRS 180467-State of Nevada 2005, all; DIRS 173559-State of Nevada [n.d.], all; and DIRS 173560-State of Nevada [n.d.], all). Health care services in the region of influence are concentrated in Clark County, particularly in the Las Vegas area.

There is a public health clinic on the Walker River Paiute Reservation in Schurz. This clinic is staffed full time with a doctor and a nurse (DIRS 180118-Gormsen and Merritt 2007, all). This facility also has emergency medical services and emergency medical technicians (DIRS 180118-Gormsen and Merritt 2007, all).

Lyon County is served by four rural community health offices (DIRS 180153-Gormsen 2007, all). One of the health offices is in Yerington and has full-time public health services, such as family planning, sexually transmitted disease clinics, and immunization clinics. Yerington's community health office is the only provider of immunizations in the Smith Valley and Mason Valley region (DIRS 180153-Gormsen 2007, all).

Lyon County is also served by the South Lyon Medical Center in Yerington. The facility has 63 hospital beds and a 24-hour emergency room (DIRS 178100-State of Nevada 2006, p. v).

Mineral County has a community health nurse who provides immunizations, conducts general health checks (such as checking blood pressure), and examines ears, eyes, noses, and throats when those services are within the community health nurse's scope of practice (DIRS 180118-Gormsen and Merritt 2007, all). The community health nurse visits a Senior Care and Share center in Mina once a month to provide these public health services. Mina also has emergency medical team services available (DIRS 180118-Gormsen and Merritt 2007, all).

Mineral County is also served by Mount Grant Hospital in Hawthorne. This 35-bed facility offers a wide range of services, including acute, long-term, and emergency care (DIRS 180692-Mineral County Nuclear Projects Office 2004, p. 21). The hospital has a surgical suite for minor elective surgery (orthopedic, podiatry, and ophthalmology) (DIRS 180692-Mineral County Nuclear Projects Office 2004, p. 22).

According to a Nye County assessment, emergency service (county-wide medical and Pahrump's fire protection) personnel are currently overextended (DIRS 174548-Abaris Group 2004, pp. 2 and 3). Nye County medical services are distributed widely and consist of a mixture of public and private clinics. The communities of Beatty, Pahrump, and Town of Amargosa Valley all have access to ambulance service, and are served by preventative care clinics staffed by physician assistants or community health nurses. These clinics focus on women's health and immunizations. They are funded in part by the State Rural Health Division (DIRS 174736-Arcaya 2005, all). Pahrump has a pediatric physician who runs a separate clinic in the community, a Veterans Administration clinic, and several private dermatologists, dentists, and chiropractors (DIRS 174736-Arcaya 2005, all; DIRS 174972-Arcaya 2005, all).

Additionally, Desert View Regional Medical Center (DVRMC), Pahrump's first hospital, opened in April 2006. The hospital has 24 beds and a 24-hour emergency room. The facility has a maternity ward, full-service lab and radiology services, as well as physical therapy services (DIRS 181897-Desert View Regional Medical Center 2007, all).

Nye County is also served by the Nye Regional Medical Center, a small, private hospital in Tonopah that has ambulance services. The center has 44 beds, 26 of which are long-term-care beds reserved for the hospital's nursing-home wing. Two full-time-equivalent physicians provide coverage for both the 24-hour emergency room and all other patients. The hospital's nursing home maintains 24-hour coverage consisting of one registered nurse and one certified nursing assistant. The Nye Regional Medical Center is able to perform diagnostic imagery and to provide services from its on-site laboratory, pharmacy, and outpatient clinic. However, the facility is not licensed for surgery. Nye County patients in need of more advanced care than can be provided at Tonopah's hospital are transported by helicopter to Reno or Las Vegas by Flight for Life, a medical air service (DIRS 174732-Arcaya 2005, all).

Although Nye County continues to be a medically underserved area and a health professional shortage area, Table 3-142 shows that the capacity of the health care system in Nye County improved between 1995 and 2000, with increases in the average number of beds and the number of beds per 1,000 residents.

Table 3-142. Hospital use in Nye County.[a]

County	1995	1998	2000
Average number of beds	21	10	44
Beds per 1,000 residents	0.86	0.33	1.3
Patient days	1,900	560	No data available

a. Source: DIRS 174732-Arcaya 2005, all.

Esmeralda County had no practicing doctors or dentists in 2005 (DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7). The U.S. Health Resources and Services Administration designated Esmeralda County as both a health professional shortage area and a medically underserved population for primary health, dental, and mental-health care for 2004 (DIRS 173560-State of Nevada [n.d.], all). Because Esmeralda County has no health-care facilities, the county has submitted a proposal to fund a new facility (DIRS 175507-McCorkel et al. 2005, all).

Clark County has 13 general acute care medical centers with a combined total of 3,439 beds (1.9 beds per 1,000 residents) and 2,729 active, licensed physicians practicing throughout the county in 2005 (DIRS 178100-State of Nevada 2006, p. v; DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7). Sunrise Hospital and Medical Center, in Las Vegas, is the largest hospital in Nevada with 701 beds (DIRS 178100-State of Nevada 2006, p. v). It is also capable of providing all medical services and staffs a 24-hour emergency room. Of the remaining 12 hospitals in Clark County, eight (Desert Springs Hospital, Mountain View Hospital, North Vista Hospital, Southern Hills Hospital and Medical Center, Spring Valley Hospital Medical Center, Summerlin Hospital and Medical Center, University Medical Center, and Valley Hospital and Medical Center) are in Las Vegas, two (Saint Rose Dominican Hospital and Saint Rose Siena Campus) are in Henderson, one (Boulder City Hospital) is in Boulder City, and one (Mesa View Regional Hospital) is in Mesquite (DIRS 178100-State of Nevada 2006, p. v).

Washoe County has five general acute care hospitals with a combined total of 1,066 beds and 952 active, licensed physicians practicing throughout the county in 2005 (DIRS 178100-State of Nevada 2006, p. v; DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7). According to 2005 data, Carson City has one general acute care hospital with 144 beds and 143 active, licensed physicians (DIRS 178100-State of Nevada 2006, p. v; DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7).

3.3.9.3.4.2 Education. Lyon County has a total of 16 elementary, middle, and high school facilities. During the 2005 to 2006 school year, Lyon County schools had a total enrollment of 8,688 students and a graduation rate for the class of 2005 of 83 percent (DIRS 180463-Lyon County School District [n.d.], pp. 2 and 10). The average student-to-teacher ratio for kindergarten through eighth grades is 21 to 1 (DIRS 180463-Lyon County School District [n.d.], p. 9). This is slightly higher than the 2003 national average student-to-teacher ratio of 16 to 1 across elementary and secondary grades levels (DIRS 177757-Snyder, Tan, and Hoffman 2006, Table 62). Lyon County is the fastest growing school district in Nevada (DIRS 180463-Lyon County School District [n.d.], p. 1). The school district hired more than 100 teachers for the 2005-2006 school year and will open new elementary schools in Fernley and Dayton for the 2006-07 and 2007-08 school years, respectively (DIRS 180463-Lyon County School District [n.d.], p. 1).

Mineral County has a total of three elementary, middle, and high school facilities. During the 2005 to 2006 school year, Mineral County schools had a total enrollment of 624 students and a graduation rate for the class of 2005 of 73 percent (DIRS 180465-Mineral County School District [n.d.], pp. 2 and 7). The average student-to-teacher ratio for kindergarten through eighth grades is 16 to 1 (DIRS 180465-Mineral County School District [n.d.], p. 6). This is consistent with the 2003 national average student-to-teacher ratio of 16 to 1 across elementary and secondary grades levels (DIRS 177757-Snyder, Tan and Hoffman 2006, Table 62).

During the 2005 to 2006 school year, Nye County had approximately 6,088 students. The county's 2005 graduation rate was approximately 60 percent (DIRS 177759- Nye County School District [n.d.], p. 11). The average student-to-teacher ratio for kindergarten through fifth grades is 20 to 1 (DIRS 177759-Nye County School District [n.d.], p. 10). Tonopah has elementary, middle, and high school facilities.

Nye County's school system saw an approximate 10 percent increase in enrollment in the 2004-2005 school year over the previous year. Most of this growth was due to increases in Pahrump's population. Pahrump is home to four elementary schools, one middle school, and one high school. Table 3-143 lists enrollment for each school. All of these schools are functioning at or above maximum design capacity (that is, they are all serving as many or more students than they were originally built to accommodate). To alleviate overcrowding, all six schools were scheduled to receive modular units over the summer of 2005 that would each hold two additional classes. A bond for a new elementary school is also under consideration for the area, with a timeline of roughly 18 months for discussion and a decision on the bond. The new elementary school would likely be designed to hold between 400 and 600 students, making it roughly equal in size to the four existing elementary schools (DIRS 174737-Arcaya 2005, all).

Table 3-143. Enrollment in Pahrump area schools, 2004-2005.[a]

School Name	Type	2004-2005 Enrollment
Pahrump Valley	High school	987
Rosemary Clark	Middle school	1,122
Hafen	Elementary school	560
JG Johnson	Elementary school	555
Mt. Charleston	Elementary school	574
Manse	Elementary school	478

a. Source: DIRS 174737-Arcaya 2005, all.

In Nye County, the Community College of Southern Nevada has a campus in Pahrump that provides postsecondary school education. The facility offers courses to fulfill general education requirements, with 4-year degree programs planned (DIRS 174737-Arcaya 2005, all). Some of these programs are also offered as distance learning courses that can be accessed at a secondary facility in Tonopah equipped for videoconferencing (DIRS 174737-Arcaya 2005, all). The nearest major university to southern Nye County is the University of Nevada, Las Vegas, 105 kilometers (65 miles) from Pahrump. The University of Nevada, Reno, is the closest major university to northern Nye County. In addition, the University of Nevada, Reno, has a Cooperative Extension Center in Pahrump.

In Esmeralda County, 86 students were enrolled in school during the 2005-2006 school year (DIRS 177760-Esmeralda County School District [n.d.], p. 3). Three schools in the county serve kindergarten through eighth grade students. These schools are in Dire, Silver Peak, and Goldfield. The average student-to-teacher ratio is 12 to 1 (DIRS 177760-Esmeralda County School District [n.d.], p. 7). The county employs seven certified teachers and one certified literacy coordinator (DIRS 174970-Arcaya 2005, all). There is no high school in Esmeralda County; high-school students from Esmeralda County attend school in Tonopah, Nye County (DIRS 155970-DOE 2002, p. 3-156).

3.3.9.3.4.3 Fire Protection. Lyon County is divided into four fire districts to meet fire suppression needs: North Lyon County Fire District, Central Lyon County Fire District, Mason Valley Fire District, and Smith Valley Fire District. In total, there are 31 career firefighters and 117 volunteer firefighters spread across these fire districts (DIRS 180693-Gormsen 2007, all). The Central Lyon, Mason Valley, and Smith Valley Fire Districts are part of a quad-county partnership with Douglas County, Storey County, and Carson City. These fire districts are weapons-of-mass-destruction and hazardous-materials certified, and will provide assistance to events in any of the four partner counties. All four of the fire districts have received at least one Fire Act grant in the last 3 years. In addition, the county receives sporadic grants from state agencies (DIRS 180693-Gormsen 2007, all).

Mineral County has four fire departments: Hawthorne Volunteer Fire Department, Mina Volunteer Fire Department, Luning Volunteer Fire Department, and Walker Lake Volunteer Fire Department. Among these four departments, the county has a total of 43 volunteer and three career firefighters. Hawthorne Volunteer Fire Department uses three Type 1 fire apparatuses, and the other three departments use one Type 1 apparatus each.

Nye County has 11 volunteer fire departments, including one in Beatty and one in Town of Amargosa Valley. The county's only paid fire department is in Pahrump. The county recently spent $2.5 million to upgrade its fire trucks and has adequate fire protection in all areas of the county except for Pahrump, which is overextended (DIRS 174731-Arcaya 2005, all). A 2004 audit of the Pahrump Valley Fire-Rescue Service commissioned by the Pahrump Town Board found that "the community is currently underserved by fire suppression and emergency medical services operational staff" and suggested that staff be added to the service, specifically an additional daily three-person team (DIRS 174548-Abaris Group 2004, p. 3). The audit also noted that Pahrump has no overall fire suppression and emergency medical services master plan, and recommended that one be developed.

Currently, the Nevada Test Site provides fire protection services to the Yucca Mountain Site. The Nevada Test Site has two active fire departments that operate 24 hours a day, 7 days a week. One of the fire departments is in Mercury, Nevada (Area 23), and the other is in Area 6 on the Nevada Test Site. The Yucca Mountain Site has two paramedics, a small medical facility, and an ambulance for emergency response. The site also has two fully trained underground rescue teams available any time underground work is underway (DIRS 177762-Gormsen 2006, all).

The BLM Las Vegas and Battle Mountain Field Offices supplement Nye County's fire-protection resources by providing wildfire suppression services to all the public lands within Nye County that are managed by BLM and the U.S. Forest Service (DIRS 177867-Gormsen 2006, all; DIRS 177925-Gormsen 2006, all). The Las Vegas Field Office provides fire suppression resources for wildfires during peak fire season, which is generally from April through October. The Battle Mountain Field Office provides fire suppression support from three locations in northern Nye County: Austin, Eureka, and Battle Mountain. In addition to firefighters, the fire suppression resources available through these locations include Type-4 and Type-3 wildfire engines, a Type-3 helicopter, Type-3 incident commanders, and single engine air tanker and air attack bases (DIRS 177867-Gormsen 2006, all; DIRS 177925-Gormsen 2006, all).

In Esmeralda County, Goldfield has nine volunteer firefighters and three fire trucks; Gold Point has eight volunteer firefighters and three fire trucks; Silver Peak has six volunteer firefighters and three fire trucks; and Fish Lake Valley has 16 volunteer firefighters and three fire trucks (DIRS 180977-Gormsen 2007, all). The community fire departments have access to the county's road department vehicles, if needed.

3.3.9.3.4.4 Law Enforcement. The Walker River Paiute Reservation has a police department with four law enforcement officers (DIRS 181594- Zuber, 2007). This yields a ratio of 3.4 officers per 1,000 residents.

The Lyon County Sheriff's Office has 78 sworn officers, 13 of whom are assigned to the detention facility. This yields a ratio of 1.6 sworn personnel per 1,000 residents (DIRS 180693-Gormsen 2007, all).

The Mineral County Sheriff's Office is currently staffed with 18 sworn officers to provide administrative, communications, detention, and patrol services in the county (DIRS 180221-Gormsen and Merritt 2007, all). This yields a ratio of 3.9 sworn officers per 1,000 residents.

The Nye County Sheriff's Office has 105 sworn officers, 85 who conduct street patrols, and 20 who are corrections and detention officers (DIRS 174974-Arcaya 2005, all). This yields a ratio of 2.2 patrol officers per 1,000 residents. The Nye County Sheriff's Office receives some funding in the form of occasional grants from state and federal agencies (DIRS 177756-Gormsen 2006, all).

The Esmeralda County Sheriff's Office has 14 employees: six officers who handle patrol (one sheriff, one sergeant, two resident deputies, and two full-time street deputies), three corrections officers, four full-time dispatchers, and one part-time civilian dispatcher (DIRS 174753-Arcaya 2005, all). This yields a ratio of 5 officers per 1,000 residents in Esmeralda County. By comparison, the national officer-to-population ratio is 2.4 officers per 1,000 residents (DIRS 155970-DOE 2002, p. 3-92). The Esmeralda County Sheriff's Office receives limited state and federal support in the form of occasional equipment grants (DIRS 178094-Arcaya 2006, all). The county does not receive ongoing grant support or training administered by state or federal agencies.

As Table 3-144 shows, crime rates for Lyon, Mineral, Nye, Esmeralda Counties and Carson City are below the national average, and, with the exception of Mineral County, have decreased between 2003 and 2005.

Table 3-144. Crime rates in the Mina rail alignment region of influence, 2003 to 2005.

Area	Crime rate[a] (percent)		
	2003[b]	2004[c]	2005[d]
Lyon County	23	22	21
Mineral County	12	13	16
Nye County	35	35	31
Esmeralda County	13	10	7
Clark County	51	51	51
Washoe County	51	47	46
Carson City	38	35	31
National	45	44	Not available

a. The crime rate is based on the occurrence of an offense per 1,000 residents.
b. Sources: DIRS 173399-State of Nevada 2004, all; DIRS 177747-State of Nevada 2005, all; DIRS 177748-State of Nevada 2006, all.

3.3.9.3.5 Transportation Infrastructure

This section describes the public roadways and mainline railroads in the area around the Mina rail alignment.

3.3.9.3.5.1 Public Roadways. Because the Mina rail alignment region of influence for transportation resources is primarily in remote and rural areas, the rail line would cross paved highways and roads with low traffic, and low-usage unpaved roads, including county roads, private roads, and off-road vehicle trails. While many of the unpaved roads are important to the daily activities of landowners and ranchers in the area, these roads are not heavily traveled. The exception is the existing Union Pacific Railroad Hazen Branchline between Hazen and Wabuska, which crosses public roads with moderate traffic (such as U.S. Highway 50A in Hazen, U.S. Highway 50 in Silver Springs, and U.S. Highway 95A in Churchill and Wabuska). Section 4.3.10, Occupational and Public Health and Safety, describes safety issues concerning rail line crossings of public roads, and road traffic related to construction and operation of the proposed railroad.

In addition to the state and federal roads discussed below, there are three paved roads with rail-public highway crossings on the Union Pacific Railroad Hazen Branchline: First Avenue, Fifth Street, and Ninth Street in Silver Springs. There are also three paved roads the Mina rail alignment would intersect and would require rail-highway crossings: Silver Peak Road in Silverpeak and two Nevada Test and Training Range access roads (one approximately 19 kilometers [12 miles] east of Tonopah off U.S. Highway 6 and the other off U.S. Highway 95 between Scottys Junction and Beatty).

Generally, the main roads within the region of influence are two-lane highways with very little daily traffic. Table 3-145 lists annual average daily traffic volumes along primary roads in the region of influence, which DOE obtained from the Nevada Department of Transportation's 2005 annual traffic report (DIRS 178749-NDOT [n.d.], all). These traffic volumes indicate that roadways near the Mina rail alignment are not congested.

All references to levels of service of roads shown in Table 3-145 are defined by the Highway Capacity Manual 2000, which is an industry standard for traffic engineering published by the Transportation Research Board (DIRS 176524-Transportation Research Board 2001, all). This manual defines six levels of service that reflect the level of traffic congestion and qualify the operating conditions of a roadway.

The six levels are given letter designations ranging from A to F, with A representing the best operating conditions (free flow, little delay) and F the worst (congestion, long delays) (DIRS 176524-Transportation Research Board 2001, all). Various factors that influence the operation of a roadway or intersection include speed, delay, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. The Highway Capacity Manual describes the ***levels of service*** as follows:

- Level of service A describes completely free-flow conditions. Individual drivers are virtually unaffected by the presence of other vehicles in the traffic stream.
- Level of service B also indicates free flow, but the presence of other vehicles becomes more noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from Level of Service A.
- Level of service C is in the range of stable flow, but marks the beginning of the range of flow in which operation of individual drivers becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by others and maneuvering requires substantial vigilance on the part of the driver.
- Level of service D represents high density but stable flow. Speed and freedom to maneuver are severely restricted, and the driver experiences a generally poor level of comfort and convenience.
- Level of service E represents operating conditions at or near capacity. All speeds are reduced to a low, but relatively uniform, value.
- Level of service F is used to define breakdown of traffic flow or stop-and-go traffic. This condition exists wherever the amount of traffic approaching a point exceeds the amount that can cross the point. Queues form behind such locations. Operations within the queue are characterized by stop and-go waves, and they are extremely unstable.

Levels of service A, B, and C are typically considered good operating conditions in which motorists experience minor or tolerable delays of service. Based on the traffic counts listed in Table 3-145, State Routes 361, 360, and 265 are operating at a level of service A. Most of U.S. Highway 95 and 95A within the region of influence are operating at a level of service B, except for a portion that is operating at a level of A, and another at level C. The section of U.S. Highway 50 within the region of influence operates at a level of service B, while U.S. Highway 50A operates at a level of service C. Sections 3.3.10 and 4.3.10, Occupational and Public Health and Safety, discuss highway accidents and fatalities.

3.3.9.3.5.2 Mainline Railroads. Two major freight railroads, both Class I, serve Nevada: the Union Pacific Railroad and the Burlington Northern and Santa Fe Railway. Union Pacific is the dominant carrier of the two in terms of tonnage of freight hauled and miles of track. The Union Pacific Railroad mainlines consist of two northern routes and one southern route that cross Nevada east to west. The region of influence for rail transportation includes the Union Pacific Railroad Hazen Branchline, and the Department of Defense Branchlines from near Wabuska to Hawthorne.

Union Pacific Railroad Hazen Branchline shipments totaled 1,419 railcars in 2005 (DIRS 178017-Holder 2006, all), which can generate from one to five trains per week. Of the 1,419 railcars, 98 railcars were shipped to the Hawthorne Army Depot. For purposes of analysis in this Rail Alignment EIS, DOE assumes that the existing rail traffic on the Union Pacific Railroad Hazen Branchline consists of an average of four trains per week (two Union Pacific trains plus two U.S. Army trains). Since the Union Pacific Railroad trains only operate as far as the end of the Union Pacific Railroad Hazen Branchline near Wabuska, DOE assumes that the existing rail traffic on the Department of Defense Branchlines averages two trains per week.

Sections 3.3.10 and 4.3.10, Occupational and Public Health and Safety, discuss rail transportation in relation to public safety.

Table 3-145. Annual average daily traffic counts in southern and western Nevada (2005)[a].

Roadway and location of traffic count station	Legend in Figure 3-235	Vehicles per day[b]	Level of service
U.S. Highway 50A			
0.8 kilometer (0.5 mile) west of the junction of U.S. Highway 50 (Churchill County)	a	7,900	C
U.S. Highway 50			
2.4 kilometers (1.5 miles) east of U.S. Highway 95A (Lyon County)	b	2,200	B
U.S. Highway 95A			
13 kilometers (8 miles) south of Silver Springs (Lyon County)	c	NA[c]	A
1 kilometer (0.6 mile) south of the railroad crossing at Wabuska (Lyon County)	d	2,850	B
0.16 kilometer (0.1 mile) east of Miley Road (Lyon County)	e	1,800	B
State Route 361 (Gabbs Valley Road)			
32 kilometer (0.2 mile) north of U.S. Highway 95 in Luning (Mineral County)	f	120	A
State Route 360 (Mina-Basalt Cutoff Road)			
0.4 kilometer (0.25 mile) west of U.S. Highway 95 south of Sodaville (Mineral County)	g	690	A
U.S. Highway 6 and U.S. Highway 95			
76.2 meters (250 feet) west of State Route 265 to Silver Peak (Esmeralda County)	n	2,000	B
State Route 265 (Silver Peak Road)			
0.16 kilometer (0.1 mile) south of U.S. Highway 6 and U.S. Highway 95 (Esmeralda County)	i	90	A
U.S. Highway 95			
61 meters (200 feet) north of railroad grade crossing in Schurz (Mineral County)	j	2,550	B
0.40 kilometer (0.25 mile) south of State Route 362 (Hawthorne Truck Bypass Road) (Mineral County)	k	2,850	B
0.40 kilometer (0.25 mile) north of State Route 361 to Gabbs (Mineral County)	l	2,300	B
6.6 kilometers (4.1 miles) north of Mina (Mineral County)	m	2,300	B
1 kilometer (0.6 mile) north of U.S. Highway 6 (Esmeralda County)	h	1,700	B
0.3 kilometer (0.2 mile) south of U.S. Highway 6 in Tonopah (Nye County)	q	5,550	C
20.3 kilometers (12.6 miles) west of the Nye-Esmeralda county line (Esmeralda County)	p	2,050	B
At the Nye-Esmeralda county line south of Tonopah (Esmeralda County)	o	2,100	B
Just south of the town of Goldfield (Esmeralda County)	r	1,950	B
South of Goldfield at mp ES-8.8 (Esmeralda County)	s	200	A
0.16 kilometer (0.1 mile) south of State Route 266 at Lida Junction (Esmeralda County)	t	2,150	B
1.6 kilometers (1 mile) north of State Route 374 (Death Valley Road) (Nye County)	u	2,400	B
0.2 kilometer (0.1 mile) south of State Route 374 (Death Valley Road) (Nye County)	v	3,400	B
0.3 kilometer (0.2 mile) north of State Route 373 (Nye County)	w	2,600	B

a. Source: DIRS 178749-NDOT [n.d.], all.
b. See Figure 3-235 for location of traffic counts.
c. NA = not available.

3.3.10 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

This section describes the affected environment for occupational and public health and safety related to construction and operation of a railroad along the Mina rail alignment. Section 3.3.10.1 describes the nonradiological, radiological, and transportation regions of influence; Section 3.3.10.2 describes the nonradiological health and safety environment; Section 3.3.10.3 describes the radiological health and safety environment; Section 3.3.10.4 describes ***background radiation*** in the vicinity of the Yucca Mountain Site; and Section 3.3.10.5 describes the nonradiological transportation health and safety environment.

The radiological health and safety environment discussion is related to the impact analyses of public and occupational ***exposure*** to ***radiation***. The nonradiological health and safety environment discussion is related to the occupational health and safety impact analysis, including occupational incidents affecting construction and operations workers resulting from workplace physical hazards, exposure to nonradiological ***hazardous chemicals***, and exposure to other nonradiological hazards (such as biological hazards). The nonradiological transportation health and safety environment discussion relates to the nonradiological transportation impact analysis, which includes impacts to workers and the public from roadway and railway transportation ***accidents*** other than accidents involving releases of ***radiation***.

3.3.10.1 Region of Influence

3.3.10.1.1 Nonradiological Region of Influence

The region of influence for occupational nonradiological impacts includes:

- The nominal width of the Mina rail alignment construction right-of-way between Wabuska and the Rail Equipment Maintenance Yard. There would be no new construction along the existing Union Pacific Branchline between Hazen and Wabuska; the region of influence for the existing rail line between Hazen and Wabuska applies only to the operations phase, not to the construction phase.
- The ***operations right-of-way*** of the existing Union Pacific Hazen Branchline between Hazen and Wabuska and the operations right-of-way of the Mina rail alignment between Wabuska and the Rail Equipment Maintenance Yard.
- Public roads in Washoe, Carson City, Douglas, Storey, Churchill, Mineral, Lyon, Nye, and Esmeralda Counties and the Walker River Paiute Reservation that the proposed railroad workforce would use during railroad construction and operations.
- The railroad construction and operations support facilities including access roads, water wells, and quarries where workers would perform construction, operations, or maintenance activities. Railroad operations support facilities within the region of influence include the following:
  - Staging Yard (including interchange tracks) at Hawthorne
  - Maintenance-of-Way Facility
  - Rail Equipment Maintenance Yard
  - Cask Maintenance Facility
  - ***Nevada Railroad Control Center*** and National Transportation Operations Center
- Construction support facilities include the following:
  - Quarries
  - Concrete batch plant
  - Construction camps
  - Water wells

The region of influence for occupational nonradiological impacts includes public roads upon which the proposed workforce would travel and the rail line right-of-way and construction and operations support facilities where the proposed workforce would work.

3.3.10.1.2 Radiological Region of Influence

The region of influence for radiological impacts to members of the public during ***incident-free transportation*** includes the area 0.8 kilometer (0.5 mile) on either side of the centerline of the Mina rail alignment, which, for purposes of analysis, includes operation of cask trains and other trains along the existing Union Pacific Railroad Hazen Branchline to the Staging Yard and operation of cask trains and repository construction and supplies trains from the Staging Yard to the Rail Equipment Maintenance Yard.

The region of influence for occupational radiological impacts during incident-free operation includes the physical boundaries of railroad operations support facilities, where workers would perform activities involving the transportation of ***spent nuclear fuel*** and ***high-level radioactive waste***. Railroad operations support facilities within the radiological region of influence include only the Staging Yard, the Rail Equipment Maintenance Yard, and the Cask Maintenance Facility because DOE anticipates that the potential for workers to be exposed to ***ionizing radiation*** from ***radioactive*** materials will occur only at those facilities. Radioactive materials would not be handled at the Nevada Railroad Control Center and National Transportation Operations Center, or the Maintenance-of-Way Facility.

For purposes of this Rail Alignment EIS, the affected environment for radiological impacts to members of the public in relation to incident-free transportation includes:

- Residents within the region of influence of the Mina rail alignment, including persons who live within 0.8 kilometer (0.5 mile) of either side of the centerline of the Union Pacific Railroad Hazen Branchline, from Hazen to the Rail Equipment Maintenance Yard. For the public radiological impact analysis, DOE evaluated four specific alignments: the alignment with the highest exposed population, the shortest alignment, the longest alignment, and the alignment with the lowest population (Table 3-146). Affected populations for the four alignments would include:
  - Populations of the public within 0.8 kilometer of either side of the centerline of the rail alignment. These populations are based on 2000 Census data.
  - Populations of Tribal members within 0.8 kilometer of either side of the centerline of the rail alignment. These populations are also based on 2000 Census data.
  - Populations within 0.8 kilometer of the Staging Yard. Based on the location of the Staging Yard at Hawthorne and 2000 Census data, DOE anticipates that there would be no members of the public within 0.8 kilometer of the Staging Yard footprint.
  - Individuals at locations such as residences or businesses located near the rail alignment.
  - Populations within the region of influence for radiological impacts for potential public exposure related to accidents and sabotage. This includes the area 80 kilometers (50 miles) on either side of the centerline of the rail line. These populations are based on 2000 Census data.

For radiological accidents and sabotage, the populations within the region of influence are based on the population within 80 kilometers (50 miles) on either side of the centerline of the proposed rail alignment. DOE based this region of influence on that described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 6-24).

Table 3-146. Mina rail alignments evaluated for radiological impacts to members of the public.[a]

Alignment with the largest population	Alignment with the smallest population	Longest alignment	Shortest alignment
941 people	878 people	901 people	904 people
339 miles	347 miles	354 miles	323 miles
Union Pacific Railroad Hazen Branchline[b]	Union Pacific Railroad Hazen Branchline[b]	Union Pacific Railroad Hazen Branchline[b]	Union Pacific Railroad Hazen Branchline[b]
Department of Defense Branchline North	Department of Defense Branchline North	Department of Defense Branchline North	Department of Defense Branchline North
Schurz alternative segment 5	Schurz alternative segment 4	Schurz alternative segment 6	Schurz alternative segment 1
Department of Defense Branchline South	Department of Defense Branchline South	Department of Defense Branchline South	Department of Defense Branchline South
Mina common segment 1	Mina common segment 1	Mina common segment 1	Mina common segment 1
Montezuma alternative segment 2	Montezuma alternative segment 3	Montezuma alternative segment 3	Montezuma alternative segment 1
Mina common segment 2	Mina common segment 2	Mina common segment 2	Mina common segment 2
Bonnie Claire alternative segment 2	Bonnie Claire alternative segment 3	Bonnie Claire alternative segment 2	Bonnie Claire alternative segment 2
Common segment 5	Common segment 5	Common segment 5	Common segment 5
Oasis Valley alternative segment 3	Oasis Valley alternative segment 1	Oasis Valley alternative segment 3	Oasis Valley alternative segment 5
Common segment 6	Common segment 6	Common segment 6	Common segment 6

a. Populations based on 2000 Census data.
b. The Union Pacific Railroad Hazen Branchline is part of the region of influence only for the purposes of the radiological impact assessment; the Union Pacific Railroad Hazen Branchline is not part of the Mina rail alignment.

3.3.10.1.3 Transportation Region of Influence

The region of influence for transportation includes public roadways in the vicinity of the Mina rail alignment, as well as the Mina rail alignment itself. The region of influence for public nonradiological transportation impacts includes public roads and the rail line right-of-way in relation to potential roadway and railway nonradiological transportation accidents that could involve the public. The region of influence for transportation is primarily in remote and rural areas, and there are two operating railroads between Hazen and Thorne. The existing Union Pacific Hazen Branchline from Hazen to Wabuska, and the Department of Defense Branchline from Wabuska to Thorne both carry very low rail volumes, with an average of two trains per week on the Union Pacific Railroad Hazen Branchline and two trains per week on the Department of Defense Branchline. Although the existing Union Pacific Railroad Mainline that services west-central Nevada is used as a point of comparison in Section 4.3.10, this Rail Alignment EIS does not assess impacts to the Union Pacific Railroad Mainline.

During railroad construction, new access roads to construction camps, quarries, and water wells would originate from nearby intersections with existing public roadways. The Mina rail alignment would be within Nevada Department of Transportation Districts 1 and 2, and the rail alignment would cross Churchill, Lyon, Mineral, Nye, and Esmeralda Counties and the Walker River Paiute Reservation. The region of influence focuses on the vicinity of the Mina rail alignment, but also includes other roadways that DOE could use to supply materials, equipment, and workers during the construction phase. DOE recognizes that during construction, completed segments of the rail line could be used to transport goods and services to construction sites and camps.

3.3.10.2 Nonradiological Health and Safety Environment

Nonradiological occupational health and safety considers potential recordable incidents, lost-time accidents, and worker fatalities resulting from potential exposure of workers to physical hazards and nonradiological hazardous chemicals in their work environment during railroad construction and operations. The affected environment for nonradiological occupational health and safety also includes potential occupational health effects from exposure to exhaust emissions from vehicles and heavy equipment, including, for example, earth-moving equipment.

Nonradiological public health and safety addresses potential exposure of members of the public to nonradiological chemical hazards and vehicle emissions that would result from railroad construction and operations. Section 3.3.4, Air Quality and Climate, and Section 3.3.8, Noise and Vibration, describe the affected environments for potential public exposure to criteria and nonradiological ***hazardous air pollutants***, including vehicle emissions, and potential exposure to noise and vibration generated from construction and operation of the proposed railroad.

The types of potential nonradiological health and safety hazards to construction workers and operations and maintenance workers under the Proposed Action include:

- Incidents resulting from physical hazards, including occupational injuries and illnesses resulting in total ***recordable cases***, ***lost workday cases***, and fatalities. Fatalities could occur on or off the work site as a result of an incident or illness experienced on the work site. Physical hazards could include the potential for falls, excavation and confined-space entry hazards, mechanical hazards, electrical hazards, ergonomic hazards, and heavy construction equipment (not passenger vehicles) hazards, and illnesses related to workplace exposure to chemical hazards.
- Off-site vehicle emissions-related health effects, including health effects related to off-site vehicular emissions from transportation of construction workers, equipment, and materials and wastes to and from the construction sites.

- On-site vehicle and heavy equipment-related health effects, including effects related to diesel engine exhaust emissions from vehicles and heavy-equipment operated by construction workers on the construction sites. These health effects encompass workers who could be exposed to vehicular and heavy equipment emissions.
- Incidents resulting from other nonradiological chemical hazards, including occupational exposure to chemicals (such as solvents and lubricants), dust (such as silica dust), and other nonradiological substances from railroad construction and operations. The U.S. Department of Labor Bureau of Labor Statistics incident rates include occupational illnesses and fatalities that could result from nonradiological chemical exposure. However, the Bureau of Labor Statistics incident rates do not include a breakdown by incident type (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all).
- Unexploded ordnance hazards, including potential encounters by rail line construction workers with unexploded ordnance. The U.S. Army has identified and mapped an area of potential unexploded ordnance along the existing Department of Defense Branchline right-of-way south of Schurz. This area is bordered by the southeastern shoreline of Walker Lake, the existing Department of Defense Branchline, and the Hawthorne Army Depot.
- Noise hazards, including short-term or long-term occupational exposure to noise that could impair hearing.
- Biological hazards that workers could encounter, such as venomous animals, West Nile Virus, Valley Fever, Hantavirus, and rabies.

3.3.10.3 Radiological Health and Safety Environment

There are ambient levels of radiation in the vicinity of the Mina rail alignment, just as there are around the world. All people are inevitably exposed to the three sources of ionizing radiation: sources of natural origin unaffected by human activities, sources of natural origin but affected by human activities (called enhanced natural sources), and manmade sources. Natural sources (natural background radiation) include ***cosmic radiation*** from space, ***cosmogenic radionuclides*** produced when cosmic radiation interacts with matter in the atmosphere or ground, and naturally occurring, long-lived ***primordial radionuclides*** in the Earth's mantle. Enhanced natural sources include those that can increase exposure as a result of human actions, deliberate or otherwise. For example, a mill tailings pile from a uranium extraction process probably would contain concentrated levels of naturally occurring ***radionuclides***. A variety of radiation exposures, generally smaller than those caused by natural sources, result from manmade sources including nuclear medicine, medical X-rays, and consumer products.

Sources of Radiation Exposure

Nationwide, on average, members of the public are exposed to approximately 360 millirem per year from natural and manmade sources. The relative contributions by radiation source to people living in the United States are (DIRS 155970-DOE 2002, p. F-4):

- Radon in homes and buildings: 200 millirem per year
- Medical radiation: 53 millirem per year
- Internal radiation from food and water: 40 millirem per year
- Terrestrial (external radiation from rocks and soil): 28 millirem per year
- Cosmic (external radiation from outer space): 27 millirem per year
- Consumer products: 10 millirem per year
- Other sources: Less than 1 millirem per year

Radiation: Radiation is energy traveling through space. Radiation can be non-ionizing, like radio waves, ultraviolet radiation, or visible light, or ionizing, depending on its effect on atomic matter. In this Rail Alignment EIS, the word "radiation" refers to ionizing radiation. Ionizing radiation has enough energy to ionize atoms or molecules while non-ionizing radiation does not. Radioactive material is a physical material that emits ionizing radiation.

Cosmic radiation: A variety of high-energy particles including protons that bombard the Earth from outer space. They are more intense at higher altitudes than at sea level where the Earth's atmosphere is most dense and provides the greatest protection.

Cosmogenic radionuclides: Radioactive nuclides generated when the upper atmosphere interacts with many of the cosmic radiations. Despite their short half-lives, they are found in nature because their supply is always being replenished.

Decay product: A nuclide resulting from the radioactive decay of a parent isotope or precursor nuclide. The decay product might be stable or it might decay to form a decay product of its own.

Decay series: The succession of elements initiated in the radioactive decay of a parent, as thorium or uranium, each of which decays into the next until a stable element, usually lead, is produced.

Effective dose equivalent: Often referred to simply as dose, it is an expression of the radiation dose received by an individual from external radiation and from radionuclides internally deposited in the body.

Natural background radiation is the largest contributor to the average radiation dose of individuals. The natural occurrence of cosmic radiation, cosmogenic radionuclides, and primordial radionuclides varies throughout the world depending on such factors as altitude and geology. External radiation comes from all three of these natural sources, but cosmic radiation and radiation from primordial radionuclides are the largest contributors to dose. Cosmic radiation consists of charged particles (primarily protons from extraterrestrial sources) that have sufficiently high energies to generate secondary particles that have direct and indirect ionizing properties. The three main primordial radionuclide contributors to external terrestrial gamma radiation are potassium-40 and the members of the thorium and uranium ***decay series***. Most external terrestrial gamma radiation comes from the top 20 centimeters (8 inches) of soil, with a small contribution from airborne radon ***decay*** products.

Internal radiation dose from natural sources comes primarily from the primordial radionuclides and their ***decay products***. The largest individual source of internal dose comes from the inhalation of radon-222 and its decay products, which are all members of the uranium-238 decay series. This exposure comes mainly from inhalation of these radionuclides in indoor air, coming from the soil underneath buildings. All of the primordial radionuclides are in the body in various concentrations, incorporated by ingesting or inhaling these radionuclides in air, water, and all types of food products. Although of smaller importance to natural internal dose than the other mechanisms, four cosmogenic radionuclides, tritium (hydrogen-3), beryllium-7, sodium-22, and carbon-14, produce quantifiable internal doses.

Table 3-147 lists estimated radiation doses to individuals from natural sources in the region of influence and other locations in the United States. The radiation doses shown in the table are in terms of ***effective dose equivalent***, which is an expression of the radiation dose received by an individual from external radiation and from radionuclides internally deposited in the body. Effective dose equivalent has units of ***rem***.

Table 3-147. Radiation exposure from natural sources.

	Annual dose in millirem (effective dose equivalent)							
Source[b]	National	Tonopah	Las Vegas	Reno	Beatty	Amargosa Valley	Goldfield	Yucca Mountain
Cosmic and terrestrial	55	143	88[a]	131[a]	150[a]	107[a]	130[a]	160[a]
Radon in homes (inhaled)[c]	200	200	200	200	200	200	200	200
Naturally occurring radiation In body	39	39	39	39	39	39	39	39
Totals[d]	300	382	327	370	389	346	369	399

a. Combined cosmic and terrestrial radiation sources.
b. Sources: DIRS 100473-National Research Council 1990, Table 1-3, p. 18; DIRS 181387-University of Nevada-Reno 2006, p. B-8, Table B4-1; DIRS 179137-CEMP 2006, all; DIRS 179138-CEMP 2006, all; DIRS 179139-CEMP 2006, all; DIRS 179140-CEMP 2006, all; DIRS 179141-CEMP 2006, all; DIRS 179142-CEMP 2006, all.
c. Value for radon is an average for the United States.
d. Totals might differ from sums of values due to rounding.

Table 3-147 lists background radiation results for Tonopah, Las Vegas, Goldfield, Beatty, Reno, and Town of Amargosa Valley. DOE obtained cosmic and terrestrial background radiation for these Nevada locations based on radiological monitoring data from September 1999 through 2006 from the Desert Research Institute Community Environmental Monitoring Program (DIRS 179137-CEMP 2006, all; DIRS 179138-CEMP 2006, all; DIRS 179139-CEMP 2006, all; DIRS 179140-CEMP 2006, all; DIRS 179141-CEMP 2006, all; DIRS 179142-CEMP 2006, all). DOE obtained background radiation data for Reno from the Environmental Health and Safety University of Nevada, Reno 2006 Annual Report (DIRS 181387-University of Nevada, Reno 2006, Page B-8, Table B4-1). The average background radiation for the United States, including terrestrial and cosmic radiation, radon exposure, and natural radiation in the body, is 300 millirem per year, with radon exposure comprising 200 millirem per year, cosmic and terrestrial radiation comprising 55 millirem per year, and natural body radiation comprising 39 millirem per year (DIRS 100473-National Research Council 1990). The background radiation for Las Vegas (the closest large city to the Mina rail alignment region of influence) is 328 millirem per year, with cosmic and terrestrial radiation doses resulting in a slightly higher total annual dose than the average for the United States (DIRS 179142-CEMP 2006, all). The background radiation for the reported locations within the region of influence range from 328 millirem per year to 390 millirem per year. Background data include background radiation resulting from fallout.

3.3.10.4 Background Radiation at the Yucca Mountain Site

Ambient radiation levels from cosmic and terrestrial sources in the Yucca Mountain region are higher than the United States average. The higher elevation at Yucca Mountain results in higher levels of cosmic radiation because there is less ***shielding*** by the atmosphere. The United States average for cosmic and terrestrial radiation exposures is 55 millirem per year (DIRS 100473-National Research Council 1990, Table 1-3, p. 18). The exposures at the Yucca Mountain ridge and Yucca Mountain surface facilities are about 160 and 150 millirem per year, respectively. Moreover, there are higher amounts of naturally occurring radionuclides in the soil and parent rock of this region than in some other regions of the United States, which also results in higher radiation doses.

The Yucca Mountain FEIS includes a detailed discussion (DIRS 155970-DOE 2002, pp. 3-95 to 3-101) of the natural radiation levels, mineral-related radiation risks, and historical activities in the Yucca Mountain region that might have resulted in radiation effects to workers and the public.

3.3.10.5 Transportation Health and Safety Environment

3.3.10.5.1 Public Roadways

Because the region of influence includes public roads primarily located in remote and rural areas, the Mina rail alignment would cross areas with relatively low traffic volumes. The exception is the existing Union Pacific Railroad Hazen Branchline, which crosses public roads with moderate traffic (such as Alternate U.S. Highway 50 in Hazen, U.S. Highway 50 in Silver Springs, and Alternate U.S. Highway 95 in Churchill and Wabuska). Section 3.3.9, Socioeconomics, describes the public road infrastructure and ***baseline*** traffic conditions along the Mina rail alignment in more detail. In summary, the Mina rail alignment would cross paved highways with low to moderate traffic volumes and unpaved roads with low traffic volumes. While many of the unpaved roads are important to the daily activities of landowners and ranchers in the area, these unpaved roads are not heavily traveled.

Table 3-148 lists the paved highways and the Union Pacific Railroad Hazen Branchline the Mina rail alignment would cross. Figure 2-12 shows the locations of these crossings (DIRS 180872-Nevada Rail Partners 2007, Table C-1). Additionally, the primary paved highways in the project vicinity are Alternate U.S. Highway 50, U.S. Highways 50 and 95, and Alternate U.S. Highway 95 in the northern portion; State Routes 359, 360, and 361 and U.S. Highway 95 in the central portion; and U.S. Highways 6 and 95 and State Routes 265, 266, and 267 in the southern portion.

Overall highway safety statistics for Nevada show that the fatality rate per 100 million vehicle-miles traveled is approximately 1.28 (1.65 in rural areas). The national average is approximately 40 percent lower at 0.91 fatalities per 100 million vehicle-miles traveled (1.42 in rural areas) (DIRS 180484-FHWA 2005, p. 1, Section V, Tables FI-20 and VM-2).

Table 3-148. Potential rail line crossings of main highways.

Segment	Highway	County/Reservation
Union Pacific Railroad Hazen Branchline[a]	Alt.U.S. Highway 50	Churchill
Union Pacific Railroad Hazen Branchline[a]	Alt.U.S. Highway 50	Lyon
Union Pacific Railroad Hazen Branchline[a]	Alt. U.S. Highway 95 (at two locations)	Lyon
Schurz alternative segment 1	U.S. Highway 95	Walker River Paiute Reservation
Schurz alternative segment 4	U.S. Highway 95	Walker River Paiute Reservation
Schurz alternative segment 5	U.S. Highway 95	Walker River Paiute Reservation
Schurz alternative segment 6	U.S. Highway 95	Walker River Paiute Reservation
Mina common segment 1	State Route 361	Mineral
Mina common segment 1	U.S. Highway 6 / 95	Esmeralda
Montezuma alternative segment 1	U.S. Highway 95	Esmeralda
Montezuma alternative segment 2	U.S. Highway 95	Esmeralda
Montezuma alternative segment 3	U.S. Highway 95	Esmeralda

a. The Union Pacific Railroad Hazen Branchline is part of the region of influence for the purposes of the transportation impact assessment, but is not part of the Mina rail alignment.

3.3.10.5.2 Railroad Accidents

This section describes the general characteristics of railroad accidents in the United States and in the State of Nevada. DOE commissioned a railroad study – *The Nevada Railroad System: Physical, Operational, and Accident Characteristics* (the Nevada railroad study), which covers the period between 1979 and 1988 (DIRS 104735-YMP 1991, all). Because the number of annual rail-related accidents and incidents in Nevada is very small, it is difficult to draw conclusions about how the safety of rail operations in Nevada has changed since 1988. However, the study is the most comprehensive and relevant rail accident study to date regarding the State of Nevada and it provides some insights into the general characteristics of rail accidents in Nevada and the United States. The study presented information on types, causes, and frequency of railroad accidents; accident locations; and some of the more significant accidents from 1979 through 1988. The important findings of the Nevada railroad study were:

- Numbers and types of accidents. During the study period, the numbers of reported rail accidents in Nevada and the entire United States were 208 and 48,256, respectively. The most common accident types for Nevada and the rest of the United States were derailment and rail–highway crossing collision.
- Causes of rail accidents. Track/roadbed conditions caused proportionately more accidents in the rest of the United States than in Nevada, and mechanical/electrical failure caused proportionately more accidents in Nevada than in the rest of the United States. Nevada showed a higher proportion of its reported accidents in the higher speed ranges than did the rest of the Nation.
- Speeds at times of accidents. In general, most rail accidents happened at very low speeds. Approximately half of all reported accidents in Nevada occurred at speeds of 16 kilometers (10 miles) per hour or less, and 40 percent of all accidents in Nevada were at 8 kilometers (5 miles) per hour or less. Nationally, 73 percent of all accidents occurred at 16 kilometers per hour or less, and 53 percent of all rail accidents occurred at 8 kilometers per hour or less.
- Elapsed time on duty. The Nevada railroad study showed that about 45 percent of all accidents occurred within the first 4 hours on duty, approximately 41 percent occurred between 4 to 8 hours on duty, and approximately 14 percent occurred after 8 hours on duty.
- Weather and time of day. In Nevada, approximately 73 percent of all accidents reported occurred in clear weather, while approximately 9 percent occurred in cloudy weather. Rain, fog, and snow accounted for lower proportions. In Nevada, approximately half (49 percent) of all rail accidents occurred at night. Nationally, approximately 42 percent of all accidents occurred at night.
- Locations of accidents. The Nevada railroad study revealed that accidents occur at slightly higher rates at switchyard tracks.
- Rail–highway at-grade crossing accidents. Excluding the switching and handling incidents, rail accidents seemed to occur at random locations. The notable exception was rail–highway at-grade crossings. In the United States, rail–highway at-grade crossings in general were a higher accident location.
- Fatal rail accidents. Fewer accidents occurred at the higher speeds, but the chance that an accident, once it did occur, produced a fatality increased as speed increased. Comparing the total number of accidents at each speed interval to the total number of fatal accidents at each speed interval revealed that an accident occurring at above 97 kilometers (60 miles) per hour was 31 times more likely to cause a fatality than an accident occurring at 8 kilometers (5 miles) per hour or less.

With the exception of accident causes, the Nevada railroad study (DIRS 104735-YMP 1991, all) found that rail-accident characteristics in Nevada were not markedly different from rail-accident characteristics in the rest of the United States. The most apparent differences related to the relatively large proportion of Nevada rail lines that were in open country where higher operating speeds are maintained, compared to the United States as a whole. Most rail accidents, both in Nevada and in the rest of the United States, occurred at very low speeds. Nevada showed a slightly higher number of high-speed accidents compared to the national average. The Nevada railroad study also showed that Nevada had a larger percentage of accidents caused by equipment failure and human factors. The Nevada railroad study also found that for accidents involving only rail equipment, there were no classical "high" accident locations as there typically are with highway transport. Instead, minor accidents tended to occur in rail yards and during switching operations. More severe accidents, occurring at higher speeds on open track, seemed to happen at random.

Railroads are required by law to submit accident/incident reports within 30 days after the month to which they pertain. The Federal Railroad Administration annually publishes *Railroad Safety Statistics* which contains statistical data, tables, and charts based on railroad accident reporting requirements. In this publication, the terms "accidents" and "incidents" are used to describe the entire list of reportable events, which includes collisions, derailments, and other events involving the operation of on-track equipment and causing reportable damage above an established threshold; impacts between railroad on-track equipment and highway users at crossings; and all other incidents or exposures that cause a fatality or injury to any person, or an occupational illness to a railroad employee. As defined in *Railroad Safety Statistics*, accidents/incidents are divided into three major groups for reporting purposes:

- Train accident. A safety-related event involving on-track rail equipment (both standing and moving), causing monetary damage to the rail equipment and track above a prescribed amount.
- Highway–rail grade crossing incident. Any impact between a rail and highway user (both motor vehicles and other users of the crossing) at a designated crossing site, including walkways, sidewalks, etc., associated with the crossing.
- Other incident. Any death, injury, or occupational illness of a railroad employee that is not the result of a train accident or highway-rail incident.

Table 3-149 summarizes rail accident data from the *Railroad Safety Statistics – Annual Report 2004* for the five-year period 2000 through 2004 (DIRS 178016-DOT 2005, pp. 13 and 17). Accident and incidents rates are not available for Nevada because train mile data is only available on a nationwide basis.

The data listed in Table 3-149 reflect rail operations involving general freight service. ***Dedicated train*** service, which would be used to move cask railcars to the Yucca Mountain repository, would follow stringent safety regulations. Additionally, dedicated train service has increased control and command capabilities, because shorter trains allow better visual monitoring from the locomotive and the escort car. Therefore, accident and incident rates for dedicated train service are expected to be lower than the ones listed in Table 3-149.

3.3.10.5.3 Transportation of Munitions

The U.S. Army currently transports munitions to and from the Hawthorne Army Depot by rail. Munitions ***shipments*** pass to and from the Depot through the town of Schurz along the existing Department of Defense Branchline. The Army assesses hazards associated with transportation of munitions using a risk assessment code ***matrix*** evaluation of the potential accident probability and potential hazard severity, as illustrated in Table 3-150 (DIRS 181032-Dillingham 2007, all).

Table 3-149. Rail accidents in Nevada and the United States (2000 through 2004).[a]

	2000	2001	2002	2003	2004
Train accidents (excluding highway–rail crossing incidents – see below)					
Nevada	12	14	9	8	17
United States	2,983	3,023	2,738	2,997	3,296
Train accidents rate (accidents per train mile) (excluding highway–rail crossing incidents)					
Nevada	NA[b]	NA	NA	NA	NA
United States	4.1×10^{-06}	4.2×10^{-06}	3.8×10^{-06}	4.0×10^{-06}	4.3×10^{-06}
Total highway–rail incidents at public crossings[c]					
Nevada	1	2	1	1	2
United States	3,032	2,843	2,709	2,610	2,644
Total highway–rail incident rates (incidents per train mile) at public crossings[c]					
Nevada	NA	NA	NA	NA	NA
United States	4.2×10^{-06}	4.0×10^{-06}	3.7×10^{-06}	3.5×10^{-06}	3.4×10^{-06}

a. Source: DIRS 178016-DOT 2005, pp. 13 and 17.
b. NA = not applicable.
c. Any impact, regardless of severity, between railroad on-track equipment and any user of a public or private crossing site must be reported to the U.S. Department of Transportation, Federal Railroad Administration, on Form F 6180.57. The crossing site includes sidewalks and pathways at, or associated with, the crossing. Counts of fatalities and injuries include motor vehicle occupants, people not in vehicles or on the trains, and people on the train or railroad equipment.

Table 3-150. Risk assessment code matrix.[a]

	Accident probability				
Hazard severity	A	B	C	D	E
I	1	1	2	3	5
II	1	2	3	4	5
III	2	3	4	5	5
IV	3	4	5	5	5

a. Source: DIRS 181032-Dillingham 2007, all.

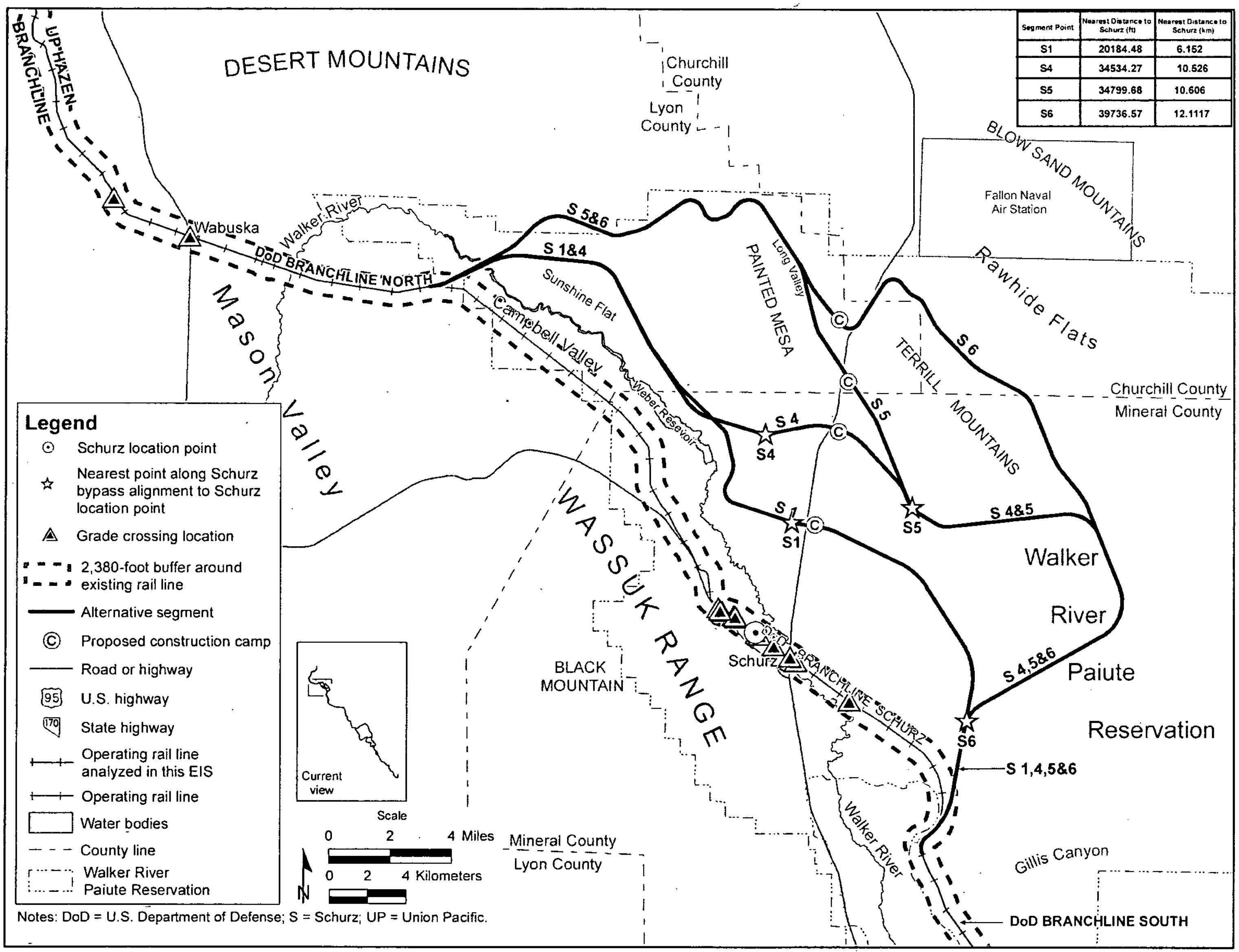
B-1. Hazard Severity: Category Description
I Catastrophic - Death or permanent disability or major property damage
II Critical - Permanent partial disability or extensive property damage
III Marginal - Lost workday due to injury or minor property damage
IV Negligible - First aid injury or minimal property damage

B-2. Accident Probability:
A Frequent - Occurs very often, continuously experienced
B Likely - Occurs several times
C Occasional - Occurs sporadically
D Seldom - Remotely possible; could occur at some time
E Unlikely - Can assume will not occur, but not impossible

The overall rating of a transportation route using the Army methodology is the combination of B-1 (Hazard Severity) and B-2 (Accident Probability) in the matrix. According to Department of Defense guidelines, a 1 rating or a 2 rating is not acceptable for shipment of munitions. A rating of 3 is acceptable for shipment of munitions only after higher-level review and approval from the military headquarters. Final ratings of 4 or 5, after controls are implemented, are acceptable for shipment of munitions. After application of controls, the Army has rated the existing ***rail route*** through the town of Schurz as 5 (corresponding to Risk Assessment Matrix Code 1-E) (DIRS 181032-Dillingham 2007, all).

The Army also uses quantity-distance calculations to provide an assessment of the Distance to Public Traffic Routes and Distance to Inhabited Buildings for storage or transportation of munitions. Public traffic route distances give consideration to the transient nature of the exposure and are calculated as 60 percent of the Inhabited Building Distance (DIRS 181032-Dillingham 2007, all).

According to Table 5-1 of Department of the Army Pamphlet 385-64, a Distance to Public Traffic Route of 725 meters (2,380 feet) or a Distance to Inhabited Building of 1,210 meters (3,970 feet) apply to munitions shipments of the types that may be made along the existing rail line. This methodology indicates that there should be an easement of at least 725 meters on either side of the tracks (no building) along the entire route. This is based on 60 percent of Inhabited Building Distance (IBD) of 1,210 meters (DIRS 181032-Dillingham 2007, p. 1). However, there are inhabited buildings within this distance for the existing Department of Defense Branchline through Schurz. Also, as shown in the Figure 3-236, there are nine grade crossings within the town of Schurz along the Department of Defense Branchline.



Segment Point	Nearest Distance to Schurz (ft)	Nearest Distance to Schurz (km)
S1	20184.48	6.152
S4	34534.27	10.526
S5	34799.68	10.606
S6	39736.57	12.1117

Figure 3-236. Inhabited building distance for existing Department of Defense Branchline.

3.3.11 UTILITIES, ENERGY, AND MATERIALS

This section describes the affected environment for public-service utilities (water, wastewater treatment, telecommunications, and electricity), energy (fossil fuels), and construction materials within the Mina rail alignment region of influence.

Section 3.3.11.1 describes the regions of influence for utilities, energy resources, and construction materials; Section 3.3.11.2 describes public-service utilities in the region of influence; Section 3.3.11.3 describes energy resources (not related to public-service utilities) in the region of influence; and Section 3.3.11.4 describes resources for construction materials in their regions of influence.

3.3.11.1 Regions of Influence

3.3.11.1.1 Regions of Influence for Utilities

The regions of influence for public water systems, wastewater treatment, telecommunications, and electricity differ and are described below.

- Public water systems: The region of influence for public water systems is Lyon, Mineral, Esmeralda, and Nye Counties, communities within those counties, and the Walker River Paiute Reservation, the bulk of which lies within Mineral County with smaller portions in Lyon and Churchill Counties.
- Wastewater treatment: The region of influence for wastewater transported offsite for treatment and disposal is the existing permitted treatment facilities in Lyon, Mineral, Esmeralda, and Nye Counties and communities within those counties, and the Walker River Paiute Reservation, the bulk of which lies within Mineral County with smaller portions in Lyon and Churchill Counties. (Note: For wastewater treated using other methods [for example, on-site portable wastewater-treatment facilities], treated wastewater would be recycled, and there is no associated region of influence.)
- Telecommunications: The region of influence for telephone and fiber-optic telecommunications is the southern Nevada region serviced by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Verizon.
- Electricity: The region of influence for electric-power resources includes areas serviced by the southern Nevada electrical grid operated by Nevada Power Company; Sierra Pacific Power Company; and Valley Electric Association, Inc.

3.3.11.1.2 Region of Influence for Energy Resources (Fossil Fuels)

The description of the affected environment for energy resources focuses on consumption of fossil fuels. For purposes of this analysis, the region of influence for fossil fuels is limited to regional suppliers within the State of Nevada.

3.3.11.1.3 Regions of Influence for Construction Materials

Construction materials include concrete, ballast, subballast, steel, steel rail, and general building materials. The region of influence for each material is defined by the distribution networks and suppliers of that material to the general project area.

The region of influence for cast-in-place concrete and subballast is limited to the State of Nevada. Subballast, sand, and gravel would be generated from available sources within the rail roadbed earthwork area, overburden at quarries, and borrow sites near the rail alignment. DOE forecasts that no surplus sand

and gravel would be available for roadbed construction from excavation cuts along the rail line. Therefore, DOE plans to obtain sand and gravel from gravel pits along the alignment or nearby U.S. Highway 95, using existing pits, new pits sited nearby, or elsewhere. DOE would determine the exact locations of gravel pits during final design and construction planning. DOE would use some of the natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate (DIRS 176034-Shannon & Wilson 2006, pp. 24 to 26).

DOE would obtain ballast rock from potential quarry sites close to the rail line construction right-of-way during the construction phase and from commercial quarry sites in southern Utah and in California during the operations phase. Therefore, the region of influence for obtaining ballast rock would encompass the State of Nevada during the construction phase, and Utah and California during the operations phase.

Other materials, including steel, steel rail, general building materials, concrete ties, and other precast concrete could be procured and shipped on a national level. Therefore, the region of influence for these materials is national.

Public water system: A water system that provides water for human consumption for an average of at least 25 persons per day (or 15 or more service connections) and is in use for at least 60 days each year.

Community water system: A public water system that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

Non-transient, non-community water system: A public water system that is not a community water system and that regularly serves at least 25 of the same persons over 6 months per year.

Source: 40 CFR 141.2.

3.3.11.2 Utilities

3.3.11.2.1 Utility Corridors and Rights-of-Way

Section 3.3.2, Land Use and Ownership, describes the major utilities and utility corridor networks in the Mina rail alignment region of influence.

3.3.11.2.2 Public Water Systems

Figure 3-237 shows the locations of ***public water systems*** in Lyon, Mineral, Esmeralda, and Nye Counties and on the Walker River Paiute Reservation. There are 140 regulated public water systems in these counties and on the Walker River Paiute Reservation (which lies primarily in Mineral County) including the 46 ***community water systems*** listed in Table 3-151.

Within the Mina rail alignment region of influence, public water systems are generally located in or near Hawthorne, Mina, and the unincorporated towns of Beatty, Pahrump, and Town of Amargosa Valley. In addition, although not a community water system, the Yucca Mountain Site has a regulated public water system (NV0000867). This system is classified as a ***non-transient, non-community public water system***.

3.3.11.2.3 Wastewater-Treatment Facilities

DOE would treat wastewater using municipal wastewater-treatment facilities, on-site portable wastewater-treatment facilities (***package plants***), or a combination of the two.

Municipalities with wastewater-treatment facilities include Mason, Yerington, Hawthorne, Schurz, Goldfield, Beatty, Gabbs, Tonopah, and Round Mountain. Table 3-152 lists the capacity of each system and the existing load.

In Hawthorne in Mineral County, a future design capacity of 1,700,000 liters (450,000 gallons) per day is specified.

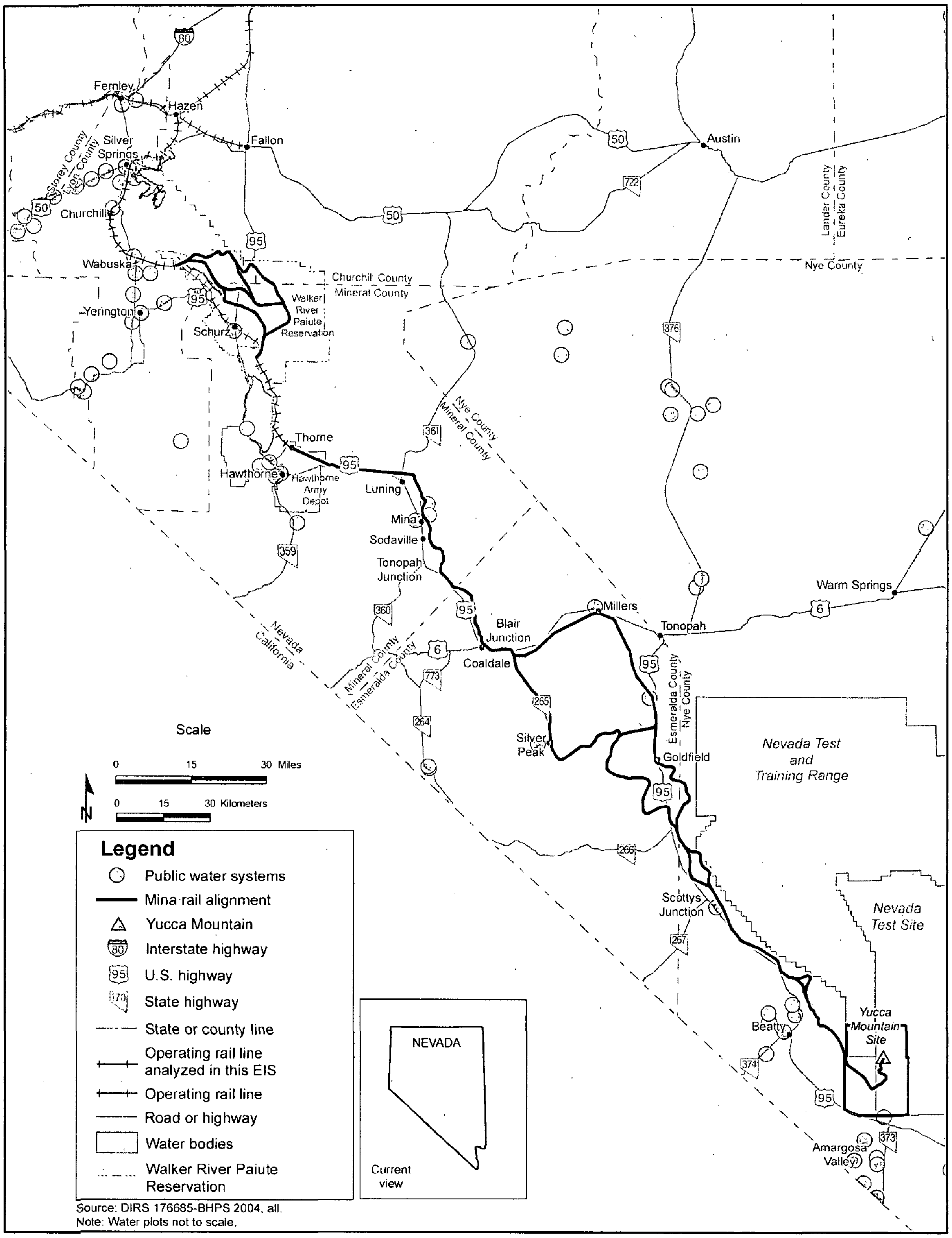


Figure 3-237. Public water systems in Lyon, Mineral, Esmeralda, and Nye Counties.

Table 3-151. Community water systems in Lyon, Mineral, Esmeralda, and Nye Counties[a] (page 1 of 2).

County	Public water supply identification number	Name
Lyon	NV0000813	Churchill Ranchos Estates
	NV0000361	Crystal Clear Water Company
	NV0000032	Dayton Town Utilities
	NV0000366	Dayton Valley Estates Water
	NV0000033	Dayton Valley Mobile Home Park
	NV0000062	Fernley Public Works
	NV0002516	Five Star Mobile Home Park
	NV0000838	Moundhouse Water System
	NV0000029	Rosepeak Water System
	NV0000267	Silver Springs Mobile Home Park
	NV0000223	Silver Springs Mutual Water Company
	NV0000224	Stagecoach General Improvement District
	NV0000242	Weed Heights Development
	NV0000256	Willowcreek General Improvement District
	NV0000255	Yerington, City of
Mineral	NV0000357	Hawthorne Army Depot
	NV0000073	Hawthorne Utilities
	NV0000074	Mina Luning Water System
	NV0000302	Walker Lake Apartments
	NV0000268	Walker Lake General Improvement District
Esmeralda	NV0000072	Goldfield Town Water
	NV0000363	Silver Peak Water System
Nye	NV0002558	Amargosa Valley Water Association
	NV0005033	Anchor Inn Mobile Home Park
	NV0000009	Beatty Water and Sanitation District
	NV0000362	Big Five Parks
	NV0000369	Big Valley Mobile Home Park
	NV0002538	C Valley Mobile Home Park
	NV0002589	Calvada North, Utilities Inc. of Central Nevada
	NV0000218	Carver's Smoky Valley Recreational Vehicle and Mobile Home Park
	NV0005032	Country View Estates, Utilities Inc. of Central Nevada
	NV0000831	Desert Mirage Home Owners Association

Table 3-151. Community water systems in Lyon, Mineral, Esmeralda, and Nye Counties[a] (page 2 of 2).

County	Public water supply identification number	Name
Nye (continued)	NV0000300	Desert Utilities
	NV0002552	Escapee Co-Op of Nevada
	NV0000063	Gabbs Water System
	NV0004074	Hadley Subdivision
	NV0000926	Hafen Ranch Estates
	NV0000175	Manhatten Town Water
	NV0000920	Mountain Falls Water System
	NV0005067	Mountain View Mobile Home Park, Utilities Inc. of Central Nevada
	NV0000183	Pahrump Mobile Home Park
	NV0005028	Shoshone Estates Water Company
	NV0000359	Shoshone Water Company
	NV0005066	Sunset Mobile Home Park
	NV0000237	Tonopah Public Utilities
	NV0000270	Utilities Inc. of Central Nevada

a. Source: DIRS 176686-BHPS 2004, all.

Table 3-152. Municipal wastewater-treatment facilities in the Mina rail alignment region of influence.

Location	Capacity (liters per day)[a]	Existing load (liters per day)
Mason, Lyon County	227,000[b]	189,000[b]
Yerington, Lyon County	2,040,000[b]	1,210,000[b]
Hawthorne, Mineral County	1,480,000[b]	1,550,000[b]
Schurz, Mineral County	189,000[b]	76,000[b]
Goldfield, Esmeralda County	170,000[b]	114,000[b]
Beatty, Nye County	570,000[b]	420,000[b]
Gabbs, Nye County	190,000[b]	190,000[b]
Tonopah, Nye County	3,800,000[b]	1,600,000[b]
Round Mountain (Hadley Subdivision), Nye County	610,000[c]	260,000[c]

a. To convert liters to gallons, multiply by 0.26418.
b. Source: DIRS 178590-EPA 1999, all.
c. Source: DIRS 178697-Kaminski 2003, all.

In Esmeralda County, Goldfield's sewage collection system was built in the 1940s and 1950s, and some of the system's original terra-cotta pipes are deteriorating. There are two lagoons, each 4,000 square meters (1 acre) in area, and a rapid infiltration system 1.6 kilometers (1 mile) north of Goldfield. The community has recently been awarded a $3 million grant under the Water Resource Development Act of 2000 (114 Stat. 2472) to renovate and upgrade the system. These renovations will allow Esmeralda County to increase the number of users served by its sewer system (DIRS 174751-Arcaya 2005, all).

Most communities in southern Nye County rely primarily on individual dwelling or small communal wastewater-treatment systems, with the exception of Beatty, which has municipal sewer service. For example, Pahrump has no community-wide wastewater-treatment system. Several wastewater-treatment units serve parts of the town, such as the dairy and the jail, but most households have septic tank and drainage-field systems, which are likely to be typical of the small communities in southern Nye County.

3.3.11.2.4 Telecommunications Services

Local telephone service in the Mina rail alignment region of influence is provided by Verizon (Lyon County), Nevada Bell Telephone Company (AT&T Nevada) (Mineral County, part of Esmeralda County, and Nye County), and Citizens Telecommunications Company of Nevada (part of Esmeralda County) (DIRS 173401-Nevada Telecommunications Association 2005, all). One or more broadband providers (such as Comcast Cable and Bandwidth T1) serve Schurz, Mina, Silver Peak, Tonopah, Goldfield, and Town of Amargosa Valley (DIRS 176453-FCC 2005, pp. 348 to 350).

3.3.11.2.5 Electrical Services

Nevada Power Company is the electric utility serving most customers in Southern Nevada, covering a territory of 12,000 square kilometers (4,600 square miles). Its customer base includes approximately 630,000 residential and 84,000 commercial or industrial accounts (DIRS 172302-Nevada Power Company 2004, all). The utility has 2,200 megawatts of generating capacity and purchases additional power to meet peak load demands of 5,800 megawatts. Nevada Power Company forecasts a 1.8 percent average annual rate of growth in peak-load demand through 2020. Total electricity sales in 2005 were 19 million megawatt-hours (DIRS 173383-Nevada State Office of Energy 2005, p. 23).

Sierra Pacific Power Company serves 330,000 electricity customers in a 130,000-square-kilometer (50,000-square-mile) territory that encompasses Carson City, Reno, Winnemucca, Elko, and Tonopah in Nevada, as well as the Lake Tahoe area in northeastern California (DIRS 173382-Sierra Pacific Power 2005, all). The utility has 1,100 megawatts of generating capacity and purchases additional power to meet peak load demands of 1,900 megawatts. Sierra Pacific Power Company forecasts a 1.6 percent average annual rate of growth in peak-load demand through 2020. Total electricity sales in 2005 were 8.8 million megawatt-hours (DIRS 173383-Nevada State Office of Energy 2005, p. 9). Both Nevada Power Company and Sierra Pacific Power Company are wholly owned subsidiaries of Sierra Pacific Resources.

Valley Electric Association, Inc., distributes power to southern Nye County, including the Pahrump Valley, Amargosa Valley, Beatty, and the Nevada Test Site. The Western Area Power Administration allocates a portion of the lower-cost hydroelectric power from the Colorado River dams to Valley Electric Association, Inc. The private power market supplies the supplemental power necessary to meet the needs of the members. Valley Electric Association, Inc., sells about 400,000 megawatt-hours to more than 15,000 members (DIRS 173383-Nevada State Office of Energy 2005, p. 39).

Table 3-153. Sales of distillate fuel oils in Nevada, 1997 through 2004.

Year	Annual sales of distillate fuel oils (millions of liters)[a]
1997	1,640[b]
1998	1,530[b]
1999	1,580[c]
2000	1,620[c]
2001	1,550[d]
2002	1,580[d]
2003	1,510[e]
2004	1,810[e]

a. To convert liters to gallons, multiply by 0.26418.
b. Source: DIRS 178588-EIA 1999, Table 4
c. Source: DIRS 178609-EIA 2001, Table 4.
d. Source: DIRS 173384-EIA 2003, Table 4.
e. Source: DIRS 176397-EIA 2005, Table 4.

3.3.11.3 Energy

Existing fossil-fuel supplies in the Mina rail alignment region of influence are available from nearby communities, mainly from relatively highly populated towns such as Hawthorne and Tonopah, and along the well-traveled U.S. Highway 95 connecting the metropolitan areas of Reno and Las Vegas. The regional supply system can respond flexibly to demand. Table 3-153 shows sales of distillate fuel oils (diesel fuel) in Nevada from 1997 through 2004. Fuel consumption remained fairly constant through 2003. The recent upward trend reflects current population growth in southern Nevada as a key determinant of total energy consumption closely linked to rising demand for housing, services, and travel.

3.3.11.4 Construction Materials

Most of the Mina rail alignment would be along the U.S. Highway 95 corridor and would be within the southern Nevada supply chain for construction materials.

The region of influence for cast-in-place concrete is the State of Nevada, where annual production in 2004 equaled approximately 16 million metric tons (18 million tons) (DIRS 173400-NRMCA 2004, p. 2).

Precast concrete is available nationally, and the annual national production in 2003 equaled approximately 15 million metric tons (17 million tons) (DIRS 173392-van Oss 2003, Table 15). Annual national production of pre-cast concrete railway ties was about 720,000 ties in 2004 and is projected to grow to about 1,180,000 ties by 2007 (DIRS 173573-Gauntt 2004, p. 17).

Ballast for rail roadbed construction is generally obtained locally because of the costs associated with transporting large volumes of these materials. Within the region of influence there are large areas of public lands that contain materials suitable for use as ballast. DOE has identified five potential quarry sites near the Mina rail alignment for use during the construction phase (see Chapter 2, Table 2-16). Following construction, the DOE-developed quarries would be closed. During the operations phase, DOE would obtain ballast for track maintenance commercially. The nearest active quarries to the region of influence are at Oroville, California, approximately 320 kilometers (200 miles) west-northwest of Mina, and at Milford, Utah, approximately 500 kilometers (310 miles) east of Mina. The Milford Quarry is on the Union Pacific Railroad route that travels from Salt Lake City, Utah, to Los Angeles, California, and processes much of the high-quality ballast for the Union Pacific Railroad lines throughout the southwest. Suitable sands and gravels would likely be available along cuts for the proposed rail line and from overburden at potential quarry rock and borrow sites. If needed, DOE could also establish sand and gravel borrow sites at various points along the Mina rail alignment, possibly adjacent to existing Nevada Department of Transportation gravel pits. Approximately 55 surplus pit locations are available adjacent to Nevada Department of Transportation materials sources and additional nearby sites could be developed (DIRS 180857-Nevada Rail Partners 2007, Section 3.1.2).

The steel market is worldwide in scope, but the region of influence DOE considered for steel supply is national. Raw production of carbon steel in the United States in 2003 equaled 86 million metric tons (95 million tons) (DIRS 173387-Fenton 2003, Table 1). Steel rail production equaled 540,000 metric tons (600,000 tons) in 2002 and 520,000 metric tons (570,000 tons) in 2003 (DIRS 173387-Fenton 2003, Table 3).

3.3.12 HAZARDOUS MATERIALS AND WASTE

This section describes existing facilities in Nevada that could receive and dispose of ***hazardous waste*** derived from hazardous materials, ***low-level radioactive wastes,*** and nonhazardous waste associated with constructing and operating the proposed railroad along the Mina rail alignment. Section 3.3.12.1 describes the region of influence for hazardous materials and wastes. Section 3.3.12.2 describes landfills for the disposal of nonhazardous, nonrecyclable, nonreusable wastes; Section 3.3.12.3 describes disposal facilities for hazardous wastes; and Section 3.3.12.4 describes the disposal of low-level radioactive wastes. Hazardous materials DOE might use during construction and operation of the proposed railroad are described throughout Section 4.3.12.

> **Hazardous waste:** Waste designated as hazardous by U.S. Environmental Protection Agency or State of Nevada regulations. Hazardous waste, defined under the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 *et seq.*), is waste that poses a potential hazard to human health or the environment when improperly treated, stored, or disposed of. Hazardous wastes appear on special Environmental Protection Agency lists or possess at least one of the following characteristics: ignitability, corrosivity, toxicity, or reactivity.
>
> **Low-level radioactive waste:** Radioactive waste that is not classified as high-level radioactive waste, transuranic waste, or byproduct tailings containing uranium or thorium from processed ore. Usually generated by hospitals, research laboratories, and certain industries (42 U.S.C. 108).

3.2.12.1 Region of Influence

The region of influence for the use of hazardous materials and the generation of hazardous and nonhazardous wastes includes the nominal width of the rail line construction right-of-way, and the locations of railroad construction and operations support facilities.

The region of influence for the disposal of hazardous wastes includes the entire continental United States because commercial hazardous waste disposal vendors could utilize facilities throughout the country.

The region of influence for the disposal of nonhazardous waste includes the disposal facilities in Mineral, Nye, Esmeralda, and Clark Counties in Nevada.

The region of influence for the disposal of low-level radioactive wastes includes DOE low-level waste disposal sites, sites in ***Agreement States***, and U.S. Nuclear Regulatory Commission-licensed sites.

3.3.12.2 Nonhazardous Waste Disposal

> **Industrial and special wastes:** Construction debris and other ***solid waste***, such as tires, that have specific management requirements for permitted landfill disposal.
>
> **Solid waste:** For purposes of this analysis, defined as nonhazardous general household waste.

DOE would dispose of nonhazardous, nonrecyclable, nonreusable wastes in municipal landfills in Nevada. Nevada has 24 operating municipal landfills that combined accept more than 12,700 metric tons (14,000 tons) of waste per day (DIRS 174663-State of Nevada 2005, Slide 5; DIRS 174664-State of Nevada 2005, all). According to the *Draft Solid Waste Management Plan* (DIRS 174041-State of Nevada 2004, p. 7), Nevada municipalities have ensured landfill capacity for decades into the future. Table 3-154 lists the capacities the Nevada Division of Environmental Protection reported in 2002 (DIRS 174041-State of Nevada 2004, Appendixes 2 and 3) for the active landfills in Mineral, Nye, Esmeralda, and Clark Counties. All of these landfills have permits to accept ***industrial and special wastes.***

DOE would utilize a contractor for the disposition of recyclable materials.

Table 3-154. Capacities of active landfills in Mineral, Nye, Esmeralda, and Clark Counties.[a]

County	Facility name[b]	Operator	Capacity (cubic meters)[c]	Per day disposal rate (metric tons)[d]	Projected closure (year)
Mineral	Hawthorne Class I	Mineral County	1,270,000	25	2041
Nye	Round Mountain Class I Expansion	Nye County	540,000	10	2028
	Tonopah Class II	Nye County	120,000	15	2011
Esmeralda	Goldfield Class I	Esmeralda County	210,000	4	2023
Clark	Apex Regional Classes I and III	Republic Silver State	61,900,000	8,000	2147
	Laughlin Class I	Silver State Services	4,600,000	85	2019
Totals			68,640,000	8,139	

a. Source: DIRS 174041-State of Nevada 2004, Appendixes 2 and 3.
b. Class I landfills receive 18 metric tons or more of waste per day; Class II landfills receive less than 18 metric tons of waste per day; and Class III landfills receive only industrial waste. Each of these landfills accepts solid and industrial and special wastes.
c. To convert cubic meters to cubic yards, multiply by 1.3079.
d. To convert metric tons to tons, multiply by 1.1023.

3.3.12.3 Hazardous Waste Disposal

The U.S. Ecology Treatment and Disposal Site in Beatty, Nevada, is a Nevada-permitted hazardous waste disposal site (DIRS 173918-American Ecology 2005, all). This facility treats and disposes of hazardous wastes and nonhazardous industrial wastes. Safety-Kleen Systems, Inc., operates a hazardous waste-permitted treatment, storage, and disposal facility in North Las Vegas, Nevada, and Philip Services Corporation operates a similar facility in Fernley, Nevada (DIRS 177662-NDEP 2006, all). Hazardous waste disposal capacity in western states has been estimated to be 50 times the demand for landfills and 7 times the demand for incineration until at least 2013 (DIRS 103245-EPA 1996, pp. 32, 33, 36, 46, 47, and 50).

3.3.12.4 Low-Level Radioactive Waste Disposal

Low-level radioactive wastes would be generated during operation of the Cask Maintenance Facility. DOE would control and dispose of site-generated low-level radioactive waste in a DOE low-level waste disposal site, a site in an Agreement State, or in a U.S. Nuclear Regulatory Commission-licensed site.

3.3.13 CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470), as amended, requires federal agencies to take into account the effects of their undertakings on historic properties. The procedures established by the Advisory Council on Historic Preservation, described in 36 CFR Part 800, define how federal agencies meet these statutory responsibilities. The section 106 process seeks to accommodate historic preservation concerns with the needs of federal undertakings through consultation between the agency official and other parties with an interest in the effects of the undertaking on historic properties, commencing at the early stages of project planning. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess its effects, and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties.

Identification of sites eligible for listing on the *National Register of Historic Places* is a primary component of historical preservation work. The evaluation of both historic and archeological sites, to determine eligibility for National Register listing, is accomplished through the application of eligibility criteria as identified in 36 CFR Part 60.4, as follows:

> The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, material, workmanship, feeling and association and
>
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) that are associated with the lives of persons significant in our past; or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) that have yielded, or may be likely to yield, information important in prehistory or history.

Prehistoric archaeological sites are most often found eligible under criterion (d), while archaeological sites containing historical deposits and some prehistoric sites are also often considered under other criteria. For example, ordinarily, cemeteries, birthplaces or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the National Register. However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the following categories: (a) a religious property deriving primary significance from architectural or artistic distinction or historical importance; (b) a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with an historic person or event; (c) a birthplace or grave of an historical figure of outstanding importance if there is no appropriate site or building directly associated with his productive life; (d) a cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; (e) a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; (f) a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or (g) a property achieving significance within the past 50 years if it is of exceptional importance.

Likewise, historic structures (as opposed to archaeological sites) are assessed under a variety of National Register criteria.

While nearly all sites have the potential to yield information useful in addressing a limited number of research questions, this limited potential is not considered sufficient to qualify a site for inclusion on the National Register under criterion (d). By establishing guidelines, agencies have clearly set the precedent that not all information is important, and thus, not all sites are important. Federal guidelines encourage the use of a set of research questions that are generally recognized as important research goals as a means of evaluating significance. If a site contains information that is demonstrably useful in answering such questions, it can be considered an important site. National Register evaluation guidelines state that a site must retain integrity to be considered eligible under one or more of the criteria.

The *National Register of Historic Places* describes historic resources as standing or collapsed buildings, structures, objects, sites, and districts that are at least 50 years old, or have achieved significance within the past 50 years. Archaeological resources are prehistoric or historic remains of human lifeways or activities that are at least 100 years old, and include artifact concentrations or scatters, whole or fragmentary tools, rock carvings or paintings, and buildings or structures. Resources that incorporate geographic areas, including both cultural and natural features, and that are associated with historic events or other cultural values include ***traditional cultural properties***, cultural landscapes (DIRS 174501-Birnbaum 1994, all), ***ethnographic landscapes*** (DIRS 155897-Parker and King 2002, all), rural historic landscapes (DIRS 155896-McClelland et al. 1990, all), and historic mining landscapes (DIRS 175489-Noble and Spude 1997, all).

For purposes of analysis in this Rail Alignment EIS, DOE has completed a sample inventory of the Mina rail alignment alternative segments and common segments, which provides a thorough characterization of the nature and distribution of resources along the rail alignment. The Department would perform an intensive cultural-resource inventory before starting construction of any specific alternative segment or common segment, and would compile a data recovery plan that would include prudent and feasible practices and measures to avoid or reduce potential adverse impacts to archaeological and historical resources.

This section focuses on cultural resources in the Mina rail alignment region of influence, including those associated with the American Indian culture. Section 3.4 further identifies and discusses American Indian interests in the region. This section summarizes information obtained through a review of available data from federal, state, and local agencies, and findings of data-gathering efforts and field investigations.

Section 3.3.13.1 describes the region of influence for cultural resources along the Mina rail alignment; Section 3.3.13.2 describes the methodology DOE used to identify such sources; Section 3.3.13.3 is a general description of the cultural resources setting and characteristics; Section 3.3.13.4 describes site-specific cultural resources; and Section 3.3.13.5 describes cultural resources for each Mina alternative segment and common segment, including those associated with American Indian culture.

3.3.13.1 Region of Influence

The region of influence for the cultural resources analysis includes two levels of coverage that incorporate areas where construction or other land disturbances could directly or indirectly affect cultural resources:

- Level I – The first level of coverage is the nominal width of the construction right-of-way, the area where ground disturbance could have direct or ***indirect impacts*** on cultural resources. Under Section 106 of the National Historic Preservation Act, the Level I region of influence would comprise the project's Area of Potential Effect.
- Level II – The second level of coverage is a 3.2-kilometer (2-mile)-wide area centered on the rail alignment, and includes the area of potential disturbances that could have indirect impacts on cultural resources. Unless otherwise noted, references in the text that follow refer to the Level II region of

influence. For example, impacts could extend beyond this area where railroad operations and maintenance activities could have an aesthetic, auditory, or visual impact on a potentially significant historic or ***ethnographic*** vista.

3.3.13.2 Methodology

DOE prepared cultural resource documents to support the description of the affected environment and the impacts assessments for the Mina rail alignment. For this analysis, the Department used the following methods to evaluate known and potential resources in the Mina rail alignment region of influence:

- ***Class I inventory***. Reviewing existing cultural resource files, examining the literature, and interviewing knowledgeable people to identify potentially significant resources within the Level II region of influence of the alternative segments and common segments. DOE compiled the results into an historic context baseline report on cultural resources (DIRS 174688-AGEISS 2005, all; DIRS 182774 Kellyard Stegner 2007, all) that establishes the basis for the analytical methodology and the results of the site-file and literature reviews. This report also lists all published and unpublished documents and archival sources DOE consulted during the analysis. The Desert Research Institute provided a supplementary Class I update in April 2007.
- ***Class II inventory***. Conducting a statistical sample field survey (DIRS 174691-BLM 1990, all) of the Level I region of influence for the common segments and alternative segments. The Class II inventory involved intensive inspection of 103 sample units that measured 120 meters (400 feet) by 800 meters (2,600 feet), centered on the rail alignment. This inventory was guided by a research design prepared in consultation with the BLM and State Historic Preservation Office and was designed to provide a 20-percent sample of the length of common segments and alternative segments. The results of this effort provide a predictive view of the possible types of cultural resources that might be expected to occur along the common segments and alternative segments and an evaluation of the possible significance of potential historic properties. The Class II survey report summarizes the results of this effort.
- Consultation with American Indians with regional ties. Interactions with American Indian tribes and organizations that have traditional ties to the region to identify traditional cultural places within the Level I and II regions of influence that are important to American Indian cultural and religious values and beliefs, and to identify other resources, such as plants and animals, that might have historic or current uses.

As previously noted, DOE prepared cultural resource reports to support the description of the affected environment and the impacts assessments for this Rail Alignment EIS. The reports include detailed information about the methods and investigative approaches DOE utilized and about evaluation of the findings. Preparation of the baseline resource reports involved consulting and citing a large number of published and unpublished sources, and contacting knowledgeable persons, institutions, and offices holding relevant data.

DOE is using a phased cultural-resource identification and evaluation approach, as described in 36 CFR 800.4(b)2, to identify specific cultural resources along a final alignment. Under this approach, DOE has completed Class I and Class II inventories of Mina rail alignment alternative and common segments. The Department would perform final field surveys (BLM Class III intensive inventories) of the actual right-of-way and centerline, as provided in the programmatic agreement between DOE, the BLM, the STB, and the Nevada State Historic Preservation Office (DIRS 176912-Wenker et al. 2006, p. 15). In the interim, 20-percent Class II inventories have provided information to characterize the nature and distribution of cultural resources along the Mina rail alignment common segments and alternative segments. Before starting any ground-disturbing activities that could affect cultural resources, the Department would perform the intensive ***Class III inventory*** of the selected segments, site evaluations, impacts assessments, and implement impact reduction or prevention measures, as appropriate.

3.3.13.3 General Environmental Setting and Characteristics

Sections 3.3.13.3.1 through 3.3.13.3.4 summarize the prehistoric, American Indian, and Euroamerican cultural history of southern Nevada. Additional detail, including sources and references, is presented in the historic context report prepared to support this Rail Alignment EIS. (DIRS 174688-AGEISS 2005, all; DIRS 182291-Desert Research Institute 2007, all; URS 2007, all)).

3.3.13.3.1 Prehistoric Period

Native people inhabited the region that encompasses the Mina rail alignment for thousands of years and left artifacts and traces of their settlement and subsistence patterns and religious beliefs. The prehistoric archaeological record in the vicinity of the Mina rail alignment is subdivided into the following three cultural periods:

- Pre-Archaic (11,500 to 7,500 years before present). The Pre-Archaic cultural period is marked by relatively few people, who traveled in small bands hunting game and gathering food. Archaeological sites dating to this period are commonly preserved on gravel bars and other landforms associated with ***pluvial lakes***, marshes, and riparian zones. These sites and their artifacts indicate a reliance on wetlands, with an emphasis on hunting large game. Isolated finds of distinctive fluted points associated with the Clovis and Folsom groups of people have a wide but sporadic distribution throughout the region.
- Early to Middle Archaic (7,500 to 1,500 years before present). During the Early to Middle Archaic cultural period, a shift occurred to a wider use of the environment, including sites near springs, perennial streams, caves, and rockshelters. A gradual increase in populations was marked by the use of plant seeds and nuts, along with hunting small game. Twelve rockshelters dating to this period and the Late Archaic period have been investigated in the vicinity of the Mina rail alignment.
- Late Archaic (1,500 to 150 years before present). Hallmarks of the Late Archaic cultural period include ceramics and small projectile points, along with the bow and arrow. Settlement patterns and subsistence practices continued from the earlier period, with sites in a variety of settings but clustered around permanent springs and riparian settings.

3.3.13.3.2 American Indian Historic Period

The Mina rail alignment would cross lands historically occupied by two indigenous ethnic groups, the Northern Paiute and the Western Shoshone. Other neighboring groups, such as the Owens Valley Paiute and Shoshones from adjacent regions, had strong kinship ties and occasionally visited the region.

Both the Northern Paiute and the Western Shoshone were characterized by local subgroups, defined by slight language or dialectical differences, traditional centers of residential occupation, more or less regular home ranges or districts, and closeness of kin ties. Local subgroups clustered around small oases scattered throughout the desert where springs and flowing streams could be found. Mountains and surrounding valleys were important resource collection areas, but seasonal changes in food availability prevented areas from being occupied year-round. Figure 3-238 shows areas occupied by these groups.

The Mina rail alignment would cross or be adjacent to the territories of several American Indian subgroups. Northern Shoshone areas include the *Agá idökadö* District north and east of Walker Lake and the *Pakwidökadö* District south of Walker Lake. Western Shoshone subgroups include bands based in the Lida-Goldfield area.

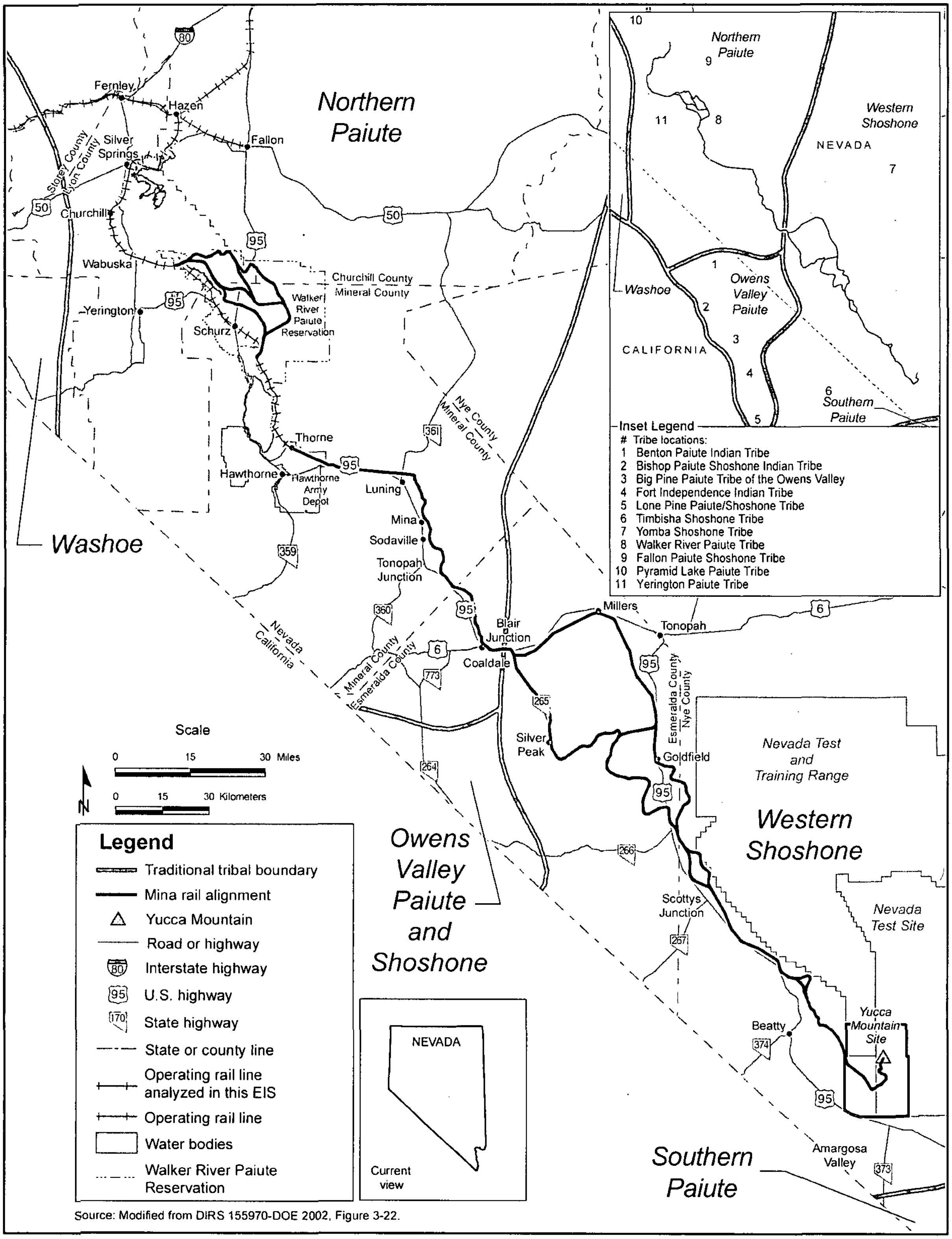


Figure 3-238. Traditional boundaries and locations of federally recognized tribes.

Following initial contact by European Americans in the early to middle 1800s, native people in central and southern Nevada began to adapt to changing conditions as settlement and development by miners, prospectors, and ranchers rapidly encroached on the landscape. As their essential resources were being lost to the Euroamerican expansion, both the Western Shoshone and the Northern Paiute were forced to confine their activities to selected reservations carved out of small portions of their traditional lands. Given the difficulties of making a living on these restricted areas, many responded by providing labor and other services to mining and ranching ventures, often living in mining towns or at ranches. In the vicinity of the region of influence, American Indian encampments are known to have been present at mining communities in the Goldfield and Tonopah areas.

3.3.13.3.3 Euroamerican Historic Period

Euroamerican incursion into the Great Basin was considerably slower than in other regions of North America. Consequently, American Indian groups in the intermontane West were able to survive early contact better than many other tribes and bands. During the first decades of contact, they were able to develop responses to the pressures exerted by Euroamericans on American Indian culture. By the reservation period of the 1860s, they had adopted means of resistance and acculturation that permitted the survival of much of their traditional lifeways.

Present-day Nevada remained largely unexplored by Euroamericans prior to 1826, at which time American and British trapping and trading parties began entering the Great Basin from the east and the northwest. Foremost among these was Peter Skene Ogden, who led a series of four expeditions into the northern Basin and Snake River plateau between 1826 and 1830, locating the Humboldt River and Humboldt Sink, as well as traveling south to Walker Lake and the Owens Valley. Specifically, on his 1829-1830 expedition, Ogden and his party retraced their steps of the previous year from the Columbia River to the Humboldt Sink, continued south to the Carson Sink and on to the Walker River which they followed down to Walker Lake. Continuing south and southwest past the location of present Hawthorne, Nevada, the party eventually reached the Owens River and Lake, following the Owens Valley south to the Mojave Desert. In 1833, an American party under the leadership of Joseph Reddeford Walker followed the Humboldt River and crossed the Sierra Nevada, returning the next year via the Owens Valley, Walker Lake, and the Walker River. On both trips, Walker and his men clashed with Northern Paiute in the vicinity of the Humboldt Sink.

The trails established by trappers and traders across the Great Basin eventually became heavily traveled overland routes to the Pacific coast. Explorers, migrants, and eventually the transcontinental railroad all made their way across the Basin. Two of the earliest groups, the Bidwell-Bartleson party of 1841 and the Walker-Chiles party of 1843, in part followed the trail established along the Walker River to the vicinity of Walker Lake before continuing on to California.

The surge of travelers along the Overland Trail corridor peaked after the discovery of gold in California in 1848, placing increasing pressure on resources along the Humboldt River, all of which were heavily relied upon by American Indian inhabitants. In the face of these destructive forces, many native inhabitants were forced to withdraw from former habitations along the river.

The United States officially acquired the territory of the Great Basin as a result of the Treaty of Guadalupe Hidalgo in 1848, which concluded the Mexican-American War. The first Euroamericans to settle in the Basin were the Mormons, who sought refuge in the Salt Lake Valley in 1847, then a remote part of Mexican territory. The Mormons were the first to arrive in the Great Basin with the intent of settlement and quickly established a number of missions throughout the territory. Among the first of these was Mormon Station, later renamed Genoa, located on the Humboldt River trail from Salt Lake City to Sacramento via Carson Pass, about 60 miles south of present-day Reno, settled in 1851.

Following in the footsteps of the Mormons, small farms and ranches began appearing in some of the more well-watered portions of the Great Basin. But it was the discovery of silver at the Comstock Lode that spurred major migration to western Nevada in the 1850s and 1860s.

As the population in the Virginia City and Carson Valley areas expanded, conflicts with native inhabitants also increased, as American Indian populations were forced out of traditional homelands and the already scarce resources upon which their livelihood depended were exhausted. Settlers demanded protection, and in 1860, the U.S. Army established Fort Churchill on the Carson River. Eventually, American Indian peoples were forced to confine their activities to selected reservations carved out of small portions of their traditional lands.

In addition to a military presence, the discovery and extraction of various ores and minerals in western Nevada, primarily gold and silver, necessitated the construction of new transportation operations. In 1880, the Carson and Colorado (C&C) Railroad Company was formed. Construction of the C&C rail line began in 1880 and ran from Carson City south along the east side of Walker Lake and extended south to Keeler, California, near the northern shore of Owens Lake. By 1900 the gold mining boom had waned in the Carson City area, but shortly thereafter gold deposits in Tonopah were discovered and the rail line continued to deliver supplies from Owens Valley to the Nevada mining operations.

To the north, in Nye, Lincoln, and Esmeralda Counties, mining remained the major economic interest. By 1870, a number of mining districts and communities were established throughout south-central Nevada. Precious metals were discovered in Tonopah in 1900 and Goldfield in 1902, and companies were formed to develop railroads and improve transportation to and from these economic centers. In 1905 a narrow gauge rail line was constructed to run from borax mines near Gold Center, Nevada, south through the Mojave Desert to Ludlow, California. The new railroad, operated under the name Tonopah and Tidewater Railroad Company, ran as both a passenger train and supply train from 1905 to 1940.

3.3.13.3.4 Cultural Landscapes

Based on the literature review of the cultural history of the region of influence, DOE identified several examples of potential cultural landscapes reflecting significant ethnographic, mining, and railroading activities within the Level II region of influence that might be eligible for listing on the *National Register of Historic Places* (DIRS 174688-AGEISS 2005, all). These include:

- Ethnographic historic period Northern Paiute settlements in the Walker River and Lake area, and Western Shoshone villages and surrounding use areas in Oasis Valley and the Goldfield area.
- Several historic mining districts, including the Santa Fe Mining District on the west slope of the Gabbs Valley Range east of Luning; the Mina or Silver Star Mining District in the Excelsior Mountains southwest of Mina; the Sodaville Mining District in the south end of the Pilot Range east of Sodaville; the Silver Peak Mining District in the Clayton Valley area; and the Goldfield area.
- Historic railroad activities in the Luning, Mina, Sodaville, Silver Peak, and Goldfield areas.

3.3.13.4 Site-Specific Cultural Resources

The corridor through which the rail alignment would pass demonstrates a history of diverse prehistoric and historic land-use patterns. Native peoples occupied this area for many thousands of years, as exhibited by the archaeological sites identified in the area. These sites include campsites, rockshelters, ***lithic scatters***, quarries, rock rings and alignments, and rock-art sites. Euroamerican presence in the area is largely limited to the past 150 years or so, and is characterized by diverse activities represented at a wide variety of site types. Recorded and anticipated sites include early transportation features such as wagon and stage roads; railroads and railroad camps and sidings; homesteads; and mines, mills, and mining camps (Figure 3-239). Isolated features and artifacts related to all of these activities can also be anticipated. This section presents data on both previously recorded cultural resources and known, but unrecorded, properties along the Mina rail alignment. This section first presents the results of the Class I site-file search of the Level II region of influence and the Class II inventory (field survey) of the Level I region of influence for the entire alignment, including alternative segments. The results are followed by a segment-by-segment discussion for each of the common segments and alternative segments. DOE based individual segment analyses on three data sources: (1) the known-site file search and literature review (DIRS 182290-Desert Research Institute 2007, all); (2) the Class II inventory and (3) information from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, all). All references consulted or used in the different analyses can be found in those reports.

3.3.13.4.1 Previously Recorded Prehistoric Resources

A Class I site-file search for archaeological sites within the Level II region of influence identified 426 prehistoric recorded sites and ***isolates*** (Table 3-155). Of this total, 85 (20 percent) are isolated artifacts that were previously assigned archaeological site numbers. Although isolates are generally considered not eligible for listing on the *National Register of Historic Places*, they indicate, along with other types of sites, the presence of prehistoric people in the region of influence. In addition to the sites containing only

Table 3-155. Previously recorded prehistoric archaeological sites in the Level II region of influence[a].

Site type	Number of sites and isolates	Eligible[b]	Not eligible	Unevaluated
Rockshelters	13	4	0	9
Specialized activity areas (campsites)	9	6	0	3
Specialized activity areas (lithic scatters)	289	10	221	58
Rock-art sites	5	2	0	3
Toolstone sources and quarry sites	15	2	8	5
Isolates[c]	85	0	84	1
Other:				
Rock ring	4	0	3	1
Rock features	5	0	2	3
Tinaja (water storage feature)	1	0	1	0
Totals	426	24	319	83

a. Source: Data from a site-file search conducted by Desert Research Institute (DIRS 182290-Desert Research Institute 2007, all).
b. Eligibility determinations taken from archaeological site forms on file, as evaluated against significance criteria for potential eligibility for the *National Register of Historic Places*.
c. Isolates include artifact occurrences that have been given a site number in the Nevada statewide archaeological recording system. Isolates are generally considered ineligible for listing on the *National Register of Historic Places*.

prehistoric components, there are 42 multi-component sites containing both prehistoric and historic components; these are listed in Table 3-156. There are no prehistoric sites within the project area that are listed on the *National Register of Historic Places*. Resources that might be eligible for listing on the National Register have been identified as being either within or adjacent to the Mina rail alignment Level II region of influence. These include three toolstone procurement sites; 19 lithic scatters and/or camps; three sites characterized by rock art, including two ***petroglyph*** sites; and six rockshelter or cave habitation sites.

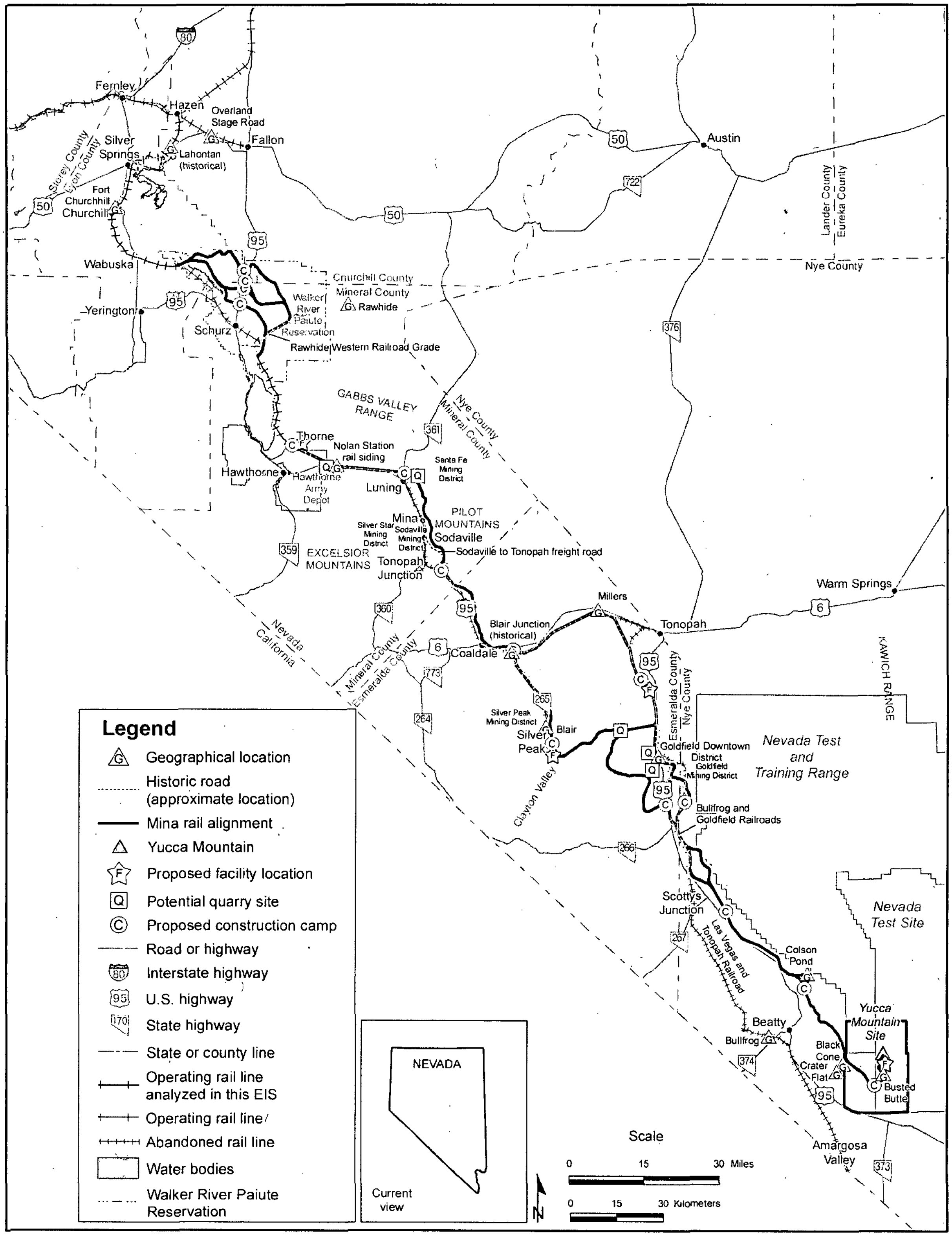


Figure 3-239. Major historic and geographical locations along the Mina rail alignment.

Table 3-156. Previously recorded historic Euroamerican sites in the Level II region of influence.[a]

Site type	Number of sites	Eligible[b]	Not eligible	Unevaluated
Historic ranching sites	0	0	0	0
Historic debris scatters (other)	46	2	40	4
Historic cemetery/graves	5	0	2	3
Historic railways	27	12	8	7
Campsite (mining or ranching, military, railroad)	3	2	1	0
Historic mining sites	31	8	15	8
Historic ranching sites (habitation)	1	1		0
Historic town sites	8	5 Goldfield downtown district listed on the *National Register of Historic Places*	1	2
Historic roads	4	1	0	3
Isolates[c]	7	0	6	1
Prehistoric/historic	42	5	28	9
Other	5	1	0	4
Unknown	2			2
Totals	181	37	101	43

a. Source: Data from site-file search conducted by Desert Research Institute (DIRS 182290-Desert Research Institute 2007, all).
b. Eligibility determinations taken from archaeological site forms on file, as evaluated against significance criteria for potential eligibility for the *National Register of Historic Places*.
c. Isolates include artifact occurrences that have been given a site number in the Nevada statewide archaeological recording system.

Site-type terminology reflects the site classification system employed in the BLM Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, Section 3.9).

3.3.13.4.2 Previously Recorded Historic Euroamerican Resources

A Class I site-file and literature search identified previously recorded historical Euroamerican sites within the Level II region of influence (see Table 3-156). One of these, the Goldfield downtown district, is listed on the *National Register of Historic Places*. Other historic resources that might be eligible for listing on the National Register have been identified as being either within or adjacent to the Mina rail alignment Level II region of influence. These resources include the following:

- Oasis Valley. Beatty Cattle Company Ranch and Colson Ranch, with associated Western Shoshone villages, both within the proposed rail alignment region of influence.
- Historic railroads, including segments of the Carson and Colorado, Las Vegas and Tonopah, Tonopah and Goldfield, and Southern Pacific railroads. The proposed rail line would follow various lengths of some of these lines between Hawthorne and Tonopah Junction, south toward Silver Peak, and intersect or follow many segments of the Las Vegas and Tonopah line along the 12 kilometers (7.2 miles) of Mina common segment 2, south of Goldfield. In these locations, DOE would refurbish the

historic rail beds for use with the proposed rail line. Eligible or unevaluated resources associated with the railroads include stations, abandoned grades, construction-related features, and workers' encampments, and resources associated with Luning, Mina, Coaldale, and other towns established along the rail lines.

- Goldfield. The downtown district of Goldfield is listed on the *National Register of Historic Places*. The town dump and a cemetery (evaluated as eligible for listing on the National Register) would be within the Montezuma alternative segment 2 region of influence. There are also potential contributing features and sites within the region of influence for this alternative segment.
- Historic roads. Segments of the Sodaville to Tonopah freight road and of the Overland Stage Road have been identified.

3.3.13.4.3 Known American Indian Resources

Previous American Indian studies and consultations associated with the Yucca Mountain Project, the Nevada Test Site, the Nevada Test and Training Range, and other projects have yielded significant information on the concerns of modern-day American Indians regarding traditional and cultural values. These concerns include evidence of their ancestors' occupation and use of traditional homelands, and their feelings about natural resources and geologic formations in the region, such as plants, animals, and natural landforms that mark important locations. Opportunities for the identification of traditional cultural properties and additional places of concern to American Indians will remain open through the consultation process. Based on past studies and research for this Rail Alignment EIS, DOE has obtained information regarding the following potentially eligible historic properties that could be of cultural value for American Indians:

- Medicine rock sites, Walker River Paiute Reservation.
- Rabbit Spring rockshelter camp near Goldfield. Within the Level II region of influence.
- Winter village, probable site of a Western Shoshone village named Matsum in the Willow Springs vicinity. Within the Level II region of influence.
- Beatty area petroglyphs. Within the Level II region of influence.
- Western Shoshone Ogwe'pi District, a cluster of winter villages along the upper Oasis Valley and the headwaters of the Amargosa River, including two probable villages. Within the Level II region of influence.
- Black Cone site, a place of religious significance near Crater Flat. Within the Level II region of influence.
- Significant crossroad where numerous traditional American Indian trails came together near Fortymile Wash. Within the Yucca Mountain Site boundary.
- Rock art near Busted Butte. Within the ***Yucca Mountain Site boundary***.

3.3.13.5 Cultural Resources by Alternative Segments and Common Segments

Sections 3.3.13.5.1 through 3.3.13.5.11 describe the cultural resources for each of the Mina rail alignment common segments and alternative segments, including data from the previously recorded Class I site-file and literature search (DIRS 182290-Desert Research Institute 2007, all), the results of the Class II inventory, and associated American Indian consultations (DIRS 174205-Kane et al. 2005, all).

3.3.13.5.1 Union Pacific Railroad Hazen Branchline

The Class I site-file search revealed that 21 cultural resources have been recorded within the Level I region of influence of the existing Union Pacific Railroad Hazen Branchline. These resources include seven prehistoric sites, 10 historic sites, one site with both prehistoric and historic components, and three unknown site types. Six of the cultural properties are considered eligible or potentially eligible for the *National Register of Historic Places*, including several that are part of the National Register-listed Lahontan Dam historic district (DIRS 182290-Desert Research Institute 2007, all). Eligible or potentially eligible resources include a large prehistoric residential base camp, a portion of the Overland Stage Road, the Newlands Waterworks at Lahontan City, a Lahontan City construction townsite and railroad station, a railroad ***berm*** and debris scatter, and a multi-component site with eligible historic elements including a telephone line and debris scatter. In addition, the existing rail line passes through Fort Churchill State Historic Park, site of an important 1860-1869 U.S. Army post.

3.3.13.5.2 Department of Defense Branchline North

Department of Defense Branchline North is an existing rail line that begins east of Wabuska. It trends east through a valley just south of Parker Butte and north of the Mason Valley Wildlife Management Area. In total, Department of Defense Branchline North is about 8 kilometers (5 miles) long.

The Class I site-file search did not identify any cultural resources recorded within the Level I region of influence. No Class II inventory has been conducted.

3.3.13.5.3 Schurz Alternative Segments

At present, the Department of Defense operates a branch rail line that runs south from the end of the Union Pacific Railroad Hazen Branchline at Wabuska, directly through Schurz on the Walker River Paiute Reservation, to the Hawthorne Army Depot. DOE is considering four alternative segments to bypass Schurz to the east and connect the proposed rail line to existing Department of Defense Branchline North east of Wabuska. These four alternative segments are referred to as Schurz 1, 4, 5, and 6.

Schurz alternative segment 1 would begin at the end of the existing Department of Defense Branchline North, would cross the Walker River, and would trend east and then southeast, roughly parallel to the Walker River for approximately 10 kilometers (6 miles). From the Walker River, Schurz alternative segment 1 would continue in a southeasterly and then easterly direction for approximately 6 kilometers (4 miles). It would trend to the south through Sunshine Flat for approximately 19 kilometers (12 miles). After crossing U.S. Highway 95 with a grade-separated crossing, the rail line would pass south of the Calico Hills. Schurz alternative segment 1 would continue south for another 6 kilometers before joining the existing Department of Defense Branchline South. Schurz alternative segment 1 would be about 52 kilometers (32 miles) long.

The Class I site-file search revealed that five cultural resources have been recorded along Schurz alternative segment 1, including two within the Level I region of influence and three within the Level II region of influence. Previously recorded sites include one prehistoric site, three historic sites, and one multi-component prehistoric and historic site. None of the five resources has been evaluated for eligibility to the *National Register of Historic Places*.

DOE surveyed 15 sample units during the Class II effort, a total of 12 kilometers (7.5 miles). Eight resources were recorded, including five prehistoric sites, all characterized by lithic scatters, and three historic sites, including two railroads and one trash deposit. One prehistoric lithic scatter and one historic railroad are potentially eligible for listing on the *National Register of Historic Places*. The other six resources appear ineligible for listing.

Schurz alternative segment 4 would begin at the end of the existing Department of Defense Branchline North, would cross the Walker River, and would trend east and then southeast, roughly parallel to the Walker River for approximately 10 kilometers (6 miles). From the Walker River, the rail line would trend generally southeast and east for about approximately 12 kilometers (7.5 miles) and would cross U.S. Highway 95 with a grade-separated crossing. Between the Terrill Mountains and Calico Hills, it would run due east for about 11 kilometers (7 miles). It would then trend southwest for approximately 16 kilometers (10 miles) and would continue in a roughly southern direction for about 6 kilometers (4 miles) before joining the existing Department of Defense Branchline South. Schurz alternative segment 4 would be about 64 kilometers (40 miles) long.

The Class I site-file search revealed that one historic cultural resource, the Rawhide Western Railroad grade, has been recorded along Schurz alternative segment 4, within the Level I region of influence. National Register-eligibility of this resource has not been determined.

DOE surveyed four sample units during the Class II effort, totaling 3.2 kilometers (2 miles). Eight prehistoric resources were recorded, including lithic and groundstone scatters, and a quarry. Three of the sites are considered potentially eligible for listing on the *National Register of Historic Places*, two are considered not eligible, and three of the sites have not been evaluated.

Schurz alternative segment 5 would begin at the end of the existing Department of Defense Branchline North, would cross the Walker River, and would run east for approximately 14 kilometers (9 miles). This alternative segment would briefly cross into Churchill County before turning southeast and traveling through Long Valley across U.S. Highway 95 with a grade-separated crossing. Between the Terrill Mountains and Calico Hills, it would run due east for about 11 kilometers (7 miles). It would then trend southwest for approximately 16 kilometers (10 miles). It would continue in a roughly southern direction for about 6 kilometers (4 miles) before joining the existing Department of Defense Branchline South. Schurz alternative segment 5 would be about 71 kilometers (44 miles) long.

The Class I site-file search revealed that four cultural resources have been recorded along Schurz alternative segment 5, including two within the Level I region of influence and two within the Level II region of influence. These include three historic sites and one multi-component prehistoric and historic site. The multi-component site, Double Spring, is considered eligible for listing on the *National Register of Historic Places* and is located in the Level II region of influence; the historic sites have not been evaluated.

DOE surveyed 10 sample units during the Class II effort, totaling 8 kilometers (5 miles). Four resources were recorded, including three prehistoric lithic scatters, all unevaluated for eligibility, and one historic site, a trash deposit that is recommended not eligible for listing on the National Register.

Schurz alternative segment 6 would begin at the end of existing Department of Defense Branchline North, cross the Walker River, and would run east for approximately 14 kilometers (9 miles). This alternative segment would briefly cross into Churchill County before turning southeast and traveling through Long Valley before turning sharply northeast and crossing U.S. Highway 95. After following U.S. Highway 95 for about 4 kilometers (2.5 miles), the rail line would then turn southeast and run along the eastern edge of the Terrill Mountains for approximately 16 kilometers (10 miles). It would then trend southwest for approximately 16 kilometers. The rail line would continue south for about 6 kilometers (4 miles) before joining the existing Department of Defense Branchline South. Schurz alternative segment 6 would be about 72 kilometers (45 miles) long.

The Class I site-file search revealed that nine cultural resources have been recorded along Schurz alternative segment 6, including five within the Level I region of influence and four within the Level II region of influence. Of these nine, seven are prehistoric or have a prehistoric component, and two are historic resources. Prehistoric resources include one isolate, two lithic scatters, one rock alignment with possible burials, one petroglyph site, and one site considered eligible for listing on the National Register that has a medicine rock, cairns, hunting blinds, and petroglyphs. The isolate and one of the lithic scatters are considered not eligible; eligibility status of the remaining prehistoric sites has not been determined. The sites within the Level I region of influence include a lithic scatter, the isolate, and the rock alignment. The two historic sites falling along Schurz alternative segment 6 are found within the Level I region of influence and include the Rawhide Western Railroad grade and the Reese River Road stage route. Eligibility status of these resources has not been determined.

DOE surveyed two sample units during the Class II effort, totaling 1.6 kilometers (1 mile). One resource, a prehistoric lithic scatter, was recorded. This site has not been evaluated for listing on the *National Register of Historic Places*.

3.3.13.5.4 Department of Defense Branchline South

Department of Defense Branchline South is existing track that starts where the Schurz alternative segments would end, about 13 kilometers (8 miles) south of Schurz. The rail line trends generally south for 10 kilometer (6 miles) before leaving the Walker River Paiute Reservation, and continues generally south for another 24 kilometers (15 miles) on the east side of Walker Lake. Department of Defense Branchline South ends near Hawthorne, where it would join Mina common segment 1. Department of Defense Branchline South is approximately 35 kilometers (22 miles) long.

The Class I site-file search revealed that three cultural resources have been recorded within 0.15 kilometer (500 feet) of the existing rail line, including an historic pier piling, the historic Nolan Station rail siding, and a boulder containing cupule-style rock art (DIRS 182290-Desert Research Institute 2007, all). The historic pier piling is considered not eligible, and the other two sites have not been evaluated for eligibility. Because this line passes through or is adjacent to the Hawthorne Army Depot, first established as a U.S. Navy ammunition storage facility in 1928, historic structures associated with the depot might lie within the region of influence. No such structures were identified during Class I or Class II inventories. Any structures identified within the Level I region of influence during future studies, however, would require recordation and evaluation.

3.3.13.5.5 Mina Common Segment 1 (Soda Spring Valley Area)

Mina common segment 1 would begin north of the city of Hawthorne and would trend southeast before turning east at U.S. Highway 95. It would trend east along U.S. Highway 95 through Soda Springs Valley for approximately 40 kilometers (25 miles). Continuing to parallel U.S. Highway 95, the rail line would cross State Route 391 and turn south for approximately 64 kilometers (40 miles). It would pass the communities of Luning and Mina, which are along U.S. Highway 95 and would be approximately 1.5 to 3 kilometers (1 to 2 miles) to the east of the rail alignment. The rail line would then turn east before crossing U.S. Highway 95 with a grade-separated crossing in the area of Blair Junction and continuing for about 1.5 kilometers (1 mile) before joining the selected Montezuma alternative segment. Mina common segment 1 would be approximately 120 kilometers (72 miles) long.

The Class I site-file search revealed that 56 cultural resources have been recorded along Mina common segment 1, including 18 within the Level I region of influence and 38 within the Level II region of influence. Within the Level I region of influence, previously recorded resources include two prehistoric lithic scatters (one site is considered not eligible, one site has not been evaluated), 14 historic sites (five sites are considered eligible, two sites are considered not eligible, and seven sites have not been evaluated), and two multi-component sites (one site is not eligible, one site has not been evaluated). Types of eligible resources falling within the Level I region of influence include the Sodaville to Tonopah Freight Road, railroad workers' camps, and a railroad grade. Within the Level II region of influence, there are 24 prehistoric sites (15 sites are considered not eligible, and nine have not been evaluated), and 14 historic sites (four are considered eligible, six are considered not eligible, and four have not been evaluated). The prehistoric sites consist of a rockshelter, lithic scatters, and isolates. Most of the historic sites are associated with railroad construction and operation, including camps, stations, and grades. Mining sites and the townsites of Redlich and Mina also fall within the region of influence of Mina common segment 1.

DOE surveyed 29 sample units during the Class II effort, totaling 23.3 kilometers (14.5 miles). A total of 19 resources were recorded, including 14 prehistoric sites (13 lithic scatters and one quarry), three historic trash deposits, and two historic railroads. One historic railroad and the prehistoric quarry site are both considered eligible for listing on the *National Register of Historic Places*. Seven of the prehistoric lithic scatters are considered not eligible, and six have not been evaluated for eligibility. The three historic trash deposits and the additional historic railroad are considered not eligible.

3.3.13.5.6 Montezuma Alternative Segments

DOE is considering three alternative segments in the Montezuma area, referred to as Montezuma alternative segments 1, 2 and 3. Montezuma alternative segment 1 would depart Mina common segment 1 just southeast of Blair Junction. It would trend roughly southeast along State Route 265 through part of the Big Smoky Valley and west of the Weepah Hills for approximately 37 kilometers (23 miles), passing to the east of the Silver Peak in Clayton Valley. It would then turn to the northwest through Clayton Valley and run through a pass between Clayton Ridge and Paymaster Ridge close to Silver Peak Road. It would then trend south for the next 11 kilometers (7 miles) between Clayton Ridge on the west and Montezuma Peak on the east before turning east for about the next 13 kilometers (8 miles), passing to the south of Montezuma Peak. The rail alignment would again turn roughly south for approximately 11 kilometers, traveling to the west of the Goldfield Hills. It would then travel northwest, cross U.S. Highway 95, and turn south before joining Mina common segment 2 near Lida Junction. Montezuma alternative segment 1 would be approximately 120 kilometers (73 miles) long.

3.3.13.5.6.1 Montezuma Alternative Segment 1. The Class I site-file search revealed that 43 cultural resources have been recorded along Montezuma alternative segment 1, including five within the Level I region of influence and 38 within the Level II region of influence. Within the Level I region of influence, two prehistoric sites, including a quarry site of unknown eligibility status and a small lithic scatter that is considered not eligible, and three historic sites (two sites, a railroad grade and telephone line, are considered eligible and one site, a trash dump, has not been evaluated) are present.

Within the Level II region of influence, previously recorded resources include 27 prehistoric sites (one site is considered eligible, 17 sites are considered not eligible, and nine have not been evaluated), 10 historic sites (three are considered eligible, four are considered not eligible, and three have not been evaluated), and one multi-component site that is considered not eligible. The majority of the prehistoric sites consist of lithic scatters and isolates, though cave and quarry sites are also present; historic sites include railroad grades, a dump, a wagon road, mining sites, and the townsite of Blair.

DOE surveyed 25 sample units during the Class II effort, totaling 20.1 kilometers (12.5 miles). Twenty resources were recorded, including 17 prehistoric lithic scatters, two historic trash deposits, and one historic mining site. One lithic scatter is considered eligible for listing on the *National Register of Historic Places*; three scatters are considered not eligible, and the remaining 13 prehistoric sites have not been evaluated for eligibility. Of the historic sites, one trash deposit and the mining site are considered not eligible; the other trash deposit has not been evaluated.

3.3.13.5.6.2 Montezuma Alternative Segment 2. Montezuma alternative segment 2 would depart Mina common segment 1 just southeast of Blair Junction. It would trend northeast for about 35 kilometers (22 miles) just south of U.S. Highway 95. Northeast of Lone Mountain, it would turn south into Montezuma Valley and run south for 49 kilometers (31 miles) before turning east and crossing U.S. Highway 95 south of Goldfield. It would then trend south for about 37 kilometers (23 miles) before joining Mina common segment 2 near Lida Junction. Montezuma alternative segment 2 would be approximately 120 kilometers (74 miles) long.

The Class I site-file search revealed that 226 cultural resources have been recorded along Montezuma alternative segment 2, including 39 within the Level I region of influence and 187 within the Level II region of influence. Within the Level I region of influence, previously recorded resources include 11 prehistoric sites (10 are considered not eligible, one has not been evaluated), 17 historic sites (one site, the townsite of Goldfield, is listed on the *National Register of Historic Places*, nine sites are considered eligible, and seven are considered not eligible), and 11 multi-component sites (one site is considered eligible, nine are considered not eligible, and one has not been evaluated). Eligible site types include railroad grades, Millers townsite, a mining camp and miner's cabin, the Goldfield Junction Station and Goldfield Dump, a feed lot with corrals, and a multi-component site with mining structures and rock art. An unrecorded American Indian settlement is also reported within the Montezuma alternative segment 2.

Within the Level II region of influence, recorded resources include 112 prehistoric sites (four sites are considered eligible, 73 are considered not eligible, and 35 have not been evaluated), 58 historic sites (14 sites are considered eligible, 42 are considered not eligible, and two have not been evaluated), and 17 multi-component sites (14 are considered not eligible, and three have not been evaluated). The majority of the prehistoric sites consist of small lithic scatters and isolates; a variety of historic sites is found, primarily associated with mining and railroad activities. Historic sites also include the townsite of Millers, cemeteries, historic dumps, and military encampments, as well as sites and features potentially contributing to the National Register-listed Goldfield townsite.

DOE surveyed 24 sample units during the Class II effort, totaling 19 kilometers (12 miles). A total of 39 resources were recorded, including 28 prehistoric lithic scatters and one quarry, four historic trash deposits, three historic railroad sites, one historic homestead site, one historic mining site, and one multi-component site.

Two of the lithic scatters are considered eligible for listing on the *National Register of Historic Places*, and seven are considered not eligible; 19 lithic scatters and the quarry have not been evaluated for eligibility. The four historic trash deposits, two of the railroads, and the mining site are considered not eligible; one railroad, the homestead, and the multi-component site have not been evaluated.

3.3.13.5.6.3 Montezuma Alternative Segment 3. Montezuma alternative segment 3 would depart Mina common segment 1 just southeast of Blair Junction. It would trend northeast for about 35 kilometers (22 miles) just south of U.S. Highway 95. Northeast of Lone Mountain, it would turn south into Montezuma Valley and trend south for 37 kilometers (23 miles). North of Goldfield, it would turn west and trend along the northern portion of the Montezuma Range for 12 kilometers (7.5 miles). It would then trend south for the next 11 kilometers (7 miles) between Clayton Ridge on the west and Montezuma Peak on the east before turning east for about the next 13 kilometers (8 miles), passing to the south of Montezuma Peak. The rail alignment would again turn roughly south for approximately 11 kilometers, traveling to the west of the Goldfield Hills. It would then travel northwest, cross U.S. Highway 95, and turn south before joining Mina common segment 2 near Lida Junction. Montezuma alternative segment 3 would be approximately 140 kilometers (88 miles) long.

The Class I site-file search revealed that 84 cultural resources have been recorded along Montezuma alternative segment 3, including eight within the Level I region of influence and 76 within the Level II region of influence. Within the Level I region of influence, there is one prehistoric site (considered not eligible) and seven historic sites (six are considered eligible, and one is considered not eligible). The eligible resources include two railroad grades, Millers townsite, the Goldfield Junction Station, a mining camp, and a feed lot with corrals.

Within the Level II region of influence, previously recorded resources include 55 prehistoric sites (35 sites are considered not eligible, and 20 have not been evaluated), 18 historic sites (four sites are considered eligible, 12 are considered not eligible, and two have not been evaluated), and three multi-component sites that are considered not eligible. The majority of the prehistoric sites consist of small lithic scatters and isolates; a rockshelter is also present. Historic sites are primarily associated with mining and railroad activities, and include camps, dumps, mining features, and railroad grades and stations.

DOE surveyed 30 sample units during the Class II effort, totaling 24 kilometers (15 miles). A total of 46 resources were recorded, including 36 prehistoric lithic scatters and one quarry, three historic trash deposits, three historic railroad sites, one historic homestead site, one historic mining site, and one multi-component site.

Two of the lithic scatters are considered eligible for listing on the *National Register of Historic Places*, and eight are considered not eligible; 26 lithic scatters and the quarry have not been evaluated for eligibility. The three historic trash deposits, two of the railroads, and the mining site are considered not eligible; one railroad, the homestead, and the multi-component site have not been evaluated.

3.3.13.5.7 Mina Common Segment 2 (Lida Junction Area)

Mina common segment 2 would begin at the end of the Montezuma alternative segments and run roughly southeast for about 3.4 kilometers (2.1 miles) before joining one of the Bonnie Claire alternative segments.

The Class I site-file search revealed that one prehistoric cultural resource, the Twin Buttes Rockshelters, is recorded along Mina common segment 2 within the Level II region of influence. This site has not been formally evaluated for eligibility, but is likely to be considered eligible. No cultural resources have been previously identified within the Level I region of influence.

No Class II effort has been conducted along this short segment.

3.3.13.5.8 Bonnie Claire Alternative Segments

DOE is considering two alternative segments in the area north of Scottys Junction – Bonnie Claire alternative segments 2 and 3.

3.3.13.5.8.1 Bonnie Claire Alternative Segment 2. Bonnie Claire alternative segment 2 would depart Mina common segment 2 as the easternmost alternative segment where it skirts the western border of the Nevada Test and Training Range. The Class I site-file search identified one cultural resource along Bonnie Claire alternative segment 2. The site includes both prehistoric and historic components (a lithic scatter and mining prospects and debris). The prehistoric component was evaluated as being eligible for listing on the *National Register of Historic Places*.

The Class II survey examined five sample units, a total of 4 kilometers (2.5 miles). Two sites and five isolates were recorded. The sites include a prehistoric campsite with a lithic and ground stone scatter, evaluated as being eligible for listing on the *National Register of Historic Places*, and a lithic scatter for which eligibility is under review. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify any known areas of importance to American Indians along this alternative segment.

3.3.13.5.8.2 Bonnie Claire Alternative Segment 3. Bonnie Claire alternative segment 3 would run west of Bonnie Claire alternative segment 2, closer to U.S. Highway 95, and generally follow an abandoned rail line grade for part of its length. The Class I site-file search revealed four previously recorded but unevaluated prehistoric sites. One of these is a rockshelter, and the other three are extractive sites located in areas of obsidian cobble occurrences. The Class II survey inspected four sample units along this segment, a total of 3.2 kilometers (2 miles). One site and 24 isolates were recorded. The site is an historic rail line construction camp along the abandoned combined Bullfrog and Goldfield/Las Vegas and Tonopah rail bed, recommended as eligible for listing on the *National Register of Historic Places*. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify specific resources for this alternative segment.

3.3.13.5.9 Common Segment 5 (Sarcobatus Flat Area)

Common segment 5 would begin 4 kilometers (2.5 miles) north of Scottys Junction and trend generally southeast through the Sarcobatus Flat area, approximately 100 meters (330 feet) east of U.S. Highway 95 at its closest point. Common segment 5 would end approximately 6 kilometers (4 miles) north of Springdale, where it would connect to one of the Oasis Valley alternative segments. Common segment 5 would be about 40 kilometers (25 miles) long (DIRS 176165-Nevada Rail Partners 2006, p. E-13).

The Class I site-file search identified 33 cultural resources within common segment 5. These resources include 20 prehistoric sites (14 lithic scatters and six quarry extractive sites), four historic sites (a Tolicha mining district campsite, two debris scatters, and a railroad segment), seven isolates, and two unknown sites. Of these sites, one lithic scatter has been recommended as eligible for listing on the *National Register of Historic Places*; 11 are not eligible, and 14 remain unevaluated.

DOE surveyed 10 sample units along this segment for the Class II effort, a total of 8 kilometers (5 miles). Four prehistoric sites (three lithic scatters and one campsite) and 33 isolates were recorded. Of these sites, the campsite was recommended as eligible for listing on the *National Register of Historic Places*, and the tree lithic scatters are not eligible.

3.3.13.5.10 Oasis Valley Alternative Segments

The Class I site-file search identified three cultural resources along Oasis Valley alternative segments 1 and 3. These resources include one prehistoric campsite (recommended as eligible for nomination to the *National Register of Historic Places)* and two sites with both prehistoric and historic components (unevaluated ethnographic village sites).

3.3.13.5.10.1 Oasis Valley Alternative Segment 1. The Class II survey looked at three sample units along Oasis Valley 1, totaling 2.4 kilometers (1.5 miles). Two prehistoric sites (lithic scatters) and one historic mine site were recorded.

Oasis Valley alternative segment 1 would pass to the east of the historic ranch known today as the Beatty Cattle Company Ranch. In addition to being an unrecorded historic ranch, the area adjacent to the ranch is known to be the location of an early historic Western Shoshone winter camp. This camp has been partially recorded but has not been evaluated.

The American Indian Resource Document notes the presence of the early Western Shoshone camp and also states that, because of its abundant water supply and large variety of culturally important plants and animals, American Indian people extensively used the entire valley (DIRS 174205-Kane et al. 2005, Section 2.3). Recent ethnographic studies on the nearby Nevada Test and Training Range revealed cultural links to Oasis Valley. The Oasis Valley area is both a potential ethnographic and historic ranching cultural landscape. In later historic times, these landscapes overlapped, as American Indian people collocated with and supplied labor for the ranches.

3.3.13.5.10.2 Oasis Valley Alternative Segment 3. Oasis Valley alternative segment 3 would cross Oasis Valley farther to the east than Oasis Valley 1, but because of proximity, much of the discussion for Oasis Valley 1 applies to this alternative segment. During the Class II survey, DOE inspected four sample units, a total of 3.2 kilometers (2 miles); five sites and 28 isolates were recorded. These resources include five prehistoric sites (four lithic scatters and one campsite with a lithic scatter and cleared rock rings). The campsite has been determined eligible for listing on the *National Register of Historic Places.*

Oasis Valley 3 would also be near a historic ranch (noted as the Colson Ranch or Indian Camp on some maps). Similar to the Beatty Cattle Company Ranch, the Colson Ranch is an unrecorded historic property that has been identified as a Western Shoshone winter camp.

3.3.13.5.11 Common Segment 6 (Yucca Mountain Approach)

The Yucca Mountain area has been heavily analyzed in conjunction with repository site characterization studies. Intensive cultural resource studies related to the development of the repository site have been completed; consequently, a large number of archaeological sites are known to exist along common segment 6. This is due more to the intensive nature of past studies than actual site density characteristics.

A Class I site-file search identified a total of 204 cultural resources along common segment 6. These resources include 152 prehistoric sites, 3 historic sites, one site with both prehistoric and historic components, and 49 isolates. Prehistoric sites include eight rockshelters (four eligible), two eligible rock-art sites, 13 campsites (five eligible), six quarry sites (two eligible), four rock features and two rock rings, and 117 lithic scatters (one eligible). Historic sites include two debris scatters and one rail segment.

The Class II survey for common segment 6 did not extend inside the Yucca Mountain Site boundary. DOE inspected thirteen sample units, a total of 11 kilometers (7 miles). Seven sites (two prehistoric lithic scatters, four eligible sites with both prehistoric and historic components, and one historic debris scatter) and 52 isolates were recorded.

To provide additional information on cultural resources along common segment 6, Desert Research Institute conducted a supplementary field survey along the section of proposed rail alignment inside the Yucca Mountain Site boundary. This survey investigated a 150-meter (500-foot)-wide corridor centered on the rail alignment for an approximate length of 5.9 kilometers (3.7 miles). This land comprised acreage that had not been previously surveyed during repository site characterization activities. Desert Research Institute identified eight cultural resources (two prehistoric sites, five isolates, and one historic site) during the Class III survey. All were evaluated as ineligible for National Register listing.

Based primarily on previous ethnographic studies, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies several areas of cultural significance for American Indians along this segment. Several of these fall within the Yucca Mountain Site boundary, including the Busted Butte rock-art site, Fortymile Wash, and Alice Hill. The American Indian Writers Subgroup also notes the cultural importance of the Beatty Wash rock-art site and Crater Flat, specifically the Black Cone geological feature in Crater Flat, which would be within 0.8 kilometer (0.5 mile) of common segment 6.

3.3.14 PALEONTOLOGICAL RESOURCES

Paleontology is a science that uses ***fossil*** remains to study life in past geological periods. DOE, the BLM, and other federal agencies recognize paleontological resources as a fragile and nonrenewable scientific record of the history of life on earth and consider them a critical component of America's natural heritage. Once such resources are damaged, destroyed, or improperly collected, their scientific and educational value could be greatly reduced or forever lost.

> **Fossil**: Fossils include the body remains, traces, and imprints of plants or animals that have been preserved in the Earth's crust since some past geologic or prehistoric time. Generally, to be considered a fossil, the remains must be older than recent in age (older than 10,000 years). Fossils are found in ***sedimentary rock***.
>
> **Sedimentary rock**: Rock formed from material deposited by water, wind, or glaciers.

The BLM manages and protects paleontological resources under the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq.*), and in accordance with 43 CFR 8365 and 43 CFR 3622. The BLM has developed policies and management actions to protect and manage paleontological resource areas of high scientific value consistent with the *Carson City Field Office Consolidated Resource Management Plan* (DIRS 179560-BLM 2001, all) and the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all), while allowing casual and academic collecting of invertebrate (animals without backbones) fossils within the regulatory framework. Because of their relative rarity and scientific importance, vertebrate (animals with backbones) fossils may only be collected with a BLM permit and remain the property of all Americans in museums or other public institutions (DIRS 180122-BLM [n.d.], all).

Section 3.3.14.1 describes the region of influence for paleontological resources along the Mina rail alignment; and Section 3.3.14.2 describes the paleontological resources within the region of influence, including the identification of previously recorded important fossil resources and the approaches for managing those resources.

3.3.14.1 Region of Influence

The region of influence for paleontological resources along the Mina rail alignment is the nominal width of the rail line construction right-of-way, and the footprints of railroad construction and operations support facilities.

3.3.14.2 Affected Environment

The BLM has established a classification system to rank areas according to their potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils (*Paleontological Resource Management* and *General Procedural Guidance for Paleontological Resource Management*). The BLM uses these rankings (called ***Condition 1***, ***Condition 2***, and ***Condition 3***) in land-use planning and to identify areas that might warrant special management or special designation (DIRS 176085-BLM 1998, all; DIRS 176084-BLM 1998, all).

> BLM ranking of areas for their potential to contain paleontological resources (DIRS 176084-BLM 1998, pp. II-2 and II-3):
>
> **Condition 1** - Areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.
>
> **Condition 2** - Areas with exposures of geological units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.
>
> **Condition 3** - Areas that are very unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

To determine the affected environment for paleontological resources along the Mina rail alignment, DOE consulted the BLM and reviewed existing documentation of paleontological resources, including applicable BLM resource management plans and the National Science Foundation's website *The Paleontology Portal.*

The Mina rail alignment would cross large areas of volcanic rock and granite, alternating with basins filled with deposits from erosion of the mountains. North of the Montezuma Range, there are some exposures of sedimentary rock in alluvial fans and playa areas. Fossils are likely found in sedimentary rock; however, there are no known occurrences of paleontological resources within the Mina rail alignment region of influence.

Although the proposed rail alignment would not cross any known fossil-rich rock outcrops, the possibility exists that beds containing fossils could be uncovered during construction of the proposed railroad.

3.3.15 ENVIRONMENTAL JUSTICE

To support the assessment of the potential for ***disproportionately high and adverse impacts*** on ***minority*** and ***low-income*** communities, this section provides the information on minority and low-income ***populations*** and communities in the Mina rail alignment region of influence. Section 3.2.15.1 describes the region of influence, Section 3.2.15.2 describes the methodology DOE used to determine population groups, and Section 3.2.15.3 describes regional population characteristics for environmental justice considerations.

> **Minority** individuals are members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, and Hispanic.
>
> A **low-income** household is one for which the household income is below the U.S. Census Bureau poverty thresholds.
>
> Source: DIRS 155970-DOE 2002, Section 3.1.13.1.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs federal agencies to make achieving environmental justice part of their missions by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations, and provide access to public information on, and an opportunity for public participation in, matters relating to human health or the environment. Executive Order 12898 also directs agencies to provide opportunities for public input on the incorporation of environmental justice principles into federal agency programs or policies. Executive Order 12898, and associated implementing guidance, establishes the framework for characterizing existing conditions related to environmental justice. For this analysis, DOE uses the terms minority and low-income in the context of environmental justice as described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 3.1.13.1) and *Poverty Thresholds* (DIRS 174625-Census Bureau 2005, all).

3.3.15.1 Region of Influence

The Mina rail alignment region of influence for environmental justice encompasses the regions of influence for all other resource areas because impacts in other resource areas could result in environmental justice impacts. Section 3.3 describes the regions of influence for the ***environmental resource areas*** analyzed in this Rail Alignment EIS. For some resource areas, the relevant region of influence is an area extending a given distance from the centerline of the rail alignment. For others, the relevant region of influence is not so precisely definable, but generally includes the landscape the rail line would cross. However, the most inclusive region of influence is that defined for hazardous materials and waste (see Section 3.3.12), which considers a nationwide region of influence.

In addition to the regions of influence delineated via direct physical proximity to the Mina rail alignment, the environmental justice region of influence includes populations that could be affected by the project that have cultural or religious ties in the area, even though the population may not have a physical presence. For a discussion of American Indian populations, and resulting cultural region of influence, see Section 3.4, American Indian Interests.

3.3.15.2 Methodology

Following the Council on Environmental Quality guidance (DIRS 103162-Council on Environmental Quality 1997, all) and the approach used in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 3.1.13), DOE considered that a minority population exists where either: (a) the minority population of the affected area exceeds 50 percent; or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (DOE used both the United States and the State of Nevada minority populations).

A **census block** is a subdivision of a census tract (or, prior to 2000, a block numbering area). A block is the smallest geographic unit for which the Census Bureau tabulates 100-percent data.

A **census county division (CCD)** is a subdivision of a county that is a relatively permanent statistical area established cooperatively by the Census Bureau and state and local government authorities. It is used for presenting decennial census statistics in those states that do not have well-defined and stable minor civil divisions that serve as local governments.

A **census block group** is a subdivision of a census tract (or, prior to 2000, a block numbering area). A block group is the smallest geographic unit for which the Census Bureau tabulates sample data. A block group consists of all the blocks within a census tract with the same beginning number.

A **census tract** is a small, relatively permanent statistical subdivision of a county delineated by a local committee of census data users for the purpose of presenting data. Designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions at the time of establishment, census tracts average about 4,000 inhabitants.

Sources: DIRS 181904-U.S. Census Bureau 2007; DIRS 181905-U.S. Census Bureau [n.d].

DOE used the Council on Environmental Quality definition of low-income and the annual statistical poverty thresholds from the U.S. Census Bureau. A low-income community exists when the low-income population percentage in the area of interest is meaningfully greater than the low-income population in the general population. For purposes of the analysis of low-income communities, DOE applied the U.S. Nuclear Regulatory Commission guidance of a 20-percent threshold above the state average of 11 percent (that is, 31 percent) for low-income populations (69 *FR* 52040).

To identify low-income populations, DOE used U.S. Census Bureau data for census block groups. The census block group, which typically consists of between 600 and 3,000 people with an optimum size of 1,500 people, is the smallest census unit for which the Census Bureau releases income data (to protect confidentiality). Block groups on American Indian reservations, off reservation trust lands, and special places must contain a minimum of 300 people. (Special places include correctional institutions, military installations, college campuses, workers' dormitories, hospitals, nursing homes, and group homes.) To identify minority populations, DOE used U.S. Census Bureau data for ***census blocks***. The census block is the smallest census unit for which the Census Bureau collects 100-percent data. The Department assessed the population within 3 kilometers (1.8 miles) on either side of the centerline of the Mina rail alignment, to be consistent with the Yucca Mountain FEIS.

DOE developed these analyses by creating Geographic Information System (GIS) representations of the Mina rail alignment alternative segments and common segments and creating a computer program to extract specific census data based on the 3-kilometer buffer distance. The specific census data required to develop the analyses included:

- Total population and number of minority persons by census block
- Total population and number of individuals below the poverty level by census block group

For Census 2000, the Census Bureau used two forms, one short and one long. The Bureau sent the short form to every household, and sent the long form, containing the seven 100-percent questions plus the sample questions, to only a limited number of households. Generally, about one in every six households nationwide received the long form. The rate varied from one in two households in some smaller areas, to one in eight households for more densely populated areas. The long form requests information on the numbers and ages of members of each household and income received during the previous full year. From this information, the Bureau makes a determination of the poverty status of the individuals living in the household. The Census Bureau additionally uses school districts, child protective services, and social services to supplement the census data to develop estimates that more fully represent actual poverty status among all populations.

3.3.15.3 Regional Characteristics

3.3.15.3.1 Minority and Low-Income Populations

The Mina rail alignment would affect portions of five counties in Nevada (Churchill, Lyon, Mineral, Esmeralda, and Nye). Table 3-157 summarizes Census 2000 data on minority and low-income populations within these general areas. The table includes specific county subdivisions and small population centers within or near the Mina rail alignment. For comparison, the table includes statewide and countywide minority and poverty data.

Based on the data in Table 3-157, seven of the county subdivisions and small population centers that would encompass the Mina rail alignment have a higher proportion of minority residents than the associated countywide proportion of minority residents. The Schurz population center and the Walker River ***Census County Division***, both in Mineral County, are the two extreme cases with the widest percentage difference of 89-percent and 80-percent minority populations, respectively, compared to a 30-percent minority population for Mineral County as a whole. These two areas exceed the 50-percent threshold described in Section 3.3.15.2.

As shown in Table 3-157, poverty rates in the affected county subdivisions tend to be higher than the associated countywide poverty percentages, except in the following county subdivisions:

- Hawthorne subdivision, where the poverty rate is lower than the Mineral County percentage
- Goldfield subdivision, where the poverty rate is lower than the Esmeralda County percentage (DIRS 176856-U.S. Census Bureau 2003)

In all cases, poverty rates in the county subdivisions are higher than the statewide figure of 11 percent.

Population centers are often assessed in relation to the county in which they are located. As shown in Table 3-157, compared to Nye County, Beatty has a lower minority population rate but a higher poverty rate. With 89 percent, Schurz has a higher minority population rate than the established 50-percent threshold and a higher poverty rate (26 percent), although it is below the established threshold of 20 percent above the state average (11 percent), which combined is a threshold of 31 percent.

To illustrate minority concentrations, Figure 3-240 shows the distribution of census block groups with minority population percentages that are more than 50 percent. It also includes federally recognized American Indian lands, because American Indians are included in the definition of minority populations. Based on Census 2000 estimates, the population living within 3 kilometers (1.8 miles) on either side of the Mina rail alignment is 5,907 (DIRS 174625-Census Bureau 2005, all). Of that population, approximately 1,100 (19 percent) are minority populations. Two block groups in Lyon County, block groups 1 and 2 of census tract 9602, comprise approximately half of the minority populations in the region of influence for environmental justice.

To illustrate low-income concentrations, Figure 3-241 shows the distribution of census block groups with low-income rates that are more than 20 percentage points above the state average of 11 percent. Based on

Census 2000 estimates, the population within 3 kilometers (1.8 miles) on either side of the centerline of the Mina rail alignment for whom poverty status is determined is 3,600. Of these, 530, or 15 percent, are living below the poverty level. This percentage is higher than the percent of the population living in poverty for the State of Nevada as a whole (11 percent) and is generally similar to the population living in poverty in the counties along the Mina rail alignment (8.6 percent to 15 percent) (see Table 3-157). There is one census county division with a poverty rate of more than 20 percent above the state average of 11, the Walker River Census County Division, with a 32-percent poverty rate.

3.3.15.3.2 American Indian Perspectives

Section 3.4 describes American Indian perspectives related to the Proposed Action, including environmental justice concerns.

Table 3-157. Minority and low-income populations in the jurisdictions potentially affected by construction and operation of the proposed rail line – Mina rail alignment.[a]

Areas	Population	Percent minority	Percent low-income
State of Nevada	2,000,000[b]	35	11
Counties			
Churchill County	24,000	18	9
Lyon County	32,500	13	10
Mineral County	5,070	30	15
Nye County	33,000	15	11
Esmeralda County	970	19	15
County subdivisions			
Silver Springs Census County Division, Lyon County, Nevada	6,700	8	13
Hawthorne Census County Division, Mineral County, Nevada	4,000	16	11
Mina Census County Division, Mineral County, Nevada	240	0.1	22
Walker River Census County Division, Mineral County, Nevada[c]	870	80	32
Amargosa Valley Census County Division, Nye County, Nevada	1,100	28	15
Beatty Census County Division, Nye County, Nevada	1,090	11	13
Tonopah Census County Division, Nye County, Nevada	2,900	18	11
Goldfield Census County Division, Esmeralda County, Nevada	450	3	12
Silverpeak Census County Division, Esmeralda County, Nevada	520	22	18
Small population centers			
Schurz (Mineral County)[c]	710	89	26
Beatty (Nye County)	1,090	11	13

a. Source: DIRS 176856-U.S. Census Bureau 2003, all.
b. The state population was rounded to 2 million for consistent analysis.
c. Encompasses the Walker River Paiute Tribe.

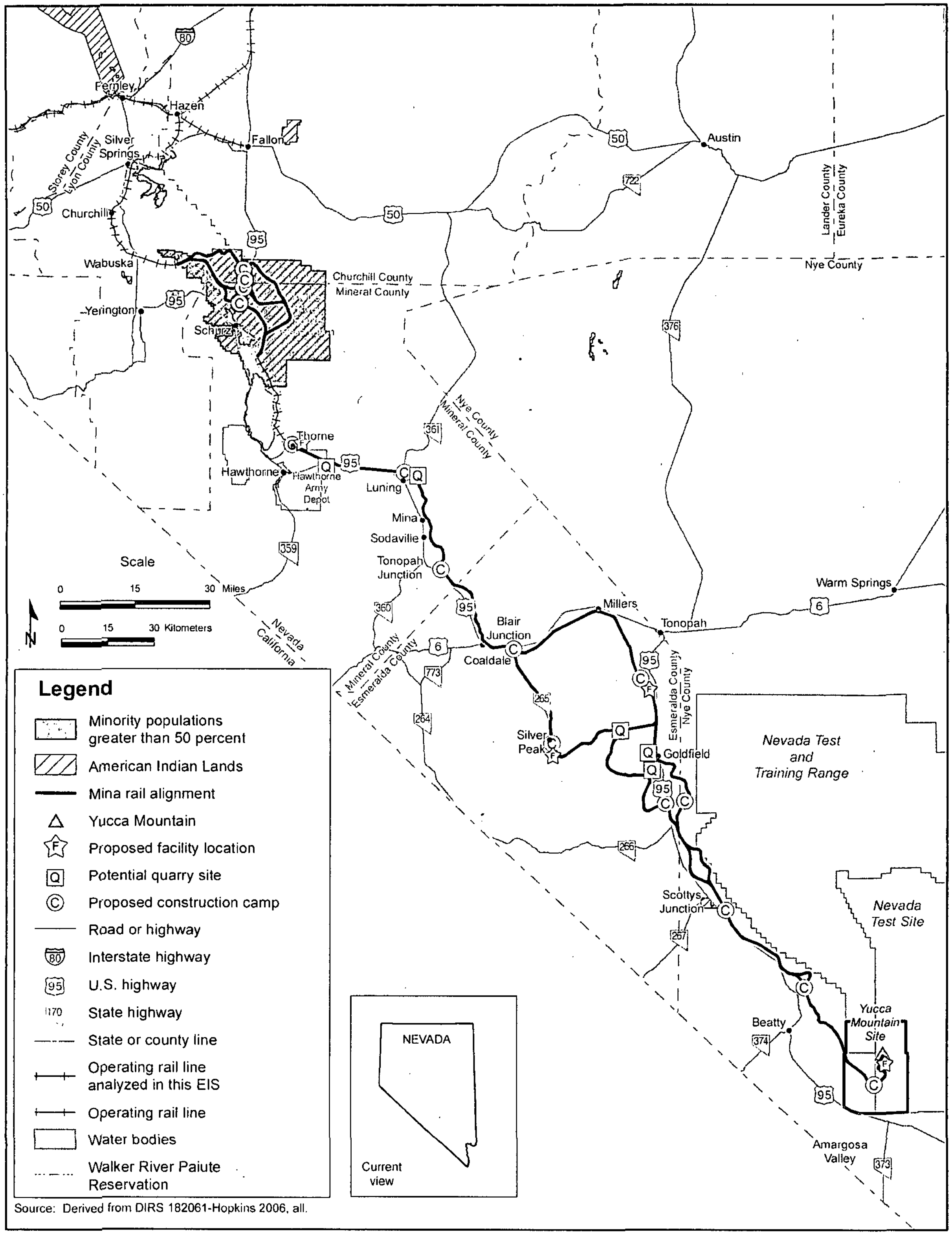


Figure 3-240. Minority populations greater than 50 percent along the Mina rail alignment.

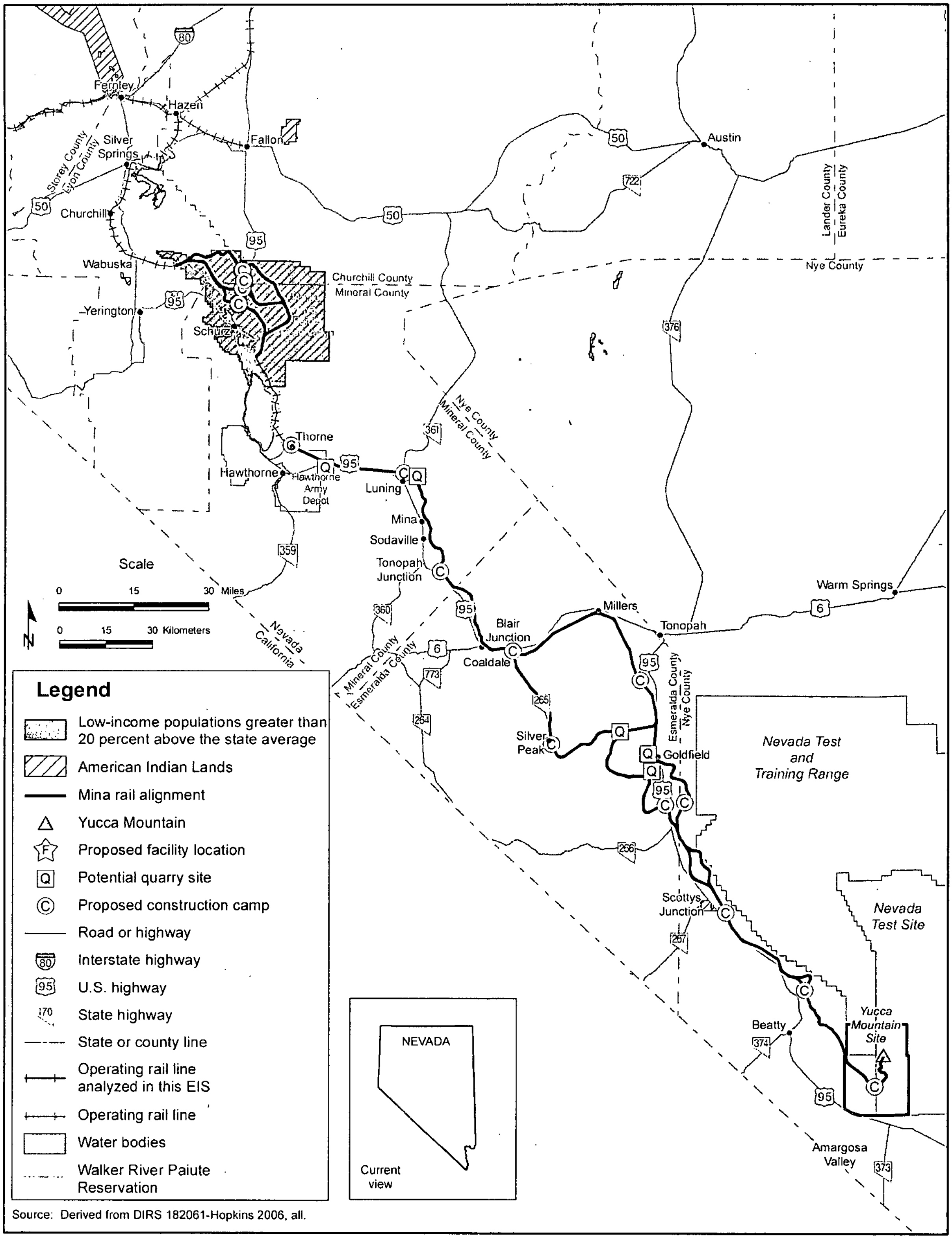


Figure 3-241. Low-income populations greater than 20 percent above the state average along the Mina rail alignment.

3.4 American Indian Interests in the Proposed Action

This section summarizes the interests and concerns expressed by various American Indian tribes and organizations within or near the Caliente and Mina rail alignment regions of influence. Sections 3.2.13 and 3.3.13, Cultural Resources, provide additional information on American Indian cultural resources.

American Indian interests regarding environmental resources are not limited to archaeological or historical sites, but include natural resources and geological formations present throughout the region. Natural resources constitute critical components of American Indian daily life and religious beliefs, while plants and animals are sources of food, raw materials, and medicines, and are components of ritual practices. Natural landforms mark locations that are significant for keeping the historic memory of American Indian people alive and for teaching children about their culture and history (DIRS 174205-Kane et al. 2005, p. 9).

In 1987, DOE initiated the Native American Interaction Program to solicit input from tribes and organizations on the characterization of the Yucca Mountain Site and the possible construction and operation of a repository for spent nuclear fuel and high-level radioactive waste. These tribes and organizations – Southern Paiute; Western Shoshone; and Owens Valley Paiute and Shoshone people from Arizona, California, Nevada, and Utah – have declared traditional ties to the Yucca Mountain area and to portions of the larger region that includes the Caliente and Mina rail alignments. As part of the scoping process for this Rail Alignment EIS, DOE held a Yucca Mountain tribal interactions meeting in June 2004 to take comments from tribal representatives about the proposed rail line along the Caliente rail alignment. In October 2004, a small group of designated tribal representatives participated in a field reconnaissance trip along the alignment, followed by a meeting of the larger consolidated group in late November 2004. Based on these efforts, the American Indian Writers Subgroup prepared a resource document, *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the American Indian Resource Document) (DIRS 174205-Kane et al. 2005, all), that provides insight into American Indian interests along the Caliente rail alignment.

At the time of these discussions, the Mina rail alignment was not under consideration as an ***implementing alternative***, and Northern Paiute peoples who traditionally occupied lands north of Goldfield and Tonopah did not participate in preparation of the American Indian Resource Document. As a consequence, the document does not present an American Indian perspective on the area from Blair Junction north to Hazen, along the Mina rail alignment. DOE obtained some information on Northern Paiute views during discussions with the Walker River Paiute Tribe, including a meeting with the Tribe in November 2006 to discuss the Mina rail alignment, but the Tribe did not complete the full environmental review process. Therefore, this section of this Rail Alignment EIS is based largely on the American Indian Resource Document prepared for the Caliente rail alignment.

The DOE Native American Interaction Program concentrates on the protection of cultural resources at Yucca Mountain and contributes to government-to-government interactions with the American Indian tribes and organizations. The program helps DOE comply with various federal laws and regulations, including the American Indian Religious Freedom Act (42 United States Code [U.S.C.] 1996 *et seq.*); the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa *et seq.*); the National Historic Preservation Act (16 U.S.C. 470 *et seq.*); the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 *et seq.*); DOE Order 1230.2, *American Indian Tribal Government Policy*; Executive Order 13007, *Indian Sacred Sites*; Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*; and the *DOE Office of Congressional Affairs, American Indian and Alaska Natives Tribal Government Policy, January 2006* (DIRS 176994-Bodman 2006, all). These laws and Executive Orders, and the DOE policy mandate the protection of archaeological sites and cultural items and require agencies to include American Indians and federally recognized tribes in discussions and interactions on major federal actions. Additional guidance is provided in DOE information brief DOE/EH-41-0019/1204, *Consultation with Native Americans.*

Of the 17 tribal groups who participate in the Native American Interaction Program, 15 are federally recognized. The Pahrump Paiute Indian Tribe, which consists of a group of Southern Paiutes living in Pahrump, Nevada, is not a federally recognized tribe. In addition, the Las Vegas Indian Center is also not a federally recognized tribe, but DOE has included it in the Native American Interaction Program because the Center represents the urban American Indian population of the City of Las Vegas and of Clark County, Nevada (DIRS 103465-Stoffle et al. 1990, p. 7).

The 17 tribes and organizations have formed the Consolidated Group of Tribes and Organizations, which is a forum consisting of tribally approved representatives who are responsible for presenting their respective tribal concerns and perspectives to DOE. The Consolidated Group of Tribes and Organizations has provided DOE with valuable insights into American Indian cultural and religious values and beliefs. These interactions have produced several reports that record the history of American Indian people and the interpretation of American Indian cultural resources in the Yucca Mountain region (DIRS 104958-DOE 1989, pp. 30 to 74; DIRS 103465-Stoffle et al. 1990, pp. 11 to 25; DIRS 104959-DOE 1990, pp. 23 to 49). DOE is committed to continued interaction and consultation with the tribes and organizations throughout the environmental review process.

3.4.1 REGION OF INFLUENCE

The region of influence for American Indian interests along the Caliente and Mina rail alignments is the area to which American Indians have historic ties.

Initial DOE studies of the region identified three tribal groups – the Southern Paiute, the Western Shoshone, and the Owens Valley Paiute and Shoshone – whose cultural heritage includes the Yucca Mountain region. Additional ethnographic efforts eventually identified 17 American Indian tribes and organizations with tribal resources in the region. Figures 3-242 and 3-243 show the traditional boundaries and locations of federally recognized tribes and their relationships to the Caliente and Mina rail alignments.

3.4.2 AMERICAN INDIAN VIEWS ON THE AFFECTED ENVIRONMENT

American Indians believe that they have inhabited their traditional homelands since the beginning of time. Archaeological surveys have found evidence that American Indians used the lands through which the Caliente rail alignment would pass on a temporary or seasonal basis (DIRS 103465-Stoffle et al. 1990, p. 29). American Indians emphasize that a lack of abundant artifacts and archaeological remains does not mean that their people did not use an area or that the land is not an integral part of their cultural ecosystem. American Indians assign meanings to places involved with their creation as a people, with religious stories, burials, and important secular events. The traditional stories of the Southern Paiute, Western Shoshone, and Owens Valley Paiute and Shoshone peoples identify such places.

The following paragraphs, excerpted from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, pp. 9 and 10), are representative of the American Indian interests in and attachment to the area that would be affected by construction and operation of the proposed railroad along the Caliente rail alignment:

> For many centuries the YMP [Yucca Mountain Project] study area and the proposed rail corridor lands have been important to the lives of American Indians. These lands contain traditional gathering, ceremonial, and recreational areas for Indian people. From antiquity to contemporary

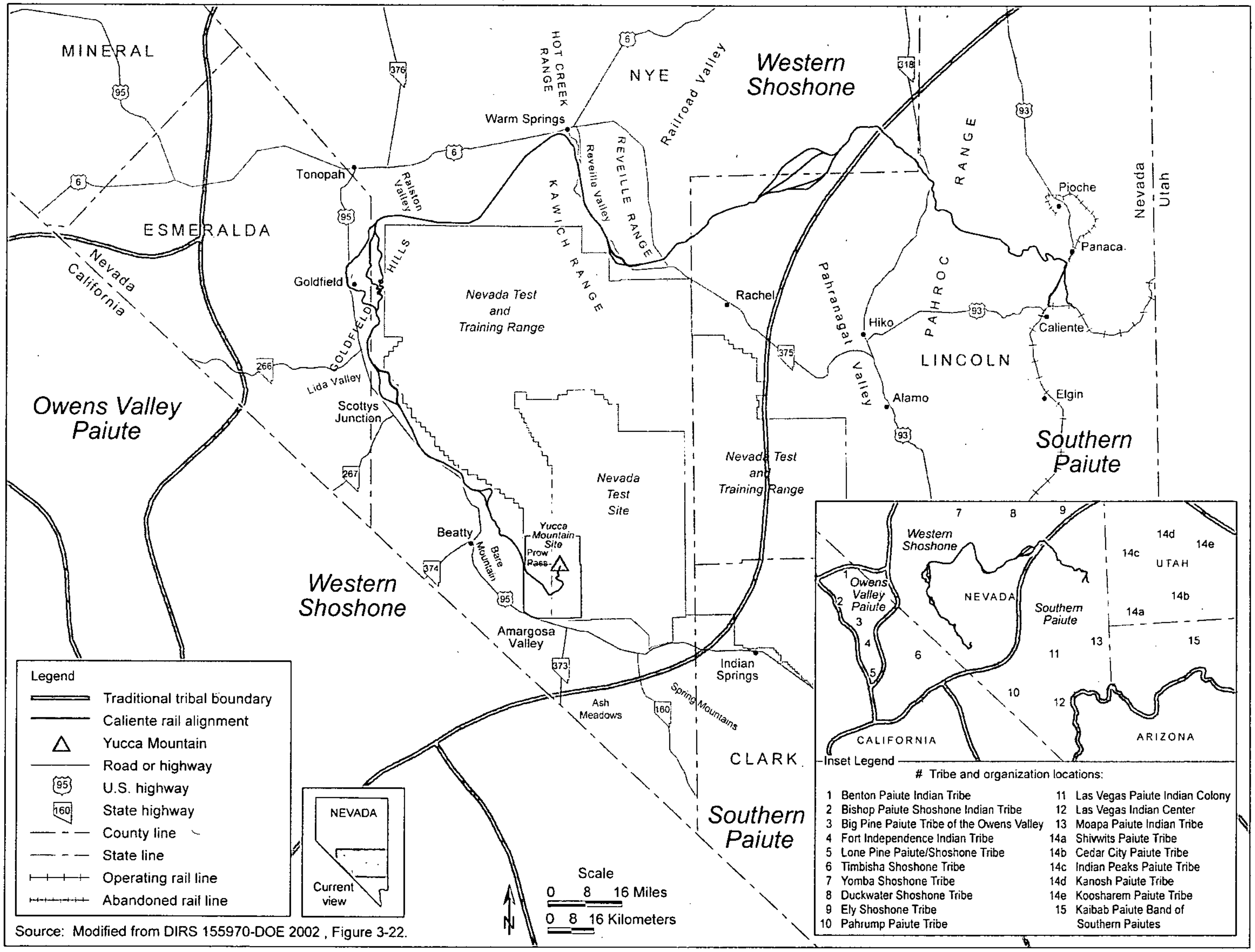


Figure 3-242. Traditional boundaries and locations of federally recognized tribes in the Caliente rail alignment region of influence.

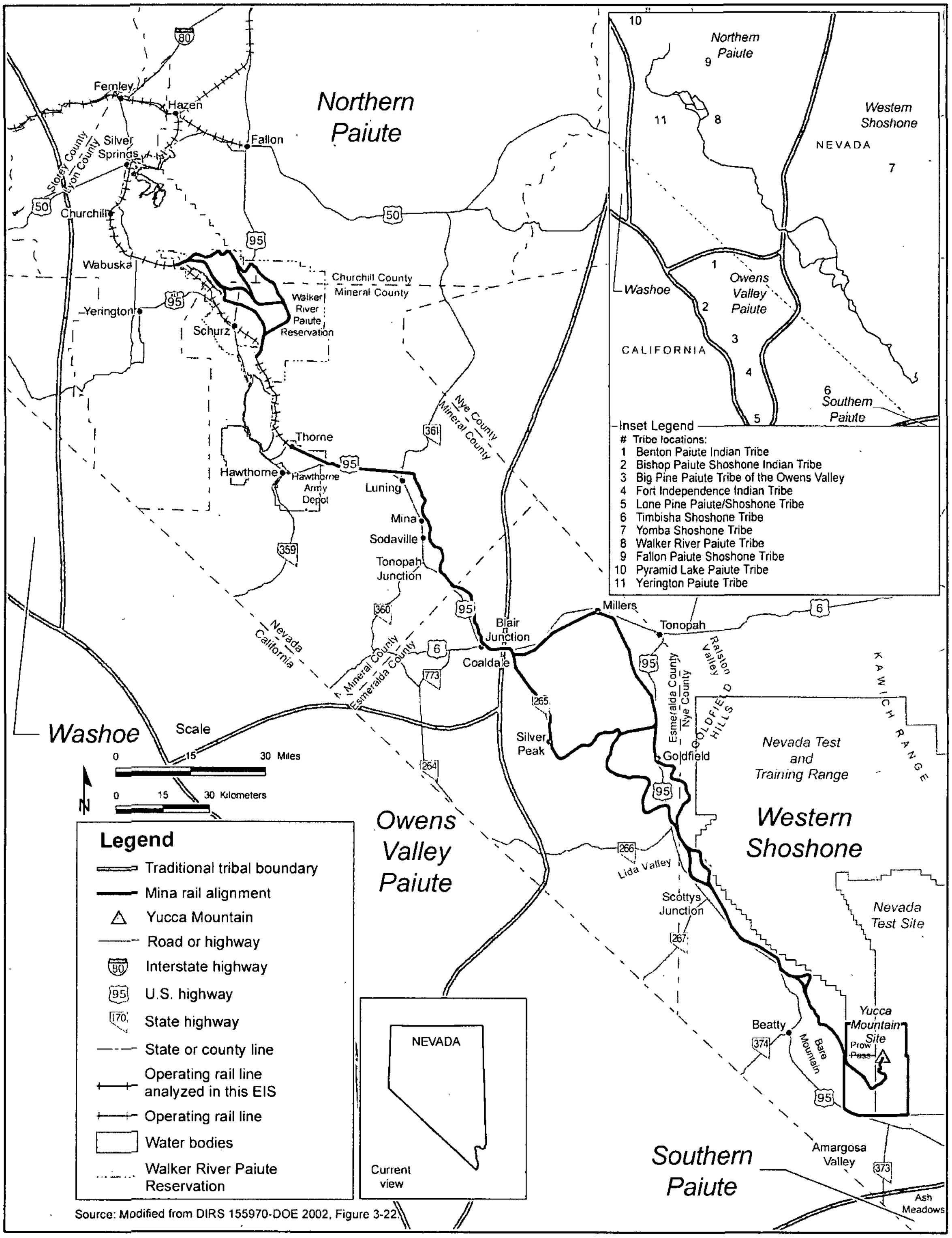


Figure 3-243. Traditional boundaries and locations of federally recognized tribes in the Mina rail alignment region of influence.

times, this area has been used continuously by many tribes. It contains numerous ceremonial resources and power places that are crucial for the continuation of American Indian culture, religion, and society. Until the mid-1900s, traditional festivals involving religious and secular activities attracted Indian people to the area from as far away as San Bernardino, California. Similarly, groups came to the area from a broad region during the hunting season and used animal and plant resources that were crucial for their survival and cultural practices. Many non-Indian people hold a different view of these lands. For example, the federal government has maintained the perception that the YMP is located in a remote area with a very low population density and other characteristics that make it ideal for the siting of a potential repository to be accessed by a newly constructed rail system. Because of this 'wasteland perception,' YMP lands were withdrawn by the federal government for the Atomic Energy Commission's nuclear testing site. The federal agency was renamed the DOE who named the land the NTS [Nevada Test Site]; a portion of the land was later designated for the YMP and the potential repository site.

Despite the loss of some traditional lands to destruction and reduced access, Indian people have neither lost their ancestral ties to, nor have forgotten the abundant cultural resources in the YMP area, or along the proposed rail corridor. Indian people have cared for the resources in these areas and will continue to do so. These strong beliefs and the presence of resources confirm the continuity in the American Indian use of and broad cultural ties to the YMP and the proposed rail alignment area.

Indian people believe that the proposed rail alignment falls within a cultural landscape and corresponding viewshed that extends many miles in all directions. Because this land is a part and not the whole, it is essential that determinations of cultural affiliation, ancestral ties, and impacts from YMP actions and programs on traditional Indian culture, religion, and society be made according to the broad regional use of lands linked around Yucca Mountain.

The extensive information compiled through long-term research involving the CGTO [Consolidated Group of Tribes and Organizations] demonstrates that American Indian cultural resources are not limited to archaeological or historical remains of native ancestors, but include all natural resources, as well as geological formations contained throughout the region. Natural resources constitute critical components of American Indian daily life and religious beliefs. Plants and animals are a source of food, raw materials, and medicine. Ritual practices cannot be properly carried out without plants and animals. Similarly, natural landforms mark locations that are significant for keeping the historic memory of American Indian people alive and for teaching children about their culture and history.

This land and its resources are well-known by American Indian people, who consider the YMP and the proposed rail corridor areas as central parts of their cultural landscape. This knowledge has allowed them to be self-sufficient and to transfer all their cultural values and practices to future generations to this day.

Based on the collective knowledge of American Indian culture and previous American Indian studies in the region, the American Indian Resource Document identifies a number of resources that are important to historical and traditional use in the region through which the proposed rail line would pass. These include several categories of resources, including biological (both plant and animal), geological, hydrological, and what non-American Indian investigators commonly refer to as archaeological and historical sites (DIRS 174205-Kane et al. 2005, p. 13).

American Indians believe that they have the responsibility to protect with care, and teach the young, the relationship of the existence of a non-destructive life on Mother Earth. This belief is the foundation of our holistic view of cultural resources, i.e., water, animals, plants, air, geology, sacred sites, TCPs [traditional cultural properties], and artifacts. Everything is considered to be interrelated and dependent on each other to sustain existence. Indian people believe that through proper respect and understanding, this complex relationship can be better understood and allow for existing and future generations to be better prepared for the care of these things.

Sections 3.4.2.1 through 3.4.2.4 briefly describe American Indian views on some of the existing resources; for more detailed information refer to the American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) and *American Indian Perspectives on the Yucca Mountain Site Characterization Project and the Repository Environmental Impact Statement* (DIRS 102043-AIWS 1998, all).

3.4.2.1 Plants and Animals

Past studies by American Indians have identified about 107 plants, 46 species of mammals, and 35 species of birds that occur in the region and have either traditional use or importance. *Native Plants of Southern Nevada: An Ethnobotany* presents a detailed discussion of plants important to American Indian inhabitants of southern Nevada.

3.4.2.2 Water Resources

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 11) observes that American Indians are concerned about all water sources along the proposed rail alignment. Surface water exists in areas along the rail alignment (see Sections 3.2.5.1 and 3.3.5.1) and is found at springs, seeps, the Amargosa River (an ephemeral stream), and in temporary collection basins ("Pohs" or "tinajas"), which are important for storing water for everyday or ceremonial use (see sections 3.2.5 and 3.3.5, Surface-Water Resources). Other locations, known as hydrological areas, contain a wide range of important cultural resources including plants, animals, archaeological sites, minerals, traditional cultural places such as "power places," sacred sites, and intellectual properties. The American Indian perspective is that water sources, including those along the proposed rail alignment, are the homes of supernatural beings who live in the area and protect the springs and water resources.

3.4.2.3 Archaeological and Historical Places

Although not considered all-inclusive, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies 24 known locations of archaeological resources that fall within or near one or more of the Caliente and Mina rail alignments alternative segments and common segments. Four of these, however, including Bare Mountain, Prow Pass, Ash Meadows, and the Spring Mountains, are well outside the Caliente and Mina rail alignments regions of influence. Section 3.2.13, Cultural Resources, describes the others.

3.4.2.4 Environmental Justice

American Indians have identified environmental justice issues in the vicinity of Yucca Mountain, and in association with development of both the Yucca Mountain Repository and the proposed railroad. In 2005, the American Indian Writers Subgroup expressed the following concerns (DIRS 174205-Kane et al. 2005, pp. 29 and 30):

> ***Holy Land Violations***
>
> American Indian people that belong to the CGTO [Consolidated Group of Tribes and Organizations] consider that much of the land along the proposed rail corridor to be as central in their lives today as these lands have been since the creation of these people. The proposed impact area(s) are a part of the traditional holy lands of Western Shoshone, Southern Paiute and Owens Valley Paiute and Shoshone peoples. These holy lands and their resources have been subjected to exorbitant amounts of damage by long-term nuclear testing activities involving the NTS [Nevada Test Site] and site characterization activities associated with the YMP [Yucca Mountain Project]. The CGTO believes that the past, present, and future pollution of these holy lands constitutes both

Environmental Justice and equity violations. No other people have had their holy lands impacted by YMP-related activities.

Cultural Survival-Access Violations

One of the most detrimental consequences of YMP operations on the survival of American Indian culture, religion, and society has been the denial of free access to their traditional lands and resources. Loss of access to traditional foodstuffs and medicine has greatly contributed to undermining the cultural well being of Indian people. These Indian people have experienced, and will continue to experience, breakdowns in the process of cultural transmission due to lack of access to YMP lands and resources. The construction and use of the proposed rail corridor will add to such impacts to the land and the perpetuation of Indian culture. No other people have experienced or been subjected to similar cultural survival impacts attributed to access limitations within the YMP area.

3.4.3 AMERICAN INDIAN TREATY ISSUE

Of special concern to the Western Shoshone people is the Ruby Valley Treaty of 1863. The Western Shoshone people maintain that the treaty gives them rights to 97,000 square kilometers (24 million acres) in Nevada, including the Yucca Mountain region (DIRS 102216-*Western Shoshone National Council v. United States of America*, 1998, all). The legal dispute over the land began in 1946 when the Indian Claims Commission Act (60 Stat. 1049) gave tribes the right to sue the Federal Government for treaty promises that are not kept. If a tribe were to win a claim against the government, the Indian Claims Commission Act specifies that the tribe could receive only a monetary award and not land or other remunerations.

The Western Shoshone people filed a claim in the early 1950s alleging that the government had taken their land. The Indian Claims Commission found that Western Shoshone title to the Nevada lands had gradually been extinguished and set a monetary award as payment for the land. In 1976, the Commission entered its final award to the Western Shoshone people, who dispute the findings of the Commission and have not accepted the monetary award for the lands in question (the U.S. Treasury has been holding these monies in an interest-bearing account). The Western Shoshone people maintain that a settlement has not been reached. In 1985, the U.S. Supreme Court ruled that even though the money has not been distributed, the United States has met its obligations with the Commission's final award and, as a consequence, the aboriginal title to the land had been extinguished (DIRS 148197-*United States v. Dann et al.*, 1985, all).

On February 6, 2003, the Western Shoshone National Council sent a letter to members of the U.S. House of Representatives Resources Committee and the Senate Indian Affairs Committee, expressing opposition to any attempt to re-introduce legislation aimed at forcing a distribution of monies from Docket 326-K of the Indian Claims Commission to the Western Shoshone. The Council letter enclosed a report, *Failure of the United States Indian Claims Commission to File a Report with Congress in the Western Shoshone Case* (Docket 326-K), prepared by the Indigenous Law Institute on behalf of the Council, which asserted that the U.S. Indian Claims Commission never completed its action in Docket 326-K. The Council therefore asserted that there is no legal basis for a distribution bill and reiterated its position that negotiations between the Western Shoshone and the United States are the preferred way to resolve this ongoing conflict. On February 25, 2003, Representative Jim Gibbons (Nevada) introduced H.R. 884, a bill "to provide for the use and distribution of the funds awarded to the Western Shoshone identifiable group under Indian Claims Commission Docket Numbers 326-A-1, 326-A-3, and 326-K, and for other purposes." The bill became Public Law 108-270 in July 2004.

On March 4, 2005, the Western Shoshone National Council filed a lawsuit against the United States, DOE, and the U.S. Department of the Interior in federal district court in Las Vegas, Nevada. The complaint sought an injunction to stop federal plans for the use of Yucca Mountain as a repository based on the five established uses of the land within the boundaries of the 1863 Ruby Valley Treaty. On May 17, 2005, the U.S. District Court rejected a request from the Western Shoshone National Council for a preliminary injunction to stop DOE from applying for a license for the Yucca Mountain Project.

In 2006, a contingent of Western Shoshones sued Union Pacific Railroad, BNSF Railroad Company, Newmont Gold Company, Barrick Goldstrike Mines Inc., Glamis Gold Inc., Nevada Land Resource Company, Sierra Pacific Power Company, and Idaho Power Company in federal court in Reno, Nevada. The lawsuit claims that the companies violated the Ruby Valley Treaty by possessing land transferred from the U.S. Government.

Although this American Indian treaty issue involves land along the Caliente and Mina rail alignments, none of the alternative segments or common segments would encroach on federally recognized American Indian lands.

3.4.4 AMERICAN INDIAN VIEWS ON CONSTRUCTING AND OPERATING THE PROPOSED RAILROAD

Previous studies (DIRS 102043-AIWS 1998, all; DIRS 174205-Kane et al. 2005, all; DIRS 103465-Stoffle et al. 1990, all) have delineated American Indian sites, areas, resources, and other interests within or adjacent to the Caliente rail alignment region of influence (DIRS 102043-AIWS 1998, Chapter 2; DIRS 174205-Kane et al. 2005, Chapter 2). Comparable studies have not been completed for the Mina rail alignment region of influence, but similar views can be anticipated. The Consolidated Group of Tribes and Organizations has consistently opposed the siting and operation of a repository at Yucca Mountain and transportation of spent nuclear fuel and high-level radioactive waste to such a repository. *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the Native American Resource Document) (DIRS 174205-Kane et al. 2005, pp. 33 and 34) summarizes the views and concerns of the Consolidated Group of Tribes and Organizations. The "*CGTO has continually stated its opposition to the siting and transportation of spent nuclear fuel and high-level waste to a repository at Yucca Mountain*" and strongly believes that "*any disturbance to cultural, biological, botanical, geological, and hydrological resources, including viewscapes, songscapes, storyscapes, and traditional cultural properties will cause adverse impacts*" (DIRS 174205-Kane et al. 2005, p. 33). Some of the American Indian views expressed in the American Indian Resource Document regarding potential impacts under the Proposed Action include the following (DIRS 174205-Kane et al. 2005, p. 9):

> Despite the loss of some traditional lands to destruction and reduced access, Indian people have neither lost their ancestral ties to, nor have forgotten the abundant cultural resources in the YMP [Yucca Mountain Project] area, or along the proposed rail corridor. Indian people have cared for the resources in these areas and will continue to do so. These strong beliefs and the presence of resources confirm the continuity in the American Indian use of and broad cultural ties to the YMP and the proposed rail alignment area.
>
> Indian people believe that the proposed rail alignment falls within a cultural landscape and corresponding viewshed that extends many miles in all directions. Because this land is a part and not the whole, it is essential that determinations of cultural affiliation, ancestral ties, and impacts from YMP actions and programs on traditional Indian culture, religion, and society be made according to the broad regional use of lands linked around Yucca Mountain.

The Consolidated Group of Tribes and Organizations has stated that no systematic evaluations of traditional sacred sites or places along the Caliente rail alignment have been made by American Indian people that allowed for an opportunity for all members of the American Indian Writers Subgroup to fully evaluate the proposed rail alignment. Without proper studies and consultation, no specific statements about impacts to particular locations can be provided by the tribal representatives. Furthermore, establishment of the Yucca Mountain protected area boundaries and construction of the proposed repository and rail line would continue to restrict the free access of American Indians to these areas (DIRS 174205-Kane et al. 2005, p. 30).

There would be a potential for indirect impacts to American Indian interests from construction activities and the presence of additional workers, particularly impacts to the physical evidence of past use of the cultural landscape (artifacts, cultural features, archaeological sites, etc.) important to American Indian people.

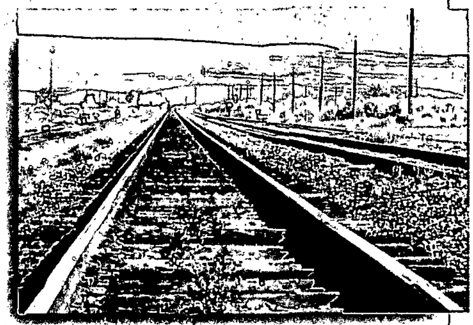
Shared-Use Options would involve ground-disturbing activities for the construction of commercial access sidings for access to the rail line. In all likelihood, any shared-use projects would result in potential impacts to American Indian interests similar to those under the Proposed Action without shared-use. American Indians would also view the operation of a shared-use rail line as having adverse effects on American Indian interests and tribal resources.

3.4.5 SUMMARY

Perceptions about the types and magnitudes of potential impacts along the Caliente and Mina rail alignments vary among the various stakeholders with interests in the proposed railroad because of different beliefs, goals, responsibilities, and values. American Indians are concerned that the proposed railroad could cause substantial and high adverse impacts to a number of American Indian interests within and adjacent to the Caliente and Mina rail alignment regions of influence.

The Proposed Action includes best management practices that would avoid, minimize, or otherwise reduce impacts to American Indian interests to the greatest extent practicable. DOE would also consider mitigation measures for any remaining impacts to American Indian interests. Relevant best management practices and potential measures to mitigate impacts, if they occur, include:

- Continue to solicit input from American Indians to identify the potential to impact American Indian cultural resources, discuss potential solutions, and avoid adverse impacts.
- Comply with all regulatory requirements that protect American Indian interests (Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*).
- Consult with American Indian tribes and protect their access to public lands that contain American Indian cultural resources (American Indian Religious Freedom Act of 1978; Executive Order 13007, *Indian Sacred Sites*).



Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor

DOE/EIS-0250F-S2D

and

Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada

DOE/EIS-0369D

Volume III

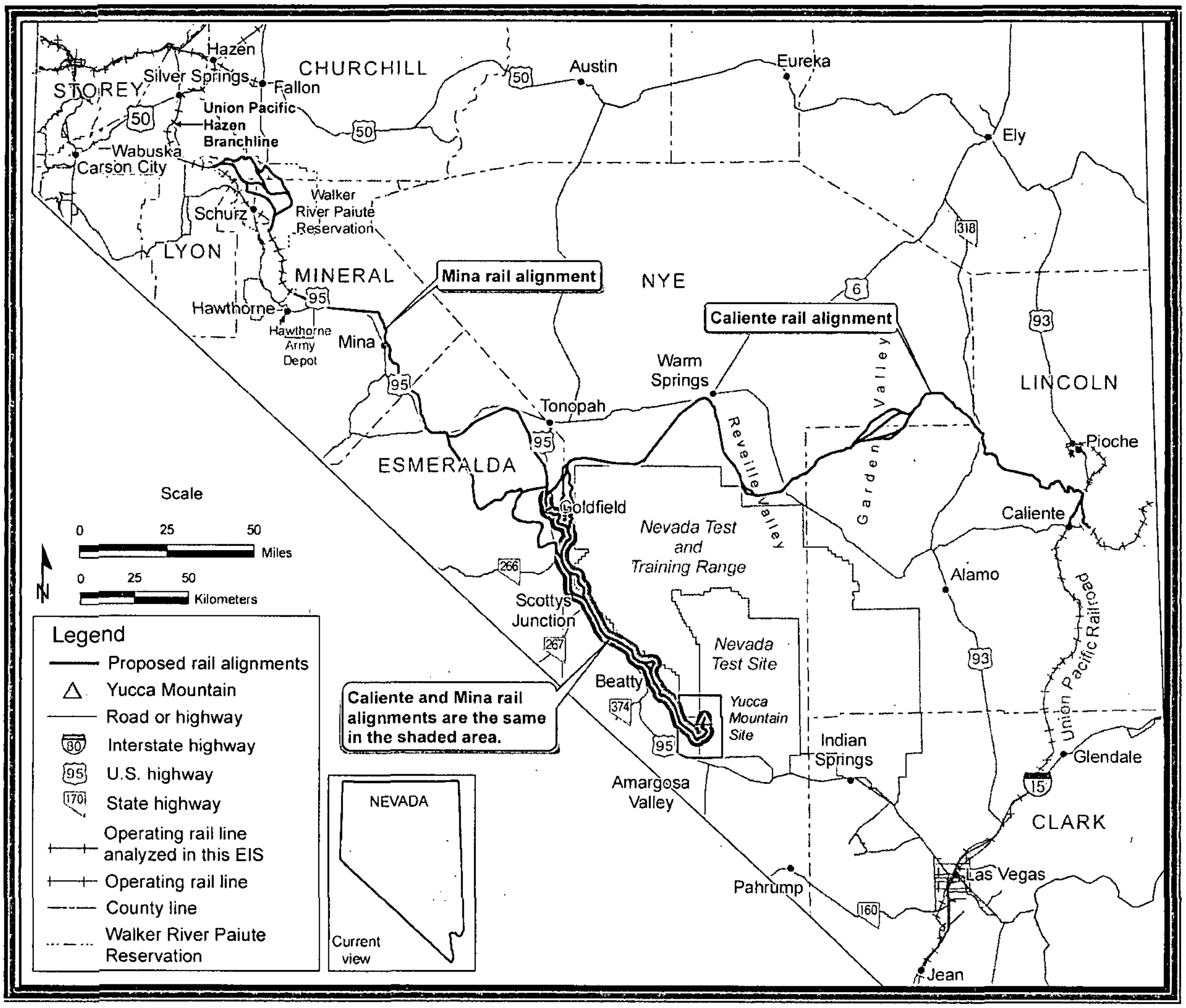
U.S. Department of Energy
Office of Civilian Radioactive Waste Management

October 2007

4. ENVIRONMENTAL IMPACTS

This chapter describes the potential environmental impacts of constructing and operating a railroad along the Caliente rail alignment or the Mina rail alignment. An impact would be any change, positive or negative, from the existing (baseline) conditions described in Chapter 3 for each environmental resource area. The No-Action Alternative represents a continuation of baseline conditions.

Glossary terms are shown in ***bold italics***.



4.1 Introduction

This chapter begins with a description of ***impacts*** associated with the ***No-Action Alternative*** (Section 4.1.1). As described in Section 2.3, under the No-Action Alternative, the U.S. Department of Energy (DOE or the Department) would not select a ***rail alignment*** or build a ***railroad*** within the Caliente ***rail corridor*** or the Mina rail corridor and would relinquish public lands withdrawn or segregated from surface and mineral entry. The description of impacts associated with the No-Action Alternative applies to both rail corridors and all ***rail line alternative segments*** and ***common segments***. Section 4.1.2 introduces descriptions of impacts associated with the ***Proposed Action.***

Sections 4.2 and 4.3 describe potential impacts associated with construction and operation of the proposed railroad along the Caliente rail alignment and the Mina rail alignment under the Proposed Action, including a ***Shared-Use Option***.

Proposed Action: To determine a rail alignment within a rail corridor in which to construct and operate a railroad to transport spent nuclear fuel, high-level radioactive waste, and other materials from an existing railroad in Nevada to a repository at Yucca Mountain, Nye County, Nevada. The Proposed Action includes the construction of railroad construction and operations support facilities.

This Rail Alignment EIS analyzes two alternatives that would implement the Proposed Action: the Caliente rail alignment and the Mina rail alignment.

This Rail Alignment EIS also analyzes a Shared-Use Option for each implementing alternative, under which DOE would allow commercial shippers to use the rail line for transportation of general freight.

No-Action Alternative: DOE would not implement the Proposed Action within the Caliente rail corridor or the Mina rail corridor.

4.1.1 IMPACTS ASSOCIATED WITH THE NO-ACTION ALTERNATIVE

The No-Action Alternative establishes a baseline for comparison with the Proposed Action to determine potential impacts of constructing and operating the proposed railroad.

Under the No-Action Alternative, DOE would not implement the Proposed Action within the Caliente rail corridor or the Mina rail corridor and would relinquish public lands withdrawn from surface and mineral entry (see Section 1.5.1). Under the No-Action Alternative, there would be no impacts to natural, human-health, social, economic, or cultural resources from construction and operation of a railroad in Nevada for shipments of ***spent nuclear fuel***, ***high-level radioactive waste***, and ***other materials*** from an existing railroad to a ***geologic repository*** at Yucca Mountain.

Under the No-Action Alternative, DOE would not cause changes in current public land uses such as grazing and recreation; uses of public land would remain subject to Bureau of Land Management (BLM) administration under applicable resource management plans. The BLM would continue to manage resources, such as biological and cultural resources and scenic values. Under the No-Action Alternative, DOE would not cause changes to existing conditions on the Walker River Paiute Reservation or at the Hawthorne Army Depot.

The location and extent of new mining claims and the associated development of mineral commodities, although not known with any certainty, would no longer be limited by the Public Land Orders described in Section 1.5.1.

4.1.2 IMPACTS ASSOCIATED WITH THE PROPOSED ACTION

Chapter 3 describes the ***affected environment*** for 16 environmental resource areas that could be affected if DOE were to construct and operate the proposed railroad along the Caliente rail alignment or the Mina rail alignment under the Proposed Action.

The description of potential environmental impacts focuses on environmental resources within and adjacent to the Caliente rail alignment (Section 4.2) and the Mina rail alignment (Section 4.3), and the locations of railroad ***construction and operations support facilities*** outside the ***nominal*** width of the rail line ***construction right-of-way***.

This chapter describes potential impacts by environmental resource area and identifies potential impacts as either ***direct*** or ***indirect***, and either ***short-term*** or ***long-term***.

The chapter is organized as follows:

- Physical setting (Sections 4.2.1 and 4.3.1)
- Land use and ownership (Sections 4.2.2 and 4.3.2)
- Aesthetic resources (Sections 4.2.3 and 4.3.3)
- Air quality and climate (Sections 4.2.4 and 4.3.4)
- Surface-water resources (Sections 4.2.5 and 4.3.5)
- Groundwater resources (Sections 4.2.6 and 4.3.6)
- Biological resources (Sections 4.2.7 and 4.3.7)
- Noise and vibration (Sections 4.2.8 and 4.3.8)
- Socioeconomics (Sections 4.2.9 and 4.3.9)
- Occupational and public health and safety (Sections 4.2.10 and 4.3.10)
- Utilities, energy, and materials (Sections 4.2.11 and 4.3.11)
- Hazardous materials and waste (Sections 4.2.12 and 4.3.12)
- Cultural resources (Sections 4.2.13 and 4.3.13)
- Paleontological resources (Sections 4.2.14 and 4.3.14)
- Environmental justice (Sections 4.2.15 and 4.3.15)

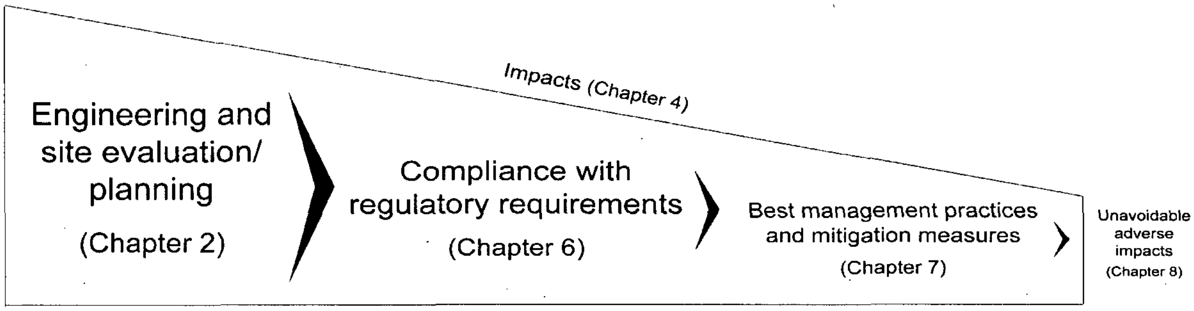
Direct impact: An effect that results solely from the construction or operation of a proposed action without intermediate steps or processes. Examples include habitat destruction, soil disturbance, air emissions, and water use.

Indirect impact: An effect that is related to but removed from a proposed action by an intermediate step or process. Examples include surface-water quality changes resulting from soil erosion at construction sites, and reductions in productivity resulting from changes in soil temperature.

Short-term impacts: In this Rail Alignment EIS, impacts limited to the construction phase (4 to 10 years).

Long-term impacts: In this Rail Alignment EIS, impacts that could occur throughout and beyond the life of the railroad operations phase (up to 50 years).

During the engineering and site evaluation and planning phase for the proposed railroad, DOE considered many factors to avoid or minimize potential environmental impacts (see Chapter 2), and would continue to consider these factors during the final design phase. As part of the Proposed Action, DOE would meet all applicable regulatory requirements during construction and operation of the proposed railroad (see Chapter 6), and would implement best management practices to ensure compliance with requirements (see Chapter 7). DOE could also implement measures to mitigate (see Chapter 7) any impacts remaining after final design and compliance with regulatory requirements and implementation of best management practices. The impacts analyses in this chapter considered the foregoing to arrive at predictions of potential impacts, as illustrated in the following graphic. Each phase shown in the graphic reduces impacts. Ultimately, there could be unavoidable impacts (see Chapter 8).



Where possible, DOE has quantified potential impacts. For example, for the air quality analysis DOE used emissions inventories to determine existing air quality at the county level, and performed air quality simulations to determine potential changes in air-pollutant concentrations at specific receptor locations. Thus, the Department is able to provide a numerical assessment of potential impacts.

In other cases (such as the analysis of impacts to aesthetic resources), it is not possible to quantify impacts and DOE provides a ***qualitative*** assessment of potential impacts. The Department has used the following descriptors to qualitatively characterize impacts where quantification of impacts was not practical:

- **Small** - For the issue, environmental effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.
- **Moderate** - For the issue, environmental effects would be sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- **Large** - For the issue, environmental effects would be clearly noticeable and would be sufficient to destabilize important attributes of the resource.

Unless otherwise noted, potential impacts described in this and other chapters would be adverse.

Each environmental resource section in this chapter describes the methodology DOE used to assess potential impacts for that resource. Each section provides a ***quantitative*** or qualitative description of potential impacts, and, where appropriate, tables summarize and compare the identified impacts for alternative segments, common segments, and construction and operations support facilities for each rail alignment.

4.1.3 PERCEIVED RISK AND STIGMA

Perceived risk and stigma: DOE uses the term risk perception to mean how an individual perceives the amount of risk from a certain activity. Studies show that perceived risk varies with certain factors, such as whether the exposure to the activity is voluntary, the individual's degree of control over the activity, the severity of the exposure, and the timing of the consequences of the exposure. DOE uses stigma to mean an undesirable attribute that blemishes or taints an area or locale.

In the *Final Environmental Impact Statement for* a *Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Yucca Mountain FEIS; DIRS 155970-DOE 2002, Section 2.5.4), DOE evaluated ***perceived risk and stigma*** associated with construction and operation of a repository at Yucca Mountain and from the transportation of spent nuclear fuel and high-level radioactive waste. As stated in the Yucca Mountain FEIS, DOE recognizes that nuclear facilities can be perceived to be either positive or negative, depending on the underlying value systems of the individual forming the perception. Thus, perception-based impacts would not necessarily depend on the actual physical impacts or risk of repository operations, including transportation. A further complication is that people do not consistently act in accordance with negative perceptions; thus, the connection between public perception of risk and future behavior would be uncertain or speculative at best.

DOE concluded that, although public perception regarding the proposed geologic repository and transportation of spent nuclear fuel and high-level radioactive waste could be measured; there is no valid method to translate these perceptions into quantifiable economic impacts. Researchers in the social sciences have not found a way to reliably forecast linkages between perceptions or attitudes reported in surveys and actual future behavior. At best, only a qualitative assessment is possible about what broad outcomes seem most likely. The Yucca Mountain FEIS did identify some studies that report, at least temporarily, a small relative decline in residential property values might result from the designation of transportation corridors in urban areas.

The Yucca Mountain FEIS presents the following conclusions regarding perceived risk and stigma:

- While in some instances risk perceptions could result in adverse impacts on portions of a local economy, there are no reliable methods whereby such impacts could be quantified with any degree of certainty.
- Much of the uncertainty is irreducible.
- Based on a qualitative analysis, adverse impacts from perceptions of risk would be unlikely or relatively small.

The more detailed discussion of perceived risk and stigma related to the Yucca Mountain FEIS Proposed Action is incorporated into this Rail Alignment EIS by reference (DIRS 155970-DOE 2002, pp. 2-95 and 2-96).

An independent economic impact study (DIRS 172307-Riddel, Boyett, and Schwer 2003, all) conducted since DOE completed the Yucca Mountain FEIS examined, among other things, the social costs of perceived risk to Nevada households living near transportation routes. The study developed such an estimate in terms of households having a willingness to accept compensation for different levels of perceived risk and a willingness to pay to avoid risk. The results of the study indicated that during the first year of transport, net job losses (and associated drop in residential real estate demand and decreases in gross state product) in relation to the baseline would occur in response to people moving to protect themselves from transport risk. However, the initial impact would be offset rapidly, as the population shifted to a more risk-tolerant base. The results of this study are similar to the studies identified in the Yucca Mountain FEIS.

Other conclusions of this study are that the public and DOE have widely divergent risk beliefs and that the public is very uncertain about the risks they face. At the same time, more than 40 percent of the respondents in a public survey conducted as part of this study felt that DOE information is reliable or very reliable, while another 40 percent felt that DOE information is somewhat reliable. These results suggest social costs could be mitigated by reducing the risk people perceive from transport through information and education programs that are well researched and effectively presented.

While stigmatization of southern Nevada can be envisioned under some scenarios, it is not inevitable or numerically predictable. Any such stigmatization would likely be an aftereffect of unpredictable future events, such as serious accidents, which might not occur. Therefore, DOE did not attempt to quantify any potential for impacts from risk perceptions or stigma in this Rail Alignment EIS.

4.2 Caliente Rail Alignment

4.2.1 PHYSICAL SETTING

This section describes potential impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.1.1 describes the methodology DOE used to assess potential impacts to physical setting; Section 4.2.1.2 describes potential impacts of constructing the railroad; Section 4.2.1.3 describes potential impacts of operating the railroad; Section 4.2.1.4 describes potential impacts under the Shared-Use Option; and Section 4.2.1.5 summarizes potential impacts to physical setting.

As described in Section 3.2.1, physical setting includes physiography, geology, and soils. Section 3.2.1.1 describes the ***region of influence*** for physical setting along the Caliente rail alignment.

4.2.1.1 Impact Assessment Methodology

To assess potential impacts to physical setting along the Caliente rail alignment, DOE considered whether railroad construction and operations would:

- Result in soil erosion or loss of topsoil
- Result in the direct conversion of ***prime farmland*** to nonagricultural uses
- Result in the loss of availability of a known mineral resource that would be of value to the region or residents of Nevada
- Generate unstable slope conditions that could result in an on-site or off-site landslide, or collapse
- Expose construction workers, DOE personnel, and structures to amplified or unique adverse effects from ***seismic*** activity

If possible, DOE quantified impacts using data from Nevada soils surveys, geological maps, ***earthquake fault*** maps and records, and the total area of disturbance that would result from constructing and operating the proposed railroad.

The total area of disturbance would be the sum of disturbed areas within the nominal width of the ***rail line*** construction right-of-way and areas outside the nominal width of the construction right-of-way (railroad operations support facilities, quarry sites, some water-well sites, and access roads). The nominal width of the construction right-of-way would encompass the rail line, alignment access roads, some wells, ***construction camps***, and ***cuts*** and ***fills*** required to attain an appropriate ***grade***. While the nominal width of the construction right-of-way would be 300 meters (1,000 feet) across BLM lands, the width could vary in certain locations along the rail alignment. For example, it could be wider to accommodate additional earthwork, or narrower to avoid a sensitive environmental resource. Section 4.2.1.2.3 describes potential impacts from constructing the railroad operations support facilities; the number and size of those facilities would not vary among alternative segments.

Some potential impacts to physical setting along the Caliente alignment are more specifically addressed under other ***environmental resource areas***. Section 4.2.2, Land Use and Ownership, describes potential impacts to ***mining districts*** and mineral and energy resources; Section 4.2.4, Air Quality and Climate, describes soil loss from ***fugitive dust*** emissions; Section 4.2.5, Surface-Water Resources, describes potential erosion due to surface-water flow; and Section 4.2.10, Occupational and Public Health and Safety, describes impacts to worker safety from geologic hazards.

4.2.1.2 Construction Impacts

Direct impacts to physical setting along the Caliente rail alignment would occur primarily during the construction phase. Section 4.2.1.2.1 describes potential construction impacts common to the entire rail alignment. Section 4.2.1.2.2 describes impacts specific to alternative segments and common segments. Tables in Section 4.4.1.2.2 list the key information DOE used to analyze potential impacts to physical setting for the common and alternative segments.

4.2.1.2.1 Construction Impacts Common to the Entire Caliente Rail Alignment

4.2.1.2.1.1 Physiography. To the extent practicable, the Caliente alignment would avoid uneven topography and rugged terrain by following valleys and skirting mountain ranges, as described in Section 3.2.1.2.1 and illustrated in Figure 3-1. Where it is necessary to cross mountain ranges, the rail line would be located in gaps and passes. The rugged natural terrain surrounding the mountain ranges would, however, contribute to the potential for impacts to topography and soils. The ruggedness of an area is represented by the "rise and fall" calculation, which is the absolute elevation change measured at a fixed distance along the alignment. The rise and fall calculation provides a context for determining the amount of disturbance that would be required to establish the appropriate grades.

Depending on the combination of alternative segments and common segments along the Caliente rail alignment, the total area that would be disturbed during the construction phase would range from approximately 55 to 61 square kilometers (14,000 to 15,000 acres) (DIRS 176170-Nevada Rail Partners 2006, p. B-3). Construction impacts to physical setting would be centered along the rail alignment and would decrease with distance from the alignment.

Cuts and fills would be required to level steep slopes and provide a suitable grade for the rail ***roadbed***. The estimated volume of cuts along the Caliente rail alignment is 22.7 to 26.3 million cubic meters (29.7 to 34.4 million cubic yards), and the estimated volume of fill is 16.5 to 20.8 million cubic meters (21.6 to 27.2 million cubic yards) (DIRS 176165-Nevada Rail Partners 2006, Appendix E). Cut and fill activities would occur within the construction right-of-way. DOE would use the material excavated from the cuts to supply the required fill. Any excess cut material not used as fill would be used to smooth topography disturbed by construction and in reclamation efforts. Most of the earthwork would be along Caliente common segment 1 (see Section 4.2.1.2.2.2) and the selected Goldfield alternative segment (see Section 4.2.1.2.2.7). There would also be major cut, fill, and other earthwork processes around Bennett Pass, the Goldfield Hills, Beatty, and Yucca Mountain.

DOE would build up to 12 construction camps along the rail alignment. Each camp would include housing, support facilities, office space, utilities, contractor work areas, roadways, and parking, and would disturb approximately 0.10 square kilometer (25 acres) inside the nominal width of the construction right-of-way (DIRS 176172-Nevada Rail Partners 2006, p. 4-1).

There are six potential quarry sites along the Caliente rail alignment, and DOE would develop up to four of these sites. Each site would be expected to disturb an area from 1.3 to 3.8 square kilometers (320 to 930 acres) outside the nominal width of the construction right-of-way (DIRS 176172-Nevada Rail Partners 2006, pp. 3-1 and 3-2).

Construction of the ***Interchange Yard*** along the Caliente alternative segment could disturb 0.061 square kilometer (15 acres); the Interchange Yard along the Eccles alternative segment would disturb 0.12 square kilometer (30 acres). Construction of the ***Staging Yard*** would disturb 0.2 square kilometer (50 acres). Construction of the Maintenance-of-Way Trackside Facility would disturb 0.061 square kilometer and the

Rail Equipment Maintenance Yard would disturb the largest area (0.41 square kilometer [100 acres]) (DIRS 176170-Nevada Rail Partners 2006, p. A-5).

Construction activities that would disturb topsoil include, but are not limited to, cut excavation; quarry-pit excavation and borrow-pit stockpiles; placement of compacted fill, ***ballast***, and ***subballast***; road development and grading; and building facility foundations. During the construction phase, the soil column would be disturbed and topsoil would be removed. The areas with disturbed soils would have an increased potential for erosion by wind and water. DOE would implement best management practices (see Chapter 7) to control erosion, minimize soil loss, and conserve topsoil for grading after construction was completed. After construction was completed, disturbed areas away from the rail line would be leveled to a grade that would blend with the terrain, covered with reserved topsoil, and to the extent practicable, revegetated.

4.2.1.2.1.2 Geology.

Faulting and Seismic Activity Seismic-related hazards in the project area include ground shaking, rock falls and landslides, soil liquefaction, and fault displacement. The potential for humans or structures to be exposed to seismic hazards is generally uniform across the entire rail alignment and consistent with the rest of southern Nevada, as shown on Figure 3-4. Construction activities would not induce earthquakes or reactivate any faults. The general east-west configuration of the Caliente rail alignment would minimize the contact between the rail alignment and the linear range-bounding faults, which have the greatest potential for reactivation. At a minimum, DOE would design and operate the proposed railroad to be consistent with American Railway Engineering and Maintenance-of-Way Association seismic guidelines (DIRS 162040-AREMA 2001, Chapter 9) and could decide to implement additional, more stringent standards.

During the construction and operations phases, DOE would monitor earthquake activity using U.S. Department of the Interior, Geological Survey, and Yucca Mountain seismic networks. The response level of the maintenance-of-way authority would depend on the earthquake magnitude and distance to the rail line (see Table 4-1). DOE would develop an inspection protocol that would outline the procedures that would be used to inspect the track, rail roadbed, bridges, and other structures along the rail line. If required after a seismic event, construction would halt, trains would run at reduced speeds, and qualified inspectors would verify the safety of the track.

The rail line and transportation casks would be constructed to be consistent with the American Railway Engineering and Maintenance-of-Way Association seismic guidelines. The inspection protocol and acceptance of the seismic guidelines would ensure that the risks associated with operating in a seismically active area would be minimized. Section 4.2.10, Occupational and Public Health and Safety, describes potential impacts to transportation safety and worker and public health and safety from seismic hazards.

Rock-Slope Hazards Several sections of the Caliente rail alignment would pass through steep and rugged terrain where unstable rock slopes would be a hazard (DIRS 176184-Shannon & Wilson 2006, pp. 41 to 43). Rock-slope failures typically occur where rock discontinuities (such as joints, bedding, foliation, and faults) are adversely oriented in relation to natural or constructed slope faces. Slope stability could be further reduced by natural weathering processes, which contribute to the mechanical breakdown of the rock mass within the rock ***matrix*** and along the discontinuities (DIRS 176184-Shannon & Wilson 2006, p. 42).

Rail line construction activities such as blasting and other cut procedures would have the potential to induce rock falls and landslides. Blasting could be required to excavate bedrock and would occur in strict compliance with existing regulations. Impacts resulting from construction and construction-related blasting are expected to be small, due to safety measures DOE would employ during blasting activities.

Table 4-1. Railways Engineering and Maintenance-of-Way Association seismic guidelines.[a]

Earthquake magnitude (Richter scale)	Response radii (kilometers)[b]	Response level[c]	Response protocol
0.0-4.9	d	I	Resume maximum operating speed. The need for the continuation of inspections will be determined by the proper maintenance-of-way authority.
5.0-5.9	160	II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority.
6.0-6.9	320	III	All trains and engines within the specified radius of the epicenter must stop and may not proceed until inspections have been performed and appropriate speed restrictions established by proper authority.
	480	II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority.
7.0 or greater	As directed, but not less than for 6.0 to 6.9	III	All trains and engines within the specified radius of the epicenter must stop and may not proceed until inspections have been performed and appropriate speed restrictions established by proper authority. The radius shall not be less than that specified for earthquakes between magnitudes 6.0 and 6.9.
		II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority. The radius shall not be less than that specified for earthquakes between magnitudes 6.0 and 6.9.

a. Source: DIRS 162040-AREMA 2001, Table 9-1.1 and p. 9-1.5.
b. To convert kilometers to miles, multiply by 0.62137.
c. Response level as defined by America Railway Engineering and Maintenance-of-Way Association.
d. Radii not applicable.

Debris Flows Debris flows are rapidly moving mixtures of water, soil, rock, and organic material. A debris flow can begin during or after heavy precipitation, and is especially dangerous if the debris dams a stream channel. If the dam fails, the saturated debris can travel downslope for several miles in a confined channel. Debris flows lose their energy and begin to deposit material when the stream gradient flattens or when the channel widens (DIRS 176184-Shannon & Wilson 2006, pp. 45 and 46).

There would be a potential for debris flows along portions of the rail alignment during the construction and operations phases. Such flows would be most common in areas where there is evidence of prior activity (DIRS 176184-Shannon & Wilson 2006, pp. 46 and 47). Debris flows could bury the rail line in sediment, destroy portions of the line, or weaken bridge pylons as a result of excessive erosion. It would not be possible to completely avoid debris flows in the area around the rail alignment.

Mineral and Energy Resources The rail line could cross surface or subsurface mineral or energy resources not part of identified mining districts or mineral leases. During construction, previously unknown resources could be identified in areas with large cuts. In 2005, the BLM generated a Mineral Potential Report for the Caliente rail corridor, using degrees to estimate areas with geologic favorability for particular mineral and energy resources (DIRS 182762-Shannon & Wilson, 2005, all). The report graded each Caliente rail alignment alternative segment and common segment on the potential for metallic and nonmetallic minerals, geothermal resources, and oil and gas resources in the area surrounding the rail alignment. The report rated each segment with high, medium, low, or no potential for each mineral resource type. However, a rating of high potential is only used as a guide in this impact analysis, and does not indicate the actual locations of commercial minerals.

During the construction phase, some minerals could be rendered inaccessible because they would be within the construction right-of-way. However, the ***operations right-of-way*** would be smaller than the construction right-of-way, so these restricted areas would become available during the operations phase. The Caliente rail alignment would not cross any known mineral deposits unique to the region. Therefore, any impacts related to restricted access to local mineral resources would be temporary and limited to the construction phase. Sections 4.2.1.2.2.1 through 4.2.1.2.2.12 provide more segment-specific information on the potential impacts to individual mineral and energy resources along alternative segments and common segments. Section 4.2.2, Land Use and Ownership, describes potential impacts to local mining districts.

Local Sources of Construction Materials Construction of a rail line along the Caliente rail alignment would require from 3.12 to 3.19 million metric tons (3.44 to 3.52 million tons) of crushed-rock ballast and from 2.72 to 2.81 million metric tons (3 to 3.1 million tons) of subballast for rail roadbed construction (DIRS 176172-Nevada Rail Partners 2006, p. 3-1). Soil and rock excavated from construction cuts would not be suitable for ballast; DOE would use this material for subballast and embankment fill (DIRS 176034-Shannon & Wilson 2006, pp. 15, 19, and 20). All of the subballast requirements would be met using excavated materials from construction cuts supplemented with bedrock extracted from the ballast quarries and if needed, alluvial ***borrow sites***.

DOE has identified six potential sites for ballast quarries along the Caliente rail alignment in the Caliente, Reveille Valley, and Goldfield areas (DIRS 176182-Shannon & Wilson 2006, p. 53). Of these potential locations, DOE would develop up to four sites to supply rock for ballast and subballast during the construction phase. Each quarry pit would be approximately 24 meters (80 feet) deep, with an anticipated ***footprint*** of approximately 0.04 square kilometer (10 acres). However, depending on the number of open quarries and the quality of the mineral materials, a quarry pit footprint could be as large as 2.1 square kilometers (530 acres). A waste-rock pile at each quarry site would disturb approximately 0.06 square kilometer (14 acres). ***Overburden*** material and rock not suitable for ballast or subballast gravel would be stored at this location until the end of quarry operations. A railroad ***siding*** to accommodate the ballast cars would be included in the total quarry disturbance area (DIRS 176172-Nevada Rail Partners 2006, pp. 3-1 and 3-2). When adding all of the maximum areas of the quarry site that could be disturbed during the construction phase (quarry pit, production plant, ballast storage, and waste pile), and including a temporary construction buffer area, a quarry site could disturb between 1.3 and 3.8 square kilometers (320 to 930 acres). These quarry-site values are considered to be maximum calculations, in the event of irregular topography and poor quality excavated mineral materials. Section 4.2.1.2.4 describes potential impacts from the quarry facilities in more detail.

The quarries would remain open through the construction phase. Afterward, DOE would reclaim disturbed areas in accordance with the post-construction and maintenance best management practices described in Chapter 7. Such practices would include grading the disturbed area, reshaping quarry-pit walls to stabilized slopes, replacing reserved topsoil, and revegetating.

DOE could use other local materials for rail line construction. Subballast would be generated from excavated cuts, crushed quarry rock, and if needed, borrow sites on certain ***alluvial fans***. Blasted bedrock from slope excavations and excess ballast rock would also be suitable for use to protect rail roadbed embankments from erosion. Some natural sand and gravel excavated from cuts and crushed rock from the quarries could be used to make concrete aggregate (DIRS 176034-Shannon & Wilson 2006, pp. 24 to 26). DOE would determine the prime sand and gravel deposits to be used before beginning construction.

Using local materials for ballast, subballast, embankment fill, and concrete aggregate would result in the consumption of construction resources (such as rock, sand, and gravel) often used for other construction projects in the area. However, alluvial deposits are plentiful in the region, and their use to construct the rail line would not substantially reduce the area supply of these resources. Because the potential impact to sand and gravel resources would be small along the entire alignment, this resource is not discussed further in Sections 4.2.1.2.2.1 through 4.2.1.2.2.12. Section 4.2.11, Utilities, Energy, and Materials, describes impacts to regional supply chains for other construction materials.

4.2.1.2.1.3 Soils. This section describes potential impacts to soils, including the removal of prime farmland from productive use. Rock excavation and land clearing would cause soil loss, surface erosion, and disruption of soil structure on previously undisturbed land.

During the construction phase, most soils would be excavated using conventional earthmoving equipment such as bulldozers, scrapers, rubber-tired backhoes, and track-mounted excavators. Solid rock encountered along the rail alignment would require drilling and blasting (DIRS 176184-Shannon & Wilson 2006, p. 48).

Soil Loss and Erosion There would be soil loss and erosion at all places where construction activities disturbed the ground surface. The severity of soil loss would depend on the extent of the disturbance, the erodibility of the soil, and the steepness of the terrain.

Land disturbed along the rail alignment would be most susceptible to soil loss and erosion during heavy rains and high winds. Areas where fine-textured soil and sand (such as on alluvial fans, lake-bed terraces, valleys, and flats) and where soils exhibited the ***erodes easily*** or ***blowing soil*** characteristics would be most susceptible to erosion. The Caliente rail alignment would be in an area with an ***arid*** climate that does not normally experience prolonged rainfall. Rainfall is typically brief, but can be very intense and form washouts in low-lying areas. Elevated water velocities during heavy rainfalls would increase erosion and scouring in areas where there is no vegetation, in areas dominated by sandy soils on steep slopes, along channel banks, and at bridge crossings (DIRS 176184-Shannon & Wilson 2006, p. 51). Construction of the proposed railroad would result in the loss of some topsoil and soil erosion. During and after construction, DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. In areas of temporary surface disturbance, the topsoil would be reserved and replaced, where practicable.

Disturbed soils would also be susceptible to wind erosion, because wind speeds greater than 19 kilometers (12 miles) per hour are sufficient to move sand grains (DIRS 176184-Shannon & Wilson 2006, p. 53). Disturbed soils with the blowing soil characteristic tend to generate sand dunes, increase fugitive dust in the air, and contribute to the loss of topsoil. Wind and water erosion could also impact ***air quality***, surface-water quality, and biological resources, as discussed in Sections 4.2.4, 4.2.5, and 4.2.7, respectively.

Prime Farmland The Farmland Protection Policy Act (7 United States Code [U.S.C.] 4201 *et seq.*) seeks to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmlands to nonagricultural uses. As discussed in Section 3.2.1.2.3, less than 1 percent of soils along the Caliente rail alignment are classified as prime farmlands. The Caliente and Eccles alternative segments, Caliente common segment 1, and Garden Valley alternative segments 1, 2, and 8 would cross prime farmland soils (see Figures 3-8 and 3-9). DOE calculated the amount of potentially disturbed prime farmland soils by multiplying the total area of disturbance by the calculated percentage of prime farmland that would be within the rail line construction right-of-way. In Lincoln County, there is 0.16 square kilometer (40 acres) of prime farmland soils along the Caliente alternative segment and 0.1 square kilometer (24 acres) of prime farmland along the Eccles alternative segment.

Along these alternative segments, DOE would limit disturbance within the construction right-of-way to minimize potential impacts to private lands and thus minimize impacts to farmland. The 1.2 square kilometer (200 acres) of prime farmland soils along Caliente common segment 1 is in relatively isolated areas in Lincoln and Nye Counties (see DIRS 182843-ICF 2007, all, plates 55 to 60, 79, and 107 to 109), and at present is not being used for agricultural production. The Garden Valley alternative segments would disturb between 0 square kilometer (0 acre) along Garden Valley alternative segment 3 up to 0.4 square kilometer (99 acres) along Garden Valley alternative segment 2. Construction of the proposed railroad along the Caliente rail alignment would result in the loss of a total of 1.8 square kilometer (440 acres) of prime farmland soils. Lincoln and Nye Counties contain approximately 2,200 square kilometers (540,000 acres) of prime farmland soils; thus, the proposed railroad would remove less than 0.1 percent of the prime farmland soils from productive use. Esmeralda County does not contain prime farmland soils.

In addition to using the Nevada soil survey database classification, DOE also requested assistance from the Nevada Natural Resources Conservation Service office to identify prime, unique statewide, or locally important farmland along the Caliente rail alignment (DIRS 181388-Arcaya 2007, all). The Conservation Service office identified two segments that would potentially cross farmland, centered around the junction between the end of the Caliente and Eccles alternative segments and the beginning of Caliente common segment 1. About 2 to 2.4 kilometers (1.2 to 1.5 miles) of the northern portion of the Eccles alternative segment would cross private land with the potential to be farmed. There are historical traces of irrigation north of the origin of Caliente common segment 1 (DIRS 181388-Arcaya 2007, all).

Soil Stability Excavation and grading activities would disturb the natural structure of the soil by breaking plant roots and natural mineral cements that bind soils. Soils disturbed along cut slopes would have a higher risk of becoming unstable and creating mudflows or landslides in steep topography because water-bearing properties would have changed, and the soil structure would have been altered. However, DOE would revegetate or otherwise stabilize these areas and would reclaim them to the extent practicable, which would reduce the potential for increased erosion (see Chapter 7).

DOE would erect up to 12 construction camps along the rail alignment to house workers. Although the camps would be temporary and used only during the construction phase, soil could become compacted at these sites. After construction was complete, DOE would grade the terrain and revegetate these areas with ***native plant species*** (see Chapter 7), which would minimize the effects of soil compaction.

Studies have shown that, if left to natural ***soil recovery***, the return of soil to pre-disturbed conditions and natural succession of vegetation in the Yucca Mountain area could take decades or more, creating an increased potential for erosion, landslides, and mudslides (DIRS 104837-DOE 1989, p. 17). Impacts due to soil disruption would be large within the construction right-of-way and immediate region of influence until new vegetation was established and the natural succession was reestablished. DOE would reduce the impacts related to the increased potential for erosion, landslides, and mudslides through the implementation of best management practices, such as revegetating disturbed sites, establishing proper roadbed grades, and using stormwater erosion control measures (see Chapter 7).

4.2.1.2.2 Construction Impacts along Alternative Segments and Common Segments

4.2.1.2.2.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline. The Caliente and Eccles alternative segments would gradually increase in elevation as they traveled northward. The Caliente alternative segment would have a total rise and fall of approximately 87 meters (290 feet) over 18 kilometers (11 miles). The Eccles alternative segment would have a rise of 190 meters (630 feet) over 19 kilometers (12 miles) (DIRS 176165-Nevada Rail Partners 2006,Appendix E).

Table 4-2 summarizes the key information DOE considered to assess construction impacts to physical setting along the Caliente and Eccles alternative segments.

Table 4-2. Summary of key information for assessing impacts from constructing the Caliente or Eccles alternative segment.

Attribute	Caliente alternative segment	Eccles alternative segment
Length (kilometers)[a,b]	18	19
Rise and fall (meters)[a,c]	87	190
Earthwork cut quantities (cubic meters)[a,d]	0.48 million	1.83 million
Earthwork fill quantities (cubic meters)[a,d]	0.17 million	0.99 million
Construction[e]	Cuts and fills up to 24 meters high	Cuts up to 24 meters and fills up to 15 meters high
Number of construction camps[f]	1 (no. 1)	1 (no. 1)
Number of well sites outside nominal width of construction right-of-way[f]	1 (no. 3)	3 (nos. 1, 2, 3)
Disturbed area (square kilometers)[g]		
• Rail alignment[h]	1.5	1.9
• Quarries[f]	1.6 (CA-8B)	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	0.0058	0.017
• Access roads to construction camps/well sites/quarries[f]	0.0073 (to well site 3)	0.015 (to well sites 1, 2, and 3)
Total disturbed area (square kilometers)[f,i]	3.1	2.1
Percent soil characteristics[j]	74 erodes easily 0 blowing soils 5.2 prime farmland	71 erodes easily 0 blowing soils 4.8 prime farmland
Soil characteristic area (square kilometers)[k]	2.3 erodes easily 0 blowing soils 0.164 prime farmland	1.5 erodes easily 0 blowing soils 0.1 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

The Caliente and Eccles alternative segments would result in the disturbance of approximately 3.1 square kilometers (770 acres) and 2.1 square kilometers (520 acres), respectively. More extensive cuts and fills would be required for the Eccles alternative segment, which would result in more permanent changes to the topography than for the Caliente alternative segment. Soil disturbance from construction activities along either alternative segment would result in localized impacts from the loss of topsoil and an increase in the potential for erosion. However, these impacts would be temporary and would be reduced through a combination of erosion control measures (see Chapter 7).

There is a high probability for perlite (a volcanic glass commercially mined south of the City of Caliente) deposits in the area around the Caliente and Eccles alternative segments. When heated very quickly, the grains of perlite expand into cellular particles, which can be incorporated into insulation, light-weight concrete, and acoustical tiles. There would be no depletion or removal of perlite; however, excavation could preclude mining of the deposits within the construction right-of-way. Because of the width of the rail line construction right-of-way in relation to the presence of this mineral resource, impacts to the perlite deposits would be small. There are some hot heat-flow wells in use around the City of Caliente; construction activities would not affect these geothermal resources because the rail alignment would not come close to the wells.

Approximately 0.16 square kilometer (40 acres) and 0.1 square kilometer (24 acres) of prime farmland would be disturbed along the Caliente or Eccles alternative segment, respectively (see Table 4-2). Disturbance of these soils, particularly if fill were added, would change their prime farmland soil classification and remove them from agricultural use. Along the Caliente alternative segment, a portion of the prime farmland soils are within the Caliente city limits, primarily on private land. A review of the prime, unique statewide, or locally important farmland by the Natural Resources Conservation Service identified land that is currently idle, but with a potential to produce alfalfa as a crop (DIRS 181388-Arcaya 2007, p. 1). The Eccles alternative segment could disturb approximately 0.2 square kilometer (50 acres) of prime farmland. Along the alternative segments, DOE would limit the area of disturbance within the construction right-of-way to minimize potential impacts to private lands. Because the Caliente alternative segment would primarily travel along the ***berm*** of an abandoned rail line, the Natural Resources Conservation Service did not identify any prime or ***unique farmland*** along that portion of the alternative segment.

More than 70 percent of soils along both the Caliente and the Eccles alternative segments have the erodes easily characteristic. Disturbance from construction along the rail alignment would disrupt the soil structure and increase the potential for erosion. DOE would implement best management practices (such as stockpiling topsoil and revegetating the area) to reduce the potential for additional soil loss due to erosion (see Chapter 7).

4.2.1.2.2.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would cross four major mountain ranges and three valleys. To maintain a rail grade of less than 2 percent, DOE would excavate and level high points along the alignment and, to the extent practicable, use this material to raise the low points. Table 4-3 lists the anticipated cut and fill requirements and other important information used in the impact analysis for Caliente common segment 1. The grading procedures would be greatest through Bennett Pass and around the North Pahroc Mountains. A total of 12 square kilometers (3,000 acres) of land would be disturbed during construction of the rail line (rail roadbed, alignment access roads, and a construction camp, water wells, and their access roads). These activities would cause topsoil loss and local erosion. Caliente common segment 1 would also travel through badland topography, erodible land created by excessive erosion. Sections of the rail alignment requiring large cuts could also increase the potential for rock falls or landslides. DOE would use erosion control measures (see Chapter 7) to control excessive loss of topsoil and local erosion along the segment, particularly in these areas. Sections of the rail alignment requiring large cuts could also increase the potential for rock falls or landslides. To minimize the chance of landslides, DOE would vary cut slope dimensions, depending on the strength and stability of the bedrock.

Limestone bedrock occurs widely along Caliente common segment 1 (DIRS 182762-Shannon & Wilson 2005, Figure E2). Limestone is found in the Burnt Springs, Highland, and North Pahroc Ranges, and might extend under the rail alignment in those areas. Rail line construction would have a small impact on the availability of limestone because this resource is widely available in mountain ranges throughout the region. There is one warm spring in the vicinity of Bennett Pass, approximately 1.6 kilometers (1 mile) from the construction right-of-way. Construction activities would not affect this spring. There is also a high potential for additional geothermal resources around the eastern portion of Caliente common segment 1. Rail line construction would not affect these potential resources because DOE would not use or otherwise disturb the subsurface geothermal resource.

Table 4-3. Summary of key information for assessing potential impacts from constructing the proposed railroad along Caliente rail alignment common segments (page 1 of 2).

Key information	Caliente common segment 1	Caliente common segment 2	Caliente common segment 3	Caliente common segment 4	Caliente common segment 5	Caliente common segment 6
Length (kilometers)[a,b]	110	50	110	11	40	51
Rise and fall (meters)[a,c]	1,300	430	720	18	170	410
Earthwork cut quantities (cubic meters)[a,d]	9.33 million	1.19 million	2.33 million	0.23 million	0.45 million	5.88 million
Earthwork fill quantities (cubic meters)[a,d]	5.89 million	0.52 million	1.93 million	0.2 million	1.01 million	2.94 million
Construction[e]	Generally, cuts and fills ranging 12 to 21 meters high; cut in rock to 21 meters high at Bennett Pass; 12-meter cuts and 19-meter high fill at the crossing of Black Canyon; fills and cuts up to 39 meters and cuts in rock to 30 meters high along White River.	Cuts and fills up to 18 meters high in irregular volcanic topography; shallower cuts and fills in alluvial deposits.	Cuts and fills up to 24 meters high; shallow cuts and fills.	Cuts and fills up to 6 meters high.	Cuts up to 15 meters high; fills generally up to 6 meters deep.	Cuts and fills up to 15 meters high; side hill cuts and fills to 42 meters high.
Number of construction camps[f]	2 (nos. 2, 3)	1 (no. 5)	3 (nos. 6, 7, 8)	1 (no. 9)	1 (no. 10)	1 (no. 12)
Number of well sites outside nominal width of construction right-of-way[f]	4 (nos. 4, 5, 6, 7)	2 (nos. 8, 9)	0	0	0	2 (nos. 14, 15)

Table 4-3. Summary of key information for assessing potential impacts from constructing the proposed railroad along Caliente rail alignment common segments (page 2 of 2).

	Caliente common segment 1	Caliente common segment 2	Caliente common segment 3	Caliente common segment 4	Caliente common segment 5	Caliente common segment 6
Disturbed area (square kilometers)[g]						
• Rail alignment[h]	11	4.1	9.7	1.0	3.1	5.3
• Quarries[f]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	0.023	0.012	Not applicable	Not applicable	Not applicable	0.012
• Access roads to construction camps/well sites/quarries[f]	0.46 (to construction camps 2, 3) 0.035 (to well sites 4, 5, 6, 7)	Not applicable 0.034 (to well sites 8, 9)	0.52 (to construction camps 6, 7, 8)	0.085 (to construction camp 9)	0.02 (to construction camp 10)	0.19 (to construction camp 12) 0.047 (to well sites 14, 15)
Total disturbed area (square kilometers)[i]	12	4.1	10	1.1	3.1	5.5
Percent soil characteristics[j]	18 erodes easily 0 blowing soils 2.6 prime farmland	16 erodes easily 10 blowing soils 0 prime farmland	17 erodes easily 32 blowing soils 0 prime farmland	41 erodes easily 1.4 blowing soils 0 prime farmland	0 erodes easily 2.6 blowing soils 0 prime farmland	0 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[k]	2.1 erodes easily 0 blowing soils 1.2 prime farmland	0.66 erodes easily 0.41 blowing soils 0 prime farmland	1.7 erodes easily 3.2 blowing soils 0 prime farmland	0.45 erodes easily 0.015 blowing soils 0 prime farmland	0 erodes easily 0.081 blowing soils 0 prime farmland	0 erodes easily 0 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

Construction of Caliente common segment 1 would disturb approximately 1.2 square kilometer (300 acres) of prime farmland soils, which would be removed from agricultural use (see Table 4-3). These soils are on ***public lands*** and are not being used for agricultural production at present. A review of the prime, unique statewide, or locally important farmland by the Natural Resources Conservation Service identified evidence of past irrigation north of the beginning of Caliente common segment 1. This land has been out of production for more than 10 years (DIRS 181388-Arcaya 2007, p. 1). Although the Natural Resources Conservation Service office does not consider the current land as farmland, if it were to become irrigated again, it would be considered farmland of statewide importance. Caliente common segment 1 would disturb approximately 0.064 square kilometer (16 acres) of this land. DOE would limit the area of disturbance within the construction right-of-way to minimize impacts to private lands.

4.2.1.2.2.3 Garden Valley Alternative Segments. The Garden Valley alternative segments would generally cross moderately hilly terrain, and most of the cuts and fills would occur in gaps of the Golden Gate Range. Table 4-4 summarizes the key information DOE used to assess impacts to physical setting from construction of any of the Garden Valley alternative segments.

Garden Valley 3 would be the longest of the Garden Valley alternative segments, but would require the least total amount of cut and of fill. Garden Valley 1 would be the shortest of the Garden Valley alternative segments and would require the least amount of cuts, but would require more fill to obtain the appropriate grade. Garden Valley alternative segments 3 and 8 would disturb a total of 3.7 square kilometers (910 acres), 0.3 square kilometer (74 acres) more than Garden Valley 1. Garden Valley alternative segment 2 would disturb 3.6 square kilometers (890 acres) (see Table 4-4). Surface disturbance during construction would remove topsoil and increase the potential for erosion around the rail alignment. These impacts would be temporary and reduced by erosion control measures (see Chapter 7).

All of the Garden Valley alternative segments would cross the Golden Gate fault. However, the few earthquakes that have occurred in the area were low magnitude and not associated with the faults that the Garden Valley alternative segments would cross (see Figure 3-3).

Limestone is present in the bedrock of the Golden Gate Range where Garden Valley alternative segments 1 and 3 would cross (DIRS 182762-Shannon & Wilson 2005, Figure E2). However, rail line construction would not adversely impact the limestone resources because limestone is abundant in the mountains around the Golden Gate Range.

Garden Valley alternative segments 1, 2, and 8 would cross between 0.29 and 0.4 square kilometer (72 and 99 acres) of prime farmland soils. The prime farmland soils are in the southern section of Garden Valley, in isolated areas where there are no irrigation or farming practices (see DIRS 182843-ICF 2007, all, plates 144 to 147, 155 to 163, and 501 to 503). Garden Valley alternative segments 1 and 3 would have a larger percentage of soils with the erodes easily characteristic than Garden Valley alternative segments 1, 3, and 8 (see Table 4-4). When disturbed by construction, these soils would have a higher potential for erosion than other soil types. During and after construction, DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

4.2.1.2.2.4 Caliente Common Segment 2 (Quinn Canyon Range Area). Caliente common segment 2 would cross several valleys and one pass. Table 4-3 summarizes the key information DOE considered to assess impacts to physical setting from the construction of Caliente common segment 2. Excess excavation material not needed for fill purposes would be graded and revegetated with native species, or reused as fill along other parts of the rail alignment. In total, construction along Caliente common segment 2 would disturb 4.1 square kilometers (1,000 acres). The disturbed areas would lose topsoil and have an increased potential for erosion. In addition, 0.66 square kilometer (160 acres) of common segment 2 would contain soils with the erodes easily characteristic, which would locally

Table 4-4. Summary of key information for assessing impacts from constructing Garden Valley alternative segment 1, 2, 3, or 8.

Attribute	Garden Valley 1	Garden Valley 2	Garden Valley 3	Garden Valley 8
Length (kilometers)[a,b]	35	35	37	37
Rise and fall (meters)[a,c]	360	260	350	260
Earthwork cut quantities (cubic meters)[a,d]	0.28 million	0.72 million	0.5 million	0.89 million
Earthwork fill quantities (cubic meters)[a,d]	0.84 million	0.53 million	0.53 million	0.64 million
Construction[e]	Low embankment fills less than 3 meters deep; cuts and fills up to 12 meters high	Shallow cuts and fills	Cuts and fills to 9 meters high	Shallow cuts and fills
Number of construction camps[f]	1 (no. 4b)	1 (no. 4c)	1 (no. 4a)	1 (no. 4c)
Number of well sites outside nominal width of construction right-of-way[f]	0	0	0	0
Disturbed area (square kilometers)[g]				
• Rail alignment[h]	2.9	3.1	3.2	3.2
• Quarries[f]	Not applicable	Not applicable	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way	Not applicable	Not applicable	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	0.45 (to construction camp 4b)	0.45 (to construction camp 4c)	0.45 (to construction camp 4a)	0.45 (to construction camp 4c)
Total disturbed area (square kilometers)[i]	3.4	3.6	3.7	3.7
Percent soil characteristics[j]	13 erodes easily 5.7 blowing soils 8.4 prime farmland	22 erodes easily 6.1 blowing soils 11 prime farmland	12 erodes easily 2.1 blowing soils 0 prime farmland	14 erodes easily 6 blowing soils 9.8 prime farmland
Soil characteristic area (square kilometers)[g,k]	0.44 erodes easily 0.19 blowing soils 0.29 prime farmland	0.79 erodes easily 0.22 blowing soils 0.4 prime farmland	0.44 erodes easily 0.078 blowing soils 0 prime farmland	0.52 erodes easily 0.22 blowing soils 0.36 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

increase the potential for soil erosion. DOE would implement best management practices (see Chapter 7) to reduce these impacts.

Caliente common segment 2 would not cross known Quaternary faults. There have been some earthquakes in the area of Caliente common segment 2, but they had magnitudes of 4.0 or lower. Potential hazards to people and structures from earthquakes of this magnitude would be very small.

A low to medium potential exists for undiscovered mineral, oil, and geothermal resources along Caliente common segment 2 (DIRS 182762-Shannon & Wilson 2005, all). Potential impacts to any undiscovered resources along this segment would be very small because the narrow footprint of the rail line would allow the extraction of most types of mineral and energy deposits.

4.2.1.2.2.5 South Reveille Alternative Segments. South Reveille alternative segments 2 and 3 would cross a relatively uniform valley with a rise and fall of 190 meters (630 feet) over 19 kilometers (12 miles) (DIRS 176165-Nevada Rail Partners 2006, Appendix E). Although there would be more cuts along South Reveille 3, it would require less earthwork to attain an appropriate grade. Table 4-5 summarizes the key information DOE considered to assess impacts to physical setting from construction of either South Reveille alternative segment.

Construction of the rail roadbed, quarries, and access roads would disturb an area of approximately 4.8 square kilometers (1,200 acres) along South Reveille alternative segment 2; South Reveille 3 would disturb slightly more surface area (5 square kilometers [1,240 acres]). In addition, a larger percentage of soils along South Reveille alternative segment 2 have the erodes easily characteristic (see Table 4-5). Surface disturbance would result in topsoil loss and a potential increase in erosion. However, DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. Overall, potential impacts from either South Reveille 2 or South Reveille 3 would be similar except that South Reveille 3 would result in more land disturbance than South Reveille 2.

Neither South Reveille 2 nor South Reveille 3 would cross known faults. North of the alternative segments, Quaternary faults are identified on the east and west sides of the Reveille Range. However, these faults do not extend into the southern edge of Reveille Valley. Therefore, the potential hazards to people and structures from seismic activity would be very small.

There would be no impacts to mineral resources along South Reveille alternative segments 2 and 3 because there is a low potential for metallic and nonmetallic minerals, gas, or geothermal resources within the construction right-of-way. In addition, the bedrock is covered by more than 91 meters (300 feet) of recent alluvial deposits (DIRS 182762-Shannon & Wilson 2005, p. 53).

4.2.1.2.2.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Caliente common segment 3 would cross the Kawich Range, Cow Canyon, and part of Reveille and Hot Creek Valleys. Bridges might be required in the areas of Cow Canyon and Warm Springs Summit, where the rail line would pass through steep and rugged terrain. Cuts and fills up to 24 meters (79 feet) would also be required through the pass through the Kawich Range. The rugged topography and bridge construction would require total earthwork to include 2.33 million cubic meters (3.04 million cubic yards) in cuts and 1.93 million cubic meters (2.52 million cubic yards) in fills. Table 4-3 summarizes the key information DOE considered to assess impacts to physical setting from construction of Caliente common segment 3.

East of Warm Springs, the rail line would cross the northern portion of the Kawich-Hot Creek Fault zone. While this fault zone was active at least 130,000 years ago, its slip rate is consistent with other large faults in the region (DIRS 174194-USGS 2005, all). In areas with high topographic relief, construction of the rail line would result in an increased potential for rock-slope failure and landslides along Caliente

Table 4-5. Summary of key information for assessing impacts from constructing South Reveille alternative segment 2 or 3.

Attribute	South Reveille 2	South Reveille 3
Length (kilometers)[a,b]	19	19
Rise and fall (meters)[a,c]	150	190
Earthwork cut quantities (cubic meters)[a,d]	0.51 million	0.33 million
Earthwork fill quantities (cubic meters)[a,d]	0.22 million	0.15 million
Construction[e]	Cuts and fills up to 9 to 12 meters high	Cuts and fills up to 15 meters high
Number of construction camps[f]	0	0
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (square kilometers)[g]		
• Rail alignment[h]	1.5	1.7
• Quarries[f,i]	3.3 (NN-9A and NN-9B)	3.3 (NN-9A and NN-9B)
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	Not applicable	Not applicable
Total disturbed area (square kilometers)[f,j]	4.8	5
Percent soil characteristics[k]	19 erodes easily 6.3 blowing soils 0 prime farmland	15 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[l]	0.91 erodes easily 0.30 blowing soils 0 prime farmland	0.7544 erodes easily 0 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Assuming that both NN-9A and NN-9B would be developed.
j. Totals might not equal sums of values due to rounding.
k. Source: DIRS 176781-MO0603GSCSSGEO.000.
l. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

common segment 3, which could also be induced by earthquakes (DIRS 176184-Shannon & Wilson 2006, Table 6). DOE would incorporate appropriate engineering features (see Chapter 2) during construction to stabilize these areas and prevent rock-slope failure and landslides. There is a high potential for some metallic and nonmetallic minerals in the bedrock below sections of Caliente common segment 3. The Warm Springs Summit area in the Kawich Range has a high potential for barite and metallic minerals such as gold and silver. Barite is found in small deposits in the Kawich range, and the rail alignment would cross a portion of the Clifford Mining District, which extracts metallic minerals (DIRS 173841-Shannon & Wilson 2005, p. 84). However, barite is not mined within the rail line construction right-of-way, and generally the bedrock is too deep for construction activities to affect the metallic minerals. There is also a high potential for traces of silver and gold east of the Kawich Range. Due to the size and location of the construction right-of-way, the impact to these mineral resources would be small. Section 4.2.2, Land Use and Ownership, provides more information about potential impacts to local mining districts.

The Warm Springs Summit area is also a well-known location for warm springs and other geothermal resources (DIRS 182762-Shannon & Wilson 2005, p. 23). The rail line would not cross any known warm springs; therefore, there would be no impacts to geothermal resources in the area.

Rail line construction along Caliente common segment 3 would disturb approximately 10 square kilometers (2,500 acres). There would be a loss of topsoil and an increased potential for erosion in the disturbed areas. In addition, terrain along Caliente common segment 3 consists of alluvial and ***playa*** deposits that are susceptible to water and wind erosion. Approximately 1.7 square kilometers (420 acres) of soils along Caliente common segment 3 have the easily eroded characteristic, and 3.2 square kilometers (790 acres) are considered to be blowing soils (see Table 4-3). The impacts from increased erosion would be small along most of the rail alignment, and moderate in Stone Cabin Valley and Cactus Flat, where there is a concentration of blowing soils (see Figure 3-5).

4.2.1.2.2.7 Goldfield Alternative Segments. Passing through the Goldfield Hills, the three Goldfield alternative segments would have similar rises and falls. To obtain the appropriate grade, Goldfield alternative segment 3 would require the most cuts and fills. Table 4-6 lists these values and the key information DOE considered to assess impacts to physical setting from construction of the Goldfield alternative segments.

Rail line construction would disturb from 6.5 square kilometers (1,600 acres) along Goldfield alternative segment 4 to 10.2 square kilometers (2,500 acres) along Goldfield alternative segment 3. Cuts and fills associated with construction of any of the Goldfield alternative segments would result in the loss of topsoil, and an increased potential for erosion. DOE would implement best management practices (see Chapter 7) to reduce the effects of these impacts.

Less than 10 percent of soils along each of the Goldfield alternative segments are considered to be blowing soils, which have a potential to be displaced easily by wind (see Table 4-6). DOE would implement best management practices to reduce the potential for additional soil loss due to wind erosion.

Section 4.2.4, Air Quality and Climate, includes more discussion of impacts related to blowing soils and fugitive dust emissions.

The southern sections of the Goldfield alternative segments would cross the Stonewall Flat fault sequences; however, the area surrounding the alternative segments has felt few earthquakes compared to other sections of the Caliente rail alignment. As shown in Figure 3-3, events in the magnitude 4.0 to 5.9 range have occurred around Ralston, Stonewall Mountain, and Tonopah. Where the selected Goldfield alternative segment would pass through rugged areas, DOE would employ stabilization measures (such as surface bolting and applying shotcrete) to ensure slope stability (see Chapter 7).

There is a high potential for metallic resources below all of the Goldfield alternative segments, each of which would cross the Goldfield Mining District, which has produced gold, silver, lead, and copper. Extraction of metallic minerals occurs in subsurface mines; therefore, there would be no impact to these mineral resources from construction of any of the Goldfield alternative segments.

There is also a high potential for the mineral zeolite to occur around the Goldfield alternative segments. Zeolite can be used as an antimicrobial agent and forms when saline ***groundwater*** reacts with certain volcanic deposits. Construction of the rail line could uncover zeolite deposits. Construction would be confined to the nominal width of the construction right-of-way, which would reduce the potential for

Table 4-6. Summary of key information for assessing impacts from constructing Goldfield alternative segment 1, 3, or 4.

Attribute	Goldfield 1	Goldfield 3	Goldfield 4
Length (kilometers)[a,b]	47	50	53
Rise and fall (meters)[a,c]	610	670	680
Earthwork cut quantities (cubic meters)[a,d]	3.07 million	2.29 million	1.87 million
Earthwork fill quantities (cubic meters)[a,d]	1.94 million	4.51 million	3.33 million
Construction[e]	Cuts up to 12 meters and fills up to 15 meters high	Cuts and fills up to 15 meters; local cuts and fills to 27 meters high	Generally cuts and fills up to 12 meters high; 1,800-meter long, 30-meter high cut
Number of construction camps[f]	0	0	0
Number of well sites outside nominal width of construction right-of-way[f]	1 (no. 12)	1 (no. 12)	3 (nos. 10, 11, 13)
Disturbed area (square kilometers)[g]			
• Rail alignment [h]	4.5	4.9	4.9
• Quarries[f,i]	5.3 (NS-3A, NS-3B)	5.3 (NS-3A, NS-3B)	1.5 (ES-7)
• Well sites outside nominal width of construction right-of-way[f]	0.0058	0.0058	0.017
• Access roads to construction camps/well sites/quarries[f]	0.011 (to well site 12)	0.011 (to well site 12)	0.057 (to well sites 10, 11, 13)
Total disturbed area (square kilometers)[f,j]	9.8	10.2	6.5
Percent soil characteristics[k]	0 erodes easily 8.8 blowing soils 0 prime farmland	0 erodes easily 9.5 blowing soils 0 prime farmland	0 erodes easily 7.7 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[l]	0 erodes easily 0.86 blowing soils 0 prime farmland	0 erodes easily 0.95 blowing soils 0 prime farmland	0 erodes easily 0.54 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Assuming that both NS-3A and NS-3B would be developed.
j. Totals might not equal sums of values due to rounding.
k. Source: DIRS 176781-MO0603GSCSSGEO.000.
l. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

additional disturbance. Therefore, potential impacts to local mineral resources would be small. Section 4.2.2, Land Use and Ownership, also addresses impacts to the Goldfield Mining District.

4.2.1.2.2.8 Caliente Common Segment 4 (Stonewall Flat Area). Crossing the Stonewall Flat area, Caliente common segment 4 would have a relatively low rise and fall amount and low cut and fill requirements (see Table 4-3). Caliente common segment 4 would cross the eastern portion of the Stonewall Flat fault zone, northwest of Ralston. However, there have been few earthquakes in the area. In the southern portion of the Goldfield Hills, one earthquake of magnitude 4.0 has been recorded within the past 150 years.

There is a high potential for metallic minerals along the central portion of Caliente common segment 4. Gold and silver deposits have been mined from the Stonewall and Cuprite Mining Districts (DIRS 173841-Shannon & Wilson 2005, pp. 56 to 59). However, impacts to these areas would be small because the minerals have not been found within the rail line construction right-of-way. Section 4.2.2, Land Use and Ownership, further describes impacts related to access to and use of such minerals and energy resources. There are also warm heat-flow wells near Caliente common segment 4. DOE would avoid these wells during rail line construction; therefore, impacts would be small.

Construction along Caliente common segment 4 would disturb approximately 1.1 square kilometers (270 acres). The surface area disruption would result in a loss of topsoil and the potential for increased erosion. The rail alignment would disturb 0.015 square kilometer (3.7 acres) of soils along Caliente common segment 4 with the erodes easily characteristic, soils that would be especially susceptible to erosion during construction, particularly from wind and water (see Table 4-3). DOE would implement best management practices (see Chapter 7) to reduce the potential for loss of topsoil and additional soil loss due to erosion.

There are also soils characterized as ***soft soils*** in playa deposits present along Caliente common segment 4. The saline conditions of these soils limit the chemical and physical potentials of the soil and could have negative effects on the vegetation-bearing capacity of the soil. Reclamation of these soils following construction would be more difficult than on non-saline soils, and would require more maintenance and care than on more productive soils. These soils would have a higher potential for erosion until revegetation was complete. DOE might need to implement additional reclamation measures and erosion control measures until the vegetation could be established (DIRS 174296-Shannon & Wilson 2005, pp. 13 and 14).

4.2.1.2.2.9 Bonnie Claire Alternative Segments. The two Bonnie Claire alternative segments would pass through Lida Valley and Sarcobatus Flat. The alternative segments would require similar amounts of fill, but Bonnie Claire alternative segment 2 would require excavation of twice as much cut material as Bonnie Claire alternative segment 3. Table 4-7 summarizes the key information DOE considered to assess impacts to physical setting from construction of either of the Bonnie Claire alternative segments.

Each alternative segment would result in a total land disturbance of 1.9 square kilometers (470 acres) (see Table 4-7). Areas disturbed during construction would result in a loss of topsoil and increase the potential for erosion. However, these impacts would be temporary and would be reduced through the implementation of best management practices (see Chapter 7).

Although the alternative segments would pass through areas that have experienced recent low-level ***seismicity*** (magnitude 3.0 to 3.9) events, neither Bonnie Claire 2 nor Bonnie Claire 3 would cross known Quaternary fault traces. The primary seismic activity within the past 150 years occurred in 1999, when a magnitude 5.3 earthquake triggered many aftershocks over a series of days. Since then, earthquakes in

Table 4-7. Summary of key information for assessing impacts from constructing Bonnie Claire alternative segment 2 or 3.

Attribute	Bonnie Claire 2	Bonnie Claire 3
Length (kilometers)[a,b]	21	19
Rise and fall (meters)[a,c]	160	170
Earthwork cut quantities (cubic meters)[a,d]	0.46 million	0.24 million
Earthwork fill quantities (cubic meters)[a,d]	0.95 million	0.7 million
Construction[e]	Cuts to 30 meters high in ***tuff***; cuts and fills to 15 meters deep in ***alluvium***	Cuts to 15 meters high in tuff; cuts and fills to 6 meters deep in alluvium; low strength rock; broken rock expected because of faults visible in outcrop
Number of construction camps[f]	0	0
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (square kilometers)[g]		
• Rail alignment[h]	1.9	1.9
• Quarries[f]	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	Not applicable	Not applicable
Total disturbed area (square kilometers)[f,i]	1.9	1.9
Percent soil characteristics[j]	27 erodes easily 0 blowing soils 0 prime farmland	25 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[k]	0.51 erodes easily 0 blowing soils 0 prime farmland	0.48 erodes easily 0 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

the immediate vicinity of the Bonnie Claire alternative segments have been below magnitude 3.0 (DIRS 176184-Shannon & Wilson 2006, Plate 4). Seismic hazards in the area are considered consistent with the rest of southern Nevada.There is a potential for metallic mineral deposits along both Bonnie Claire alternative segments. Each segment would travel around the Wagner Mining District, which has produced low-tonnage mixed oxide and sulfide copper ore (DIRS 173841-Shannon & Wilson 2005, p. 54). DOE would position the rail alignment to avoid the mining district and to reduce the potential for

impacts to mineral deposits. Section 4.2.2, Land Use and Ownership, addresses potential impacts to the Wagner Mining District.
The rail alignment would travel along the low sections of Stonewall Flat; therefore, impacts to metallic mineral deposits would be small.

About 0.48 to 0.51 square kilometer (120 to 130 acres) of the soils along Bonnie Claire alternative segment 3 and Bonnie Clair alternative segment 2, respectively, have soils with the erodes easily characteristic (see Table 4-7). Thus, there would be a high potential for erosion along these alternative segments. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. Overall, the potential impacts from constructing a rail line along either Bonnie Claire 2 or Bonnie Claire 3 would be similar.

4.2.1.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Passing through Sarcobatus Flat, common segment 5 would have a low rise and fall. Table 4-3 summarizes the key information DOE considered to assess impacts to physical setting from construction of common segment 5.

The potential to expose people or structures to seismic hazards would be small because common segment 5 would not cross any known Quaternary fault traces, and would travel over relatively level terrain.

There is a high potential for metallic mineral resources where common segment 5 would pass near the Clarkdale Mining District. Small gold and silver deposits have been mined in Clarkdale, and are hypothesized to extend below portions of common segment 5 (DIRS 173841-Shannon & Wilson 2005, Table 1). However, construction activities would not uncover the bedrock and disturb the mineral resources. The area of common segment 5 also has a generally high potential for geothermal resources; there are several thermal springs near U.S. Highway 95 that would be parallel to the rail line (DIRS 173841-Shannon & Wilson 2005, p. 23). However, because DOE would avoid these resources during rail line construction, the potential for impacts would be small.

Construction of this common segment would disturb a total of 3.1 square kilometers (770 acres) of land. Surface disturbance related to construction activities would remove topsoil and increase the potential for erosion along the rail alignment. These impacts would be temporary and would be reduced through the use of best management practices (see Chapter 7).

Approximately 0.081 square kilometer (20 acres) of common segment 5 has the blowing soils characteristic, which would increase the potential for soil loss from wind. DOE would implement best management practices to minimize any additional soil loss from erosion. Section 4.2.4, Air Quality and Climate, addresses impacts related to construction-generated fugitive dust emissions.

4.2.1.2.2.11 Oasis Valley Alternative Segments. Oasis Valley alternative segments 1 and 3 would have a similar profile throughout the valley. Table 4-8 summarizes the key information DOE considered to assess impacts to physical setting from construction of either Oasis Valley alternative segment.

The Oasis Valley alternative segments would not cross known fault traces. Within the past 150 years of seismic records, there has been generally low earthquake activity in the area, so the potential seismic-related impacts to humans and structures would be small.

There is a low potential for commercial metallic, nonmetallic, and oil resources in the area of the Oasis Valley alternative segments (DIRS 182762-Shannon & Wilson 2005, Appendix E). The minerals present in the area around the alternative segments are found in small veins in the surrounding hills. There would be small impacts to such resources because the rail alignment would remain in the valley, away from

Table 4-8. Summary of key information for assessing impacts from constructing Oasis Valley alternative segment 1 or 3.

Attribute	Oasis Valley 1	Oasis Valley 3
Length (kilometers)[a,b]	10	14
Rise and fall (meters)[a,c]	70	66
Earthwork cut quantities (cubic meters)[a,d]	0.051 million	0.12 million
Earthwork fill quantities (cubic meters)[a,d]	0.55 million	1.03 million
Construction[e]	Cuts and fills to 6 meters high	Cuts and fills to 12 meters high
Number of construction camps[f]	1 (no. 11)	1 (no. 11)
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (square kilometers)[g]		
• Rail alignment[h]	0.97	1.3
• Quarries[f]	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	0.04 (to construction camp 11)	0.04 (to construction camp 11)
Total disturbed area (square kilometers)[f,i]	1	1.3
Percent soil characteristics[j]	0 erodes easily 13 blowing soils 0 prime farmland	0 erodes easily 4.8 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[g,k]	0 erodes easily 0.13 blowing soils 0 prime farmland	0 erodes easily 0.062 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

mineral-bearing ***outcrops***. There is a high potential for geothermal deposits in the area; however, neither Oasis Valley alternative segment would approach any known hot springs or wells.

Oasis Valley alternative segment 3 would require more earthwork than Oasis Valley alternative segment 1 to obtain the appropriate grade (see Table 4-8) and would disturb 0.3 square kilometer (74 acres) more land area than Oasis Valley alternative segment 1. Construction activities would remove topsoil in the area and increase the potential for erosion along the rail alignment. Oasis Valley alternative segment 1 also contains about twice as much blowing soils as Oasis Valley alternative segment 3. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

Overall, potential impacts along either Oasis Valley alternative segment would be small. Oasis Valley alternative segment 3 would be longer and would require more land disturbance than Oasis Valley alternative segment 1, and Oasis Valley alternative segment 1 would contain more soils with a high potential for erosion.

4.2.1.2.2.12 Common Segment 6 (Yucca Mountain Approach). Approaching Yucca Mountain, common segment 6 would pass through rugged terrain and along fault blocks. To achieve an appropriate grade, 15-meter (49-foot) cuts and fills would be required with up to 42-meter (140-foot) cuts and fills in some areas (see Table 4-3). Some of the fill would be required to build the bridge over Beatty Wash.

There is a low potential for ground rupture associated with the eastern and western Yucca Fault systems (DIRS 176184-Shannon & Wilson 2006, Table 6). In areas with high topographic relief, construction of this common segment would also result in an increased potential for rock-slope failure and landslides (DIRS 176184-Shannon & Wilson 2006, Table 6). DOE would incorporate appropriate engineering features (see Chapter 2) during construction to stabilize these areas and prevent rock-slope failure and landslides. Construction activities would not be expected to result in off-site rock falls and landslides.

There is a high potential for the occurrence of some metallic and nonmetallic minerals along common segment 6. The rail alignment would cross the northeastern portion of the Bare Mountain Mining District, which has extracted a variety of minerals commodities over its period of operation, including fluorspar, silica, limestone, and trace amounts of gold and mercury (DIRS 173841-Shannon & Wilson 2005, p. 39). Construction impacts to mineral resources in this area would be small because the width of the construction right-of-way would allow for the extraction of the mining district's resources. Section 4.2.2, Land Use and Ownership, further describes impacts to the Bare Mountain Mining District.

There is a potential for geothermal resources in the northern portions of common segment 6. There are several warm and hot springs around Beatty, some of which are used as warm bathing pools. The rail alignment would bypass the springs; therefore, there would be no impact to local geothermal resources (DIRS 182762-Shannon & Wilson 2005, p. 23).

Construction activities along common segment 6 would disturb an estimated 5.5 square kilometers (1,400 acres). These activities could cause topsoil loss and increase erosion potential. DOE would implement best management practices (see Chapter 7) to minimize these impacts. There are no special soil characteristics along this common segment.

4.2.1.2.3 Facilities

4.2.1.2.3.1 Facilities at the Interface with the Union Pacific Railroad Mainline. There would be two facilities at the Interface with the Union Pacific Railroad Mainline: the Staging Yard and the Interchange Yard. The Staging Yard would be constructed on one of two potential locations along the Caliente alternative segment (Caliente-Indian Cove or Caliente-Upland) or on the Eccles alternative segment (Eccles-North).

The Staging Yard would disturb approximately 0.2 square kilometer (50 acres) and consist of a 610-square-meter (6,600-square-foot) office, a 560-square-meter (6,000-square-foot) Satellite Maintenance-of-Way Facility, and a paved access road (DIRS 176168-Nevada Rail Partners 2006, pp. 5-1 and 5-2).

The Interchange Yard would disturb 0.061 square kilometer (15 acres) at the Caliente location or 0.12 square kilometer (30 acres) at the Eccles location. The total amount of earthwork required would be 15,000 cubic meters (20,000 cubic yards) for Caliente and 120,000 cubic meters (150,000 cubic yards) for

Eccles (DIRS 176170-Nevada Rail Partners 2006, p. A-5). There would be no buildings in the Interchange Yard.

Construction of these facilities would result in the removal of topsoil and an increased potential for erosion within the disturbed areas. DOE would implement best management practices (see Chapter 7) to minimize potential erosion impacts. There would be a permanent loss of topsoil in the areas under the buildings and paved roads.

4.2.1.2.3.2 Maintenance-of-Way Facilities. The Maintenance-of-Way Headquarters Facility would be south of Tonopah and would disturb 0.012 square kilometer (3 acres). Construction of the Trackside Facility along Caliente common segment 3 northeast of Goldfield would disturb 0.061 square kilometer (15 acres) (DIRS 176170-Nevada Rail Partners 2006, Appendix B). Construction of these facilities would result in topsoil loss and increased erosion potential. DOE would implement best management practices to minimize potential erosion impacts. During construction, the topsoil would be sequestered and stabilized to prevent its permanent loss.

4.2.1.2.3.3 Rail Equipment Maintenance Yard. Construction of the Rail Equipment Maintenance Yard would disturb approximately 0.41 square kilometer (100 acres) (DIRS 176170-Nevada Rail Partners 2006, p. A-5). This area could include the Cask Maintenance Facility, and escort-car and locomotive light-repair garages. It could also house the ***Nevada Railroad Control Center*** and the National Transportation Operations Center. Construction of these facilities would result in topsoil loss and increased erosion potential. DOE would implement best management practices to minimize potential erosion impacts. During construction, the topsoil would be sequestered and regraded to prevent its permanent loss.

4.2.1.2.3.4 Cask Maintenance Facility. The ***Cask Maintenance Facility*** would be used to house the transportation casks, and would process them during routine inspections, cleaning, and repair. The facility would disturb 0.081 square kilometer (20 acres), which would include buildings, a rail yard, and track siding (DIRS 176168-Nevada Rail Partners 2006, p. 1-3). The facility could be in one of three locations: collocated with the Rail Equipment Maintenance Yard, along one of the rail alignment segments outside the ***Yucca Mountain Site boundary***, or at a currently undetermined location outside Nevada.

4.2.1.2.4 Quarries

DOE would develop up to four of six potential quarry sites along the Caliente rail alignment. Each quarry site would contain an operations plant, quarry and production area, access roads, a railroad siding with loading facility, and could contain a conveyor belt (see Figure 2-33). The operations plant would include administrative offices, a parking area, sanitary facilities, and an equipment fueling and service area. The quarry and production area would include the pit, which would vary in size depending on quarry location, a waste-rock pile with a rectangular footprint of 0.057 square kilometer (14 acres), a ballast stockpile, settling ponds, a water well, and emergency generators.

The maximum disturbance area for each quarry was calculated from the areas that would be disturbed from excavating the quarry pit and building the associated plant facilities, roads, railroad siding, and conveyor belts. A construction buffer was also included, and would be reclaimed once construction was completed. The quarry pit would create the largest disturbance area, so if less ballast was needed, or high-quality minerals were excavated, the total disturbance area for the quarry site would likely be much smaller. Depending on the topography, the relative positions of the facilities, and quality and amount of extracted rock, the total area of disturbance from a quarry site would range from 1.3 to 3.8 square kilometers (320 to 930 acres).

Construction and operation of quarries would modify the physical setting in multiple ways. Construction of the buildings, access roads, and conveyer belts would disturb topsoil. During quarry operation, rock extraction would require the removal of the thin soil overburden. The result would be some topsoil loss during quarry construction and operation. Construction and operation of the quarries would also increase the potential for erosion. These impacts would be temporary, limited to the area around the quarry facilities, and DOE would implement best management practices (see Chapter 7) to reduce the impacts. Where practicable, the topsoil would be reserved for reclamation and revegetation. Excavation of bedrock from the pit would result in permanent loss of the mineral resources and change the local topography. However, the quarries would be in areas with abundant mineral resources; therefore, impacts to the overall availability of minerals suitable for quarrying would be small.

After construction, DOE would implement reclamation activities to reduce permanent impacts. The Department would demolish quarry access roads by removing the roadway materials and regrading the area. Terrain restoration around the quarry facility and pit would include restoring quarry pit walls to more stable slopes, grading and replacing topsoil, and revegetating the area (DIRS 176172-Nevada Rail Partners 2006, p. 3-4). Reclamation activities would reduce the direct and indirect topsoil loss and increased erosion impacts caused by quarry construction and operation.

Sections 4.2.1.2.4.1 through 4.2.1.2.4.6 describe potential impacts related to each potential quarry site along the Caliente rail alignment.

4.2.1.2.4.1 Quarry CA-8B. Potential quarry CA-8B would be in hilly terrain west of the Caliente alternative segment. The quarry pit (see Figure 2-24) would be mined from the side of a hill with a vertical relief of 61 meters (200 feet). The ballast produced from this quarry could be a portion of the 2.15 million metric tons (3.47 million tons) required for railroad construction and maintenance. At most, this quarry pit could occupy an area of 0.093 square kilometer (23 acres) to a depth of 61 meters, which would produce approximately 14.5 million metric tons (16 million tons) of ballast (DIRS 176172-Nevada Rail Partners 2006, p. A-2). The actual quarry dimensions would likely be much smaller – approximately 0.04 square kilometer (10 acres) to a depth of 24 meters (80 feet) (DIRS 176172-Nevada Rail Partners 2006, p. 3-2). The entire quarry footprint, including roads, conveyer belt, quarry and production area, and its construction buffer zones would disturb 1.6 square kilometers (400 acres).

Access to quarry CA-8B would be by existing and new roads (DIRS 176172-Nevada Rail Partners 2006, Appendix I). DOE would construct 5.4 kilometers (3.4 miles) of new roadway and would improve 4.3 kilometers (2.7 miles) of existing roadway to access the quarry pit and facilities (DIRS 176172-Nevada Rail Partners 2006, Table 4-7). Excavated ballast would be trucked to the quarry plant, which would be on a nearby plateau. Once the ballast was separated, it would be transported to the Caliente alternative segment by one of two proposed conveyer-belt options. One option would be for the conveyer belt to travel east from the processing plant to the railroad siding. Under the other option, it would travel south and service the Staging Yard. The conveyer belt and service road would disturb a 15-meter (50-foot)-wide path from the processing plant to the rail loading facility. Existing roads would be updated by grading and adding a gravel roadbed.

4.2.1.2.4.2 Quarry NN-9A. Quarry NN-9A is one of two potential quarries along the South Reveille alternative segments. When operational, this quarry could supply a portion of the 3.15 million metric tons (3.47 million tons) of ballast required for railroad construction and maintenance (DIRS 176172-Nevada Rail Partners 2006, p. 3-1). The quarry pit and associated facilities would be east of the junction of South Reveille alternative segments 2 and 3 shown on Figure 2-25. Two 12-meter (40-foot)-high hills would be mined for the ***basalt*** bedrock. For quarry NN-9A, DOE would construct 7.1 kilometers (4.4 miles) of new roadway and would update 15 kilometers (9.5 miles) of existing roads (DIRS 176172-Nevada Rail Partners 2006, Table 4-7). Quarry NN-9A would be able to produce a maximum of 36.3 million metric tons (40 million tons) of ballast excavated out of a 1.3-square-kilometer (330-acre) pit 11 meters (36 feet) deep. There would be two potential plant facilities to the north and south of the quarry pit. Ballast would be trucked along existing County Road 525 to the loading facility on Caliente common segment 3. The disturbance area for the entire quarry footprint would be 2 square kilometers (490 acres).

4.2.1.2.4.3 Quarry NN-9B. Potential quarry NN-9B would be smaller than NN-9A and would be east of the quarry NN-9A location shown on Figure 2-25. Although either quarry would be at the junction of the two South Reveille alternative segments, quarry NN-9B would be closer to South Reveille 2 and would require less road construction and shorter transport routes. This quarry could supply a portion of the 3.15 million metric tons (3.47 million tons) of required ballast (DIRS 176172-Nevada Rail Partners 2006, p. 3-1).

Quarry NN-9B would excavate a 37-meter (120-foot)-high ridge. For quarry NN-9B, DOE would construct 7.1 kilometers (4.4 miles) of new roadway and would update 15 kilometers (9.1 miles) of existing roads (DIRS 176172-Nevada Rail Partners 2006, Table 4-7). Quarry NN-9B would produce 2.72 million metric tons (3 million tons) of ballast from a 0.23-square-kilometer (60-acre) pit 4.6 meters (15 feet) deep. These dimensions would likely be smaller to satisfy the ballast requirements for construction. The ballast from quarry NN-9B would be trucked on new unnamed roads to the loading facility on the selected alternative segment. The disturbance area for the quarry NN-9B construction footprint would be 1.3 square kilometers (320 acres).

4.2.1.2.4.4 Quarry ES-7. Potential quarry ES-7 would be west of Goldfield alternative segment 4 and could be developed if DOE selected Goldfield alternative segment 4 (see Figure 2-26). The quarry pit and plant facilities would be on a 49-meter (160-foot)-high mesa with access to two basalt deposits. DOE could extract a maximum of 8.49 million metric tons (9.36 million tons) of basalt ballast from the 0.11-square-kilometer (27-acre) pit with a depth of 30 meters (100 feet). Depending on the amount of ballast required, the footprint of this quarry would likely be smaller. There could also be a secondary quarry of variable-quality rock in the area. It would be able to produce a maximum of 2.9 million metric tons (3.2 million tons) of ballast from a 37,000-square-meter (9.2-acre) pit 30 meters deep. However, the final dimensions of this secondary quarry would likely be smaller. This quarry could supply a portion of the required 3.15 million metric tons (3.47 million tons) of ballast (DIRS 176172-Nevada Rail Partners 2006, p. 3-1).

Access to the quarry pit and production plant would be via an existing road off U.S. Highway 95, with new roadway construction to extend into the quarry site (DIRS 176172-Nevada Rail Partners 2006, Appendix I). DOE would construct approximately 6.6 kilometers (4.1 miles) of new roadway and would improve approximately 8.4 kilometers (5.2 miles) of existing roadway to access the quarry pit and facilities (DIRS 176172-Nevada Rail Partners 2006, Table 4-7). A conveyer belt would carry the ballast from the production facility to the rail siding. The conveyer belt and correlating service road would be 15 meters (50 feet) wide. The total disturbance area of the quarry footprint would be 1.5 square kilometers (370 acres).

4.2.1.2.4.5 Quarry NS-3A. Potential quarry NS-3A would be on basalt hills in a valley along the eastern side of Goldfield alternative segment 3 (see Figure 2-27) and could be constructed if DOE selected Goldfield alternative segment 1 or 3. The quarry pit might have to be split into two locations because of the large quantities of overburden in the area (DIRS 176172-Nevada Rail Partners 2006, p. D-1). The quarry would be able to produce a maximum of 99.8 million metric tons (110 million tons) of basalt rock from two pits totaling 21 square kilometers (530 acres) with depths ranging from 12 to 30 meters (40 to 100 feet). However, rail line construction would require 3.15 million metric tons (3.47 million tons) of ballast. The ballast would be processed at one of the two potential quarry plant facilities and trucked to the loading facilities along 13 kilometers (8 miles) of existing roads and 3.5 kilometers (2.2 miles) of new road (DIRS 176172-Nevada Rail Partners 2006, Table 4-7). The total quarry footprint disturbance area would be 3.8 square kilometers (940 acres).

4.2.1.2.4.6 Quarry NS-3B. Potential quarry NS-3B would also be on basalt hills along Goldfield alternative segment 3 (see Figure 2-27) (DIRS 176172-Nevada Rail Partners 2006, Appendix I) and could be constructed if DOE selected Goldfield alternative segment 1 or 3. The quarry area would be south of the quarry NS-3A potential location. Basalt rock would be quarried on either side of the rail alignment in 21- to 30-meter (69- to 100-foot) cuts, which would produce a maximum of 27.2 million metric tons (30 million tons) of ballast. The cuts would occupy an area of 12 square kilometers (2,900 acres). The ballast from quarry N3-3B would be trucked on new unnamed roads to the loading facility on Goldfield alternative segment 3. If chosen, this quarry could supply a portion of the required 3.15 million metric tons (3.47 million tons) of ballast. The total quarry footprint disturbance area would be 1.5 square kilometers (370 acres).

4.2.1.3 Railroad Operations Impacts

The proposed railroad would operate for up to 50 years (DIRS 176173-Nevada Rail Partners 2006, p. 4-1). The operations right-of-way would be nominally 61 meters (200 feet) on either side of the centerline of the rail line. By definition, the operations right-of-way would be within the construction right-of-way; therefore, use of the completed rail line to Yucca Mountain would have no additional impact to physical setting beyond the permanent alterations resulting from construction.

Rail line maintenance would require periodic inspections to verify the condition of the track, drainage structures, and rock-wall surfaces. When necessary, rock faces on cuts would be repaired to minimize the potential for rockfall or landslide. Areas along the rail line would also be monitored for evidence of erosion, particularly where there is a high percentage of soils classified as erodes easily (Caliente alternative segment [74 percent], Eccles alternative segment [71 percent], Bonnie Claire alternative segment 2 [26 percent], Bonnie Claire alternative segment 3 [25 percent], and Caliente common segment 4 [41 percent]).

Eroded areas encroaching on the track bed would be repaired, which could include replacement of ballast and subballast to reduce erosion of exposed soils. Although there would be a potential for erosion and landslides along the rail line, the potential would be substantially similar to ***baseline*** conditions, and would be attributed to natural occurrences after construction was completed, not to due to train operations. In addition, DOE would use appropriate slope-stabilizing engineering practices (see Chapter 2) during the construction phase that would reduce hazards from rockfalls and landslides during the operations phase. Section 4.2.8, Noise and Vibration, describes potential impacts from vibration in more detail.

During the operations phase, DOE would continue to monitor seismic activity in the region. DOE would also continue to follow the procedures based on the American Railways Engineering and Maintenance-of-Way Association seismic guidelines it adopted during the construction phase (see Section 4.2.1.2.1.2 and Table 4-1). These measures, also outlined in Chapter 7, would reduce the potential for structural damage and human exposure to seismic hazards.

4.2.1.4 Impacts under the Shared-Use Option

The Shared-Use Option would include the construction and operations activities described in Sections 4.2.1.2 and 4.2.1.3, and private companies would use the rail line for shipment of general freight. Under the Shared-Use Option, potential construction and operations impacts would be very similar to those identified in Sections 4.2.1.2 and 4.2.1.3 for the Proposed Action without shared use.

The Shared-Use Option would require the construction of more rail sidings within the rail line construction right-of-way in areas of relatively flat terrain. A commercial-use interchange facility at the beginning of the line and a facility at the termination point of commercial use to support the Shared-Use Option would also be constructed within the construction right-of-way. Implementation of the Shared-

Use Option would increase the area of surface disturbance by less than 0.1 percent (see Chapter 2). There would be a potential for topsoil loss and increased erosion in this area.

Under the Shared-Use Option, the rail line would likely be in use for more than 50 years, compared to the railroad operations life under the Proposed Action without shared use. Shared use of the proposed rail line would add no impacts to physical setting beyond the permanent alterations already described.

4.2.1.5 Summary

Table 4-9 summarizes potential impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment. With the exception of topsoil loss, the overall impacts would be small because of the best management practices or ***mitigation*** measures DOE would implement (see Chapter 7). There would be a potential for increased erosion because relatively undisturbed land would be extensively graded. Impacts related to soil erosion or loss of topsoil would be small, because implementation of best management practices would effectively reduce the potential for increased erosion and sedimentation that could occur during construction activities. In addition, soil disturbance would be distributed throughout several counties, reducing the concentration of increased soil erosion.

The Caliente rail alignment would cross faults in Nevada, a seismically active area. However, DOE would adopt the American Railway Engineering and Maintenance-of-Way Association seismic guidelines. Additional seismic monitoring procedures would also be implemented during the construction and operations phases. Construction of the rail alignment would avoid known commercial mineral deposits, and would not remove them from permanent use. The quarries and borrow sites that would be opened and used for supplying the ballast and subballast would remove mineral resources from the area. However, construction would consume only a small percentage of the total available supply of these materials over several counties. There would be no additional impacts to the physical setting from the railroad operations under the Proposed Action or the Shared-Use Option.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 1 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment		
Caliente alternative segment (Lincoln County)	Total surface disturbance: 3.1 square kilometers, would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.16 square kilometer; less than 0.1 percent of prime farmland soils in Lincoln County. Small impact to local mineral resources due to potentially disturbed perlite deposits near the alternative segment.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 2 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment (continued)		
Eccles alternative segment (Lincoln County)	Total surface disturbance: 2.1 square kilometers, would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.1 square kilometer; less than 0.1 percent of prime farmland soils in Lincoln County. Small impact to local mineral resources due to potentially disturbed perlite deposits near the alternative segment.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 1 (Lincoln County and Nye County)	Total surface disturbance: 12 square kilometers, would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 1.2 square kilometer; less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties. Small impact to limestone resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Garden Valley alternative segments 1, 2, 3, and 8 (Lincoln County and Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Garden Valley 1 = 3.4 square kilometers Garden Valley 2 = 3.6 square kilometers Garden Valley 3 = 3.7 square kilometers Garden Valley 8 = 3.7 square kilometers Loss of prime farmland soils: Garden Valley 1 = 0.29 square kilometers Garden Valley 2 = 0.4 square kilometers Garden Valley 8 = 0.36 square kilometers Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties. No impacts to limestone resources due to location.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 2 (Lincoln County and Nye County)	Total surface disturbance: 4.1 square kilometers, would result in topsoil loss and increased potential for erosion. No impact to mineral or geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
South Reveille alternative segments 2 and 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: South Reveille 2 = 4.8 square kilometers South Reveille 3 = 5 square kilometers No impact to mineral or geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 3 (Nye County)	Total surface disturbance: 10 square kilometers, would result in topsoil loss and increased potential for erosion. Small potential impact to barite, gold, silver, and geothermal resources due to location of common segment.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 3 of 4).

Rail line segment/facilities (county)	Construction impacts	Operations impacts
Rail line segment (continued)		
Goldfield alternative segments 1 and 4 (Nye County and Esmeralda County) Goldfield alternative segment 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Goldfield 1 = 9.8 square kilometers Goldfield 3 = 10.2 square kilometers Goldfield 4 = 6.5 square kilometers Potential impacts to metallic and nonmetallic resources would be small.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 4 (Nye County and Esmeralda County)	Total surface disturbance: 1.1 square kilometers, would result in topsoil loss and increased potential for erosion. Small impacts to metallic and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Bonnie Claire alternative segments 2 and 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Bonnie Claire 2 = 1.9 square kilometers Bonnie Claire 3 = 1.9 square kilometers Small impacts to metallic mineral resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Common segment 5 (Nye County)	Total surface disturbance: 3.1 square kilometers, would result in topsoil loss and increased potential for erosion. Small impact to metallic mineral and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Oasis Valley alternative segments 1 and 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Oasis Valley alternative segment 1 = 1 square kilometer Oasis Valley alternative segment 3 = 1.3 square kilometers Small impacts to mineral resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Common segment 6 (Nye County)	Total surface disturbance: 5.5 square kilometers, would result in topsoil loss and increased potential for erosion. Small impacts to mineral and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Facilities		
Access roads (included in total surface disturbance in individual segments) (Lincoln, Nye, and Esmeralda Counties)	Total surface disturbance: 3.4 square kilometers, would result in topsoil loss and increased potential for erosion. Alteration of prime farmland soils (see table entries for Caliente alternative segment, Eccles alternative segment, and Caliente common segment 1)	Potential for soil erosion in localized areas along access roads; implementation of erosion prevention methods would reduce impacts.
Facilities at the Interface with the Union Pacific Railroad Mainline (includes the Interchange Yard, the Staging Yard, and the Satellite Maintenance-of-Way Facility) (Lincoln County)	Total surface disturbance: 0.26 square kilometer, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facilities; implementation of erosion prevention methods would reduce impacts.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 4 of 4).

Rail line segment/facilities (county)	Construction impacts	Operations impacts
Quarries		
Maintenance-of-Way Facilities (includes the Maintenance-of-Way Headquarters Facility and the Maintenance-of-Way Trackside Facility) (Lincoln, Nye, and Esmeralda Counties)	Total surface disturbance: 0.073 square kilometer, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facilities; implementation of erosion prevention methods would reduce impacts.
Rail Equipment Maintenance Yard (includes Cask Maintenance Facility) (Nye County)	Total surface disturbance: 0.41 square kilometer, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facility; implementation of erosion prevention methods would reduce impacts.
Water wells (Lincoln, Nye, and Esmeralda Counties)	Total surface disturbance: 0.11 square kilometer, would result in topsoil loss and increased potential for erosion. (137 potential well sites with 231 potential wells; 117 well sites would be within the nominal width of the construction right-of-way; 20 well sites would be outside the nominal width of the construction right-of-way, at 0.0057 square kilometer surface disturbance at each well site)	Potential for soil erosion in localized areas around the well sites; implementation of erosion prevention methods would reduce impacts.
Potential quarry CA-8B (Lincoln County)	Total surface disturbance: 1.6 square kilometers, would result in topsoil loss and increased potential for erosion. Extraction of all 14.5 million metric tons of rock would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential quarry ES-7 (Nye County)	Total surface disturbance: 1.5 square kilometers, would result in topsoil loss and increased potential for erosion. Extraction of all 11.4 million metric tons from two pits would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential quarries NS-3A and NS-3B (Esmeralda County)	Total surface disturbance: 3.8 (NS-3A) to 1.5 (NS-3B) square kilometers, would result in topsoil loss and increased potential for erosion. NS-3A: Extraction of all 99.8 million metric tons would reduce the availability of local construction mineral materials. NS-3B: Extraction of all 27.2 million metric tons would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.

a. To convert square kilometers to acres, multiply by 247.10; to convert metric tons to tons, multiply by 1.1023.

4.2.2 LAND USE AND OWNERSHIP

This section describes impacts to land use and ownership from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.2.1 describes the methods DOE used to assess potential impacts; Section 4.2.2.2 describes potential impacts to land use during the construction phase; Section 4.2.2.3 describes potential railroad operations impacts; Section 4.2.2.4 describes potential impacts under the Shared-Use Option; and Section 4.2.2.5 summarizes potential impacts to land use and ownership.

Section 3.2.2.1 describes the region of influence for land use and ownership.

4.2.2.1 Impact Assessment Methodology

Table 4-10 lists factors DOE considered to determine potential impacts to land use and ownership from project-related construction and operations activities.

Table 4-10. Impact assessment considerations for land use and ownership.

Land use	Potential for impact
General	Nonconformance with applicable general and regional plans and approved or adopted policies, goals, or operations of communities or governmental agencies
Private land	Change in current land use
	Permanent displacement of existing, developing, or approved urban/industrial buildings or activities (residential, commercial, industrial, governmental, or institutional)
	Loss of ownership or title to private land
American Indian land	Conflict with existing land-use plans or cause incompatible land uses
Department of Defense land	Conflict with existing land-use plans or cause incompatible land uses
Livestock grazing lands	Loss of grazing land and associated ***animal unit months***
	Alteration of livestock operations or disruption of livestock movement
	Change to the amount or distribution of existing stockwater sources
	Potential human disturbance to livestock (such as loss of livestock due to collisions with trains)
Mineral and energy resources	Potential to preclude mining operations or the extraction of oil, gas, and geothermal resources within the rail line construction right-of-way
	Disturbance to existing or proposed mining operations with an approved mining plan
	Potential to cause the collapse of active underground mines, tunnels, or shafts
Recreational areas and access to public or private lands	Potential disturbance to federal, state, local, or private land designated as recreational sites
	Potential alteration of routes for large, recurring organized off-highway vehicle events and races
	Restricted or altered access to federal, state, local, or private recreational sites or public land
	Restricted or altered access to private land
Utility and transportation corridors and rights-of-way	Interference with an existing or planned utility or transportation right-of-way
	Need for a new right-of-way within a BLM-designated right-of-way avoidance area, such as an Area of Critical Environmental Concern

4.2.2.1.1 Assumptions and Approach

DOE assessed potential impacts to land use and ownership along the rail line based on the nominal width of the construction right-of-way.

For railroad construction and operations support facilities, this section describes potential impacts to land use and ownership in conjunction with each facility's nearest segment, based on the current land use at the site. Table 4-11 describes the required support facilities and the current land uses at their proposed locations. Chapter 2 describes the facilities and their locations in more detail.

Because the basis for rail line impacts is the construction right-of-way, impacts from construction camps, some construction wells, and some facilities that would be within the rail line construction right-of-way are included in the analysis of that area and are not addressed separately.

Table 4-11. Land use associated with railroad construction and operations support facilities (page 1 of 2).

Facilities	Number of facilities under the Proposed Action[a,b]	Within the nominal width of the construction right-of-way	Land ownership
Construction camps	Up to 12 Camp 1 would occupy 0.23 square kilometer for the Caliente alternative alignment or 0.05 square kilometer for the Eccles alternative alignment	All but camp 1	BLM-administered public land, except for a portion of camp 1 that would be on private land
Construction wells	Maximum of 107 well sites Area of disturbance for each would be 0.0057 square kilometer	All but 14	Construction wells outside the nominal width of the construction right-of-way would be on BLM-administered land
Quarries	Up to four needed out of six potential sites	No	All on BLM-administered land except for sidings for quarry CA-8B, which would be on private land
Interchange Yard	One on either the Caliente or Eccles alternative segment 0.061 square kilometer of land at Caliente or 0.12 square kilometer at Eccles	No	Would fall within existing Union Pacific Railroad right-of-way
Upland or Indian Cove Staging Yard	One if DOE selected the Caliente alternative segment 0.45 square kilometer at Upland or 0.73 square kilometer at Indian Cove	No	Private land
Eccles-North Staging Yard	Required if DOE selected the Eccles alternative segment, occupying 0.3 square kilometer	No	BLM-administered public land
Maintenance-of-Way Trackside Facility	One required	Yes	BLM-administered public land

Table 4-11. Land use associated with railroad construction and operations support facilities (page 1 of 2).

Facilities	Number of facilities under the Proposed Action[a,b]	Within the nominal width of the construction right-of-way	Land ownership
Maintenance-of-Way Headquarters Facility	One, occupying 0.013 square kilometer of land	No	BLM-administered public land
Rail Equipment Maintenance Yard	Includes the Satellite Maintenance-of-Way Facility, possibly the Nevada Railroad Control Center and National Transportation Operations Center	No	DOE-managed land (Yucca Mountain Site)[c]
Cask Maintenance Facility	One This facility has three location options: (1) collocated with the Rail Equipment Maintenance Yard, (2) anywhere along the rail line outside the Yucca Mountain Site boundary, or (3) anywhere outside Nevada	No	For purposes of analysis, collocated with the Rail Equipment Maintenance Yard

a. To convert square meters to square feet, multiply by 10.76.
b. To convert square kilometers to acres, multiply by 247.10.
c. DOE would implement the Proposed Action only after the proposed public land withdrawal for the Yucca Mountain Site was completed, when control of the land would be transferred to DOE.

Although not all the well locations identified would be used for the project, for purposes of analysis and to conservatively estimate impacts to land use and ownership, DOE assumes that it would develop all the well locations outside the rail line construction right-of-way and footprints of the quarry sites.

4.2.2.2 Construction Impacts to Land Use and Ownership

Sections 4.2.2.2.1 through 4.2.2.2.8 discuss potential land-use impacts during the construction phase. Because potential impacts to land use would occur primarily from the presence of the rail line, the construction timeframe (which could range from 4 to 10 years) would have little effect on the resulting land-use impacts, other than to provide greater lead time to implement mitigation measures, establish land-use agreements, and revise grazing allotment permits where applicable. Therefore, DOE did not assess potential land-use impacts for different construction timeframes.

Table 4-12 provides an overview of land ownership within the rail line construction right-of-way and the locations of support facilities.

4.2.2.2.1 Private Land

4.2.2.2.1.1 County and Local Land-Use Plans. In general, DOE developed the Caliente rail alignment to avoid private land. There would be no land-use conflicts in terms of county land uses, projects, or planning.

- *Lincoln County Master Plan* (DIRS 174520-State of Nevada 2001, all)

This plan addresses the proposed Yucca Mountain Repository and discusses the potential impacts of the repository on the county, which include an anticipated increase in ***demand*** for housing, schools, medical services, police and fire protection, and highway patrols due to rail or facility workers in Caliente. Lincoln County also proposes to revise its Emergency Management Plan to address the issue of hazardous cargo transport along U.S. Highway Route 93 and other roads in the county (DIRS 174520-State of Nevada 2001, p. 24).

Table 4-12. Land ownership by alternative segment and common segment within the rail line construction right-of-way and facilities outside the construction right-of-waya.

Rail line segment or facility	Land ownership	Area (square kilometers)[b]	Area (acres)
Caliente alternative segment	Private	0.31	77
	Public (BLM-administered)	0.35	87
Staging Yard, Caliente-Indian Cove	Private	0.73	180
Staging Yard, Caliente-Upland	Private	0.45	110
Construction camp 1 (Caliente alternative segment)	Private	0.15	38
	Public (BLM-administered)	0.08	21
Potential quarry CA-8B	Private	0.27	66
	Public (BLM-administered)	1	330
Eccles alternative segment	Private	0.31	77
	Public (BLM-administered)	4.5	1,130
Staging Yard, Eccles-North	Public (BLM-administered)	0.30	74
Construction camp 1 (Eccles alternative segment)	Private	0.005	1.4
	Public (BLM-administered)	0.05	12
Caliente common segment 1	Private	0.001	0.2
	Public (BLM-administered)	35	8,540
Garden Valley alternative segment 1	Public (BLM-administered)	11	2,590
Garden Valley alternative segment 2	Public (BLM-administered)	11	2,620
Garden Valley alternative segment 3	Public (BLM-administered)	11	2,830
Garden Valley alternative segment 8	Public (BLM-administered)	10	2,550
Caliente common segment 2	Public (BLM-administered)	15	3,690
South Reveille alternative segment 2	Public (BLM-administered)	56	1,370
South Reveille alternative segment 3	Public (BLM-administered)	6.0	1,490
Caliente common segment 3	Public (BLM-administered)	33	8,270
Goldfield alternative segment 1	Private	0.37	91
	Public (BLM-administered)	13	3,330
Goldfield alternative segment 3	Private	0.01	2.4
	Public (BLM-administered)	15	3,780
Goldfield alternative segment 4	Private	0.23	56
	Public (BLM-administered)	16	3,850
Caliente common segment 4	Public (BLM-administered)	3.5	870
Bonnie Claire alternative segment 2	Public (BLM-administered)	6.1	1,520
Bonnie Claire alternative segment 3	Public (BLM-administered)	6.1	1,500
Common segment 5	Public (BLM-administered)	12	2,950
Oasis Valley alternative segment 1	Private	0.04	9.9
	Public (BLM-administered)	3.8	940
Oasis Valley alternative segment 3	Public (BLM-administered)	5.3	1,300
Common segment 6	Public (BLM-administered)	12	2,880
	Public (DOE)	4.1	1,020

a. Source: DIRS 181617-Hopkin 2007, all.
b. Values are rounded to two significant figures, except for areas larger than 1,000 acres, which are rounded to nearest value of 10.

- *Nye County Comprehensive Plan* (DIRS 147994-McRae 1994, all)

  This plan addresses the proposed Yucca Mountain Repository and states that the repository could affect the county's future economy and the quality of life of its residents. The plan does not address the proposed railroad. However, DOE has determined that a rail line along the Caliente rail alignment would not substantially alter current land uses or impact future land-use plans in Nye County.

- *Esmeralda County Master Plan* (DIRS 176770-Duval et al. 1976, all)

  This plan predates plans for a repository at Yucca Mountain; therefore, it does not address the project. The plan states that the county must be consulted on all proposed federal projects. DOE continues to consult Esmeralda County (and other affected counties) on the Proposed Action. DOE has determined that a rail line along the Caliente rail alignment would not substantially alter current land uses or impact future land-use plans in Esmeralda County. The only private land that would be affected within an established town in Esmeralda County would be along Goldfield alternative segment 4 (see discussion in Section 4.2.2.2.1.2).

None of the three county plans discusses proposed or existing land uses along the Caliente rail alignment. Although there are no land-use plans at the county level, DOE does not anticipate potential land-use conflicts in relation to future county projects and planning.

- *City of Caliente Master Plan* (DIRS 157312-Sweetwater and Anderson 1992, all)

  This plan acknowledges that railroad operations will continue to be a primary economic activity in the City of Caliente. The Caliente alternative segment would utilize the former Pioche and Prince Branchline of the Union Pacific Railroad and the proposed Staging Yard on the alternative segment would be north of the city at either Indian Cove or Upland. Locating the Staging Yard north of the city would reduce disruption to the community due to noise, traffic, dust, and trains blocking the vehicle crossing, in accordance with the provisions of the master plan (DIRS 157312-Sweetwater and Anderson 1992, p. 54). The master plan also directs new residential development and "major economic centers" to the north of the city, but does not indicate exact locations. Possible future residential clustering near the Caliente alternative segment within or north of the city may be deemed an incompatible land use due to train noise. However, the Caliente alternative segment would not pose a direct conflict with current land zoning within the City of Caliente. The lands encompassing the former Pioche and Prince Branchline within the City of Caliente do not have any zoning designation. Current land zoning surrounding the Caliente alternative segment in the city is largely commercial or industrial, although the Lincoln County Hospital, senior citizen apartments, and a trailer court are immediately west of U.S. Highway 93; all of these locations are well outside the proposed construction right-of-way. While there is no zoning within the former branchline right-of-way within the city, adjacent property owners, such as the Caliente Hot Springs Motel, have come to use portions of this land. Section 4.2.2.2.1.2 discusses impacts to individually owned private parcels.

Although there is no zoning designation in the community of Goldfield, the designation of its historic district is a consideration for determining potential adverse impacts to land use. The historic district would be approximately 0.6 kilometer (0.4 mile) from the Goldfield alternative segment 4 construction right-of-way. Goldfield has been historically linked with both mining and railroad activity. Therefore, a new rail line adjacent to the town would not be a wholly incompatible feature with its historic characteristics. The BLM, DOE, and the Surface Transportation Board (STB) signed a Programmatic Agreement regarding the Yucca Mountain rail alignment project with the Nevada State Historic Preservation Office on April 17, 2006, to formalize the consultation process (DIRS 176912-Wenker et al. 2006, all). Appendix M is a copy of the Programmatic Agreement. As for any other potential cultural resources along the rail alignment, DOE would consult with the State Historic Preservation Office to determine potential impacts and possible mitigation measures (see discussion in Section 4.2.13, Cultural Resources).

4.2.2.2.1.2 Private Parcels. DOE would need to gain access to private land that falls within the Caliente rail alignment construction right-of-way and the locations of support facilities. Segments that would cross private lands include the Caliente alternative segment, the Eccles alternative segment, Caliente common segment 1, Goldfield alternative segment 4, and Oasis Valley alternative segments 1, 3, and 4. None of the other segments would cross private land.

While the nominal width of the rail line construction right-of-way would be 300 meters (1,000 feet), DOE would reduce the area of disturbance in some areas to minimize impacts to private land. For example, along the Caliente alternative segment, the area of disturbance would be 31 meters (100 feet). Where practicable, DOE would also reduce the area of disturbance (variable widths) adjacent to private lands near Goldfield to avoid individual parcels.

Land uses along the Caliente and Eccles alternative segments construction rights-of-way and facilities locations consist of private residential, commercial, and industrial uses concentrated along U.S. Highway 93, and ranch lands and residential uses dispersed beyond the municipal jurisdiction of the City of Caliente. There would be direct impacts to private property within the Caliente rail alignment construction right-of-way, resulting in changes of land use.

The Caliente alternative segment construction right-of-way would encompass or cross 32 parcels totaling 0.31 square kilometer (77 acres) (see Table 4-12 and Figure 3-14). These 32 parcels have 22 property owners. The Eccles alternative segment would cross 11 private parcels totaling 0.32 square kilometer (80 acres) (see Table 4-13). These 11 parcels have 10 property owners.

The parking lot and access road to the Caliente Hot Springs Motel would lie within the Caliente alternative segment construction right-of-way. While the ownership of this land along the former Pioche and Prince Branchline is uncertain, the motel has used this land for many years. The motel could be adversely affected because of the rail line's proximity. If DOE selected the Caliente alternative segment, the Department would negotiate with the motel owner to gain access to the land. The likely socioeconomic impacts to the motel would be a consideration when determining compensation.

In addition, there are three structures on residential properties that would be within the Caliente alternative segment construction right-of-way. DOE would need to gain access to these private lands, and the structures could be demolished or relocated.

The Caliente alternative segment would also pass through the location of existing Union Pacific Railroad buildings, requiring their demolition or relocation.

Construction of the Staging Yard at the Caliente-Indian Cove location would require access to 0.73 square kilometer (180 acres) of land across 6 parcels west of the rail alignment with four owners and at present used for ranching and farming. Construction of the Staging Yard at Caliente-Upland would require acquisition of approximately 0.45 square kilometer (110 acres) across 17 parcels with 12 owners.

Section 4.2.2.2.3.2 discusses the Eccles-North location for the Staging Yard, which would be on public land.

The rail siding for potential quarry CA-8B would be on private land, across two parcels occupying 0.27 square kilometer (66 acres) of land.

There are two private parcels within the construction right-of-way of Caliente common segment 1. The first is near the easternmost end of the segment in Meadow Valley. Approximately 810 square meters (0.2 acre) would be within the construction right-of-way (see Figure 3-14).

Table 4-13. Uses of private land along the Caliente and Eccles alternative segments.[a]

Alternative segment and land use	Number of parcels within the construction right-of-way	Area of parcels within the construction right-of-way (square meters)[b]
Caliente alternative segment		
Vacant	17	75,000
Residential	42	6,400
Commercial	1	260
Industrial	1	80
Rural	10	225,000
Unknown[c]	1	6,100
Eccles alternative segment		
Vacant	6	7,500
Residential	2	1.400
Rural	3	315,000

a. Source: DIRS 181617-Hopkins 2007, all.
b. To convert square meters to acres, multiply by 0.000247.
c. According to the Land Ownership Geographic Information System datasets for the Caliente rail alignment, one parcel of land has a land-use code listed as "unknown."

Goldfield alternative segment 1 would cross the most private land of the Goldfield alternative segments (six parcels covering 0.37 square kilometer [91 acres] of land). Goldfield alternative segment 3 would cross the least amount of private land (0.01 square kilometer [2.4 acres]) among the Goldfield alternative segments. Goldfield alternative segment 4 would pass to the immediate west and south of the community of Goldfield, which is clustered along U.S. Highway 95. The Goldfield alternative segment 4 construction right-of-way would intersect 37 privately owned parcels (including four patented ***mining claims***) with at least 20 individual landowners (0.225 square kilometer [56 acres]) (see Table 4-14 and Figure 3-23). Esmeralda County owns 12 of the 37 parcels, and the Nevada Department of Highways owns one parcel (while state and county entities own 13 parcels, they are non-federal lands and still

considered private land in this Rail Alignment EIS). DOE would gain access to portions of privately owned land if the Department selected Goldfield alternative segment 4. This would result in direct impacts to private land within the construction right-of-way, resulting in change of land use.

The Oasis Valley alternative segment 1 construction right-of-way would cross one parcel owned by a cattle company (see Figure 3-25), impacting 0.04 square kilometer (9.9 acres) of land. DOE would need to gain access to this land, causing a change in land use.

4.2.2.2.2 American Indian Land

During the first scoping period for this Rail Alignment EIS in 2004, DOE received comments from the Western Shoshone Nation indicating that a rail line crossing Timbisha Shoshone Trust Land would be incompatible with current and planned land uses. The opposition was based, in part, on treaty issues involving land in the vicinity of the Caliente rail alignment (see Section 3.4). The Department subsequently eliminated Bonnie Claire alternative segment 1, which would have crossed onto Timbisha Shoshone Trust Land, from analysis.

4.2.2.2.3 BLM-Administered Public Land

4.2.2.2.3.1 Consistency with BLM Resource Management Plans. Some portions of the Caliente rail alignment would cross federal land the BLM has identified for potential disposal (sale). The ***withdrawal*** of these lands along the rail alignment for other federal use would take precedence over potential land disposals.

Table 4-14. Uses of private land along the Goldfield alternative segments.

Segment and land use	Number of parcels within the construction right-of-way	Area of parcels within the construction right-of-way (square meters)[a]
Goldfield alternative segment 1	6 (all patented mining claims)	370,000
Goldfield alternative segment 3	2 (both patented mining claims)	10,000
Goldfield alternative segment 4		
Vacant	27	78,100
Residential	1	470
Commercial	1	65
Utilities	4	9,500
Patented mining claims	4	137,000

a. To convert square meters to acres, multiply by 0.000247.

While this federal use would not pose a conflict with BLM ***resource management plans***, the community or public would lose the ability to use affected land for future economic or private development.

DOE reviewed existing documentation to determine whether construction and operation of the proposed railroad along the Caliente rail alignment would be consistent with existing land-use plans and policies.

- *Draft Resource Management Plan/Environmental Impact Statement for the Ely District* (Draft Ely District Resource Management Plan; DIRS 174518-BLM 2005, all)

  The Draft Ely District Resource Management Plan preferred alternative proposes to dispose of public lands north of Caliente through which portions of the Caliente and Eccles alternative segments would pass. The lands within the proposed rail alignment are withdrawn under Public Land Order 7653 (70 *Federal Register* 76854), and the withdrawal supersedes the planned land disposal on affected property; therefore, the proposed railroad project does not currently conflict with the plan. In conformance with the Draft Ely District Resource Management Plan, the rail line would not pass through designated or potential ***Areas of Critical Environmental Concern***. In addition, in conformance with the plan, the rail alignment construction right-of-way would conform to the criteria of the plan, and would be less than 0.8 kilometer (0.5 mile) wide. Although the rail alignment would not be entirely located within the existing designated corridors, under the plan's preferred alternative, the BLM can grant rights-of-way on a case-by-case basis. Section 4.2.11 of this Rail Alignment EIS describes potential impacts on utilities.

- *Tonopah Resource Management Plan and* ***Record of Decision*** (Tonopah Resource Management Plan; DIRS 173224-BLM 1997, all)

  The Tonopah Resource Management Plan designates 1,075 kilometers (668 miles) for transportation and utility corridors (DIRS 173224-BLM 1997, p. 2). It also allows rights-of-way on more than 600 square kilometers (149,000 acres) if the land use is compatible with existing land values. The plan identifies areas for potential disposal at Goldfield, Scottys Junction, and Beatty. The Tonopah Resource Management Plan does not specifically address the portions of land released from withdrawal in 1999 adjacent to (on the western border of) the Nevada Test and Training Range. Because withdrawal for other federal use has precedence over potential land disposals, there would be no conflict with the Tonopah Resource Management Plan.

- *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (Las Vegas Resource Management Plan; DIRS 176043-BLM 1998, all)

  The Las Vegas Resource Management Plan designates corridors within its planning area to avoid Areas of Critical Environmental Concern. The proposed rail alignment would not pass through or near any right-of-way avoidance areas, such as Areas of Critical Environmental Concern. The portion of the rail alignment (common segment 6) that would pass through this district would be on land for which DOE already has a temporary right-of-way and a portion of which is slated for future land withdrawal for the Yucca Mountain Project. Therefore, there would be no conflict with the Las Vegas Resource Management Plan.

BLM-administered lands encompassing the Caliente rail alignment have been withdrawn from surface and mineral entry to avoid land-use conflicts in the near term (70 *FR* 76854, December 28, 2005). Furthermore, this withdrawal takes precedence over potential land disposals that might be planned in and around the rail alignment. Under the terms of the BLM land-disposal policy, identification of the lands for another federal purpose, such as the proposed railroad, would disqualify the land for disposal for other uses. Therefore, there would be conflict with current BLM land-use plans or policies.

4.2.2.2.3.2 Construction Impacts to BLM Grazing Allotments. Construction of the rail line and support facilities would result in surface disturbance across a number of grazing allotments. Wherever the rail line would cross a grazing allotment, DOE quantified the amount of forage loss in animal unit months.

DOE calculated potential loss of animal unit months as the proportion of land within each grazing allotment that would be crossed by the footprints of the rail line construction right-of-way and support facilities. The Department did not consider site-specific allotment characteristics. The BLM would determine actual loss of animal unit months for each affected allotment in association with the issuance of a ***right-of-way grant***. For this analysis, DOE conservatively assumed that all the area within the rail line construction right-of-way would be unavailable for forage. Section 4.2.9, Socioeconomics, describes the economic consequences of reductions in permitted animal unit months.

The presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes and acclimate to and cross the rail line in most areas. The rail line could pose additional risk to ranching operations because livestock could be struck by passing trains. DOE or the commercial user (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate. The rail line could intersect existing fences on active grazing allotments. The BLM and DOE would review with the affected allotment permittees the need to restore fences.

The Caliente rail alignment would cross a number of stockwater pipelines on active ***grazing allotments***. During the construction phase, DOE would sleeve these pipelines within a casing pipe under the rail roadbed to protect them and keep them operational. The casing pipe would be capable of withstanding the load of the roadbed, track, and rail traffic.

There would also be a number of new construction wells on grazing allotments outside the construction right-of-way. The well footprints would be small (approximately 0.0057 square kilometer [0.4 acre] each) and would not affect grazing patterns except for the presence of human activity during the construction phase.

The Maintenance-of-Way Headquarters Facility would be in Esmeralda County, approximately 8 kilometers (5 miles) southeast of Tonopah along U.S. Highway 95 (see Figure 2-50). It would occupy approximately 0.013 square kilometer (3.2 acres) of vacant, BLM-administered land. The facility would be within the Silver King allotment, which at present is unused (DIRS 176942-Metscher 2006, all). There is no specific segment or alignment associated with the Maintenance-of-Way Headquarters Facility. Although there is no active grazing on this land, because a permanent structure would be constructed, there would be long-term changes in land use.

Alternative Segments at the Interface with Union Pacific Railroad Mainline

Caliente Alternative Segment: This alternative segment would run along the former Union Pacific Railroad Pioche and Prince Branchline, generally parallel and east of U.S. Highway 93 (see Figure 3-27). It would cross the Comet and Panaca Allotments. There would be no stockwater sources within the Caliente alternative segment construction right-of-way. Overall, using the nominal width of the construction right-of-way, the Caliente alternative segment would encompass approximately 0.81 square kilometers (200 acres) of grazing allotment land. The loss of this amount of grazing land could result in the total loss of up to five animal unit months across all three affected allotments (see Table 4-15).

Approximately 1.3 square kilometers (320 acres) of grazing land on the Highway Allotment would be affected if DOE developed potential quarry CA-8B. Quarry CA-8B would impact 7.6 percent of the allotment. Assuming a direct correlation between allotment size and animal unit months, the quarry could reduce the animal unit months on this allotment by nine. Quarry CA-8B would also impact 0.07 square kilometer (18 acres) of grazing land on the Peck Allotment. Similarly, this could reduce animal unit months on the Peck Allotment by less than one.

Eccles Alternative Segment: The Eccles alternative segment would cross the Clover Creek, Little Mountain, Peck, and Comet Allotments (see Figure 3-27). At present, the Little Mountain Allotment is not active. The rail alignment would intersect fences that separate the Peck and Comet Allotments and the Peck and Little Mountain Allotments. There would be no stockwater sources within the Eccles alternative segment construction right-of-way. Overall, the Eccles alternative segment would encompass approximately 4.8 square kilometers (1,200 acres) of grazing allotment land. Assuming a direct correlation between allotment size and animal unit months, the Eccles alternative segment could reduce animal unit months by 18 (see Table 4-15).

The Eccles alternative segment Interchange Yard would fall within the current Union Pacific Railroad right-of-way within the Clover Creek Allotment, running parallel to the north side of the existing Union Pacific tracks. Because the Interchange Yard would be within the existing Union Pacific Railroad right-of-way, there would no additional impacts to grazing uses on this land. The Eccles-North location for the Staging Yard would be entirely on BLM-administered land within the Peck Allotment, occupying approximately 0.3 square kilometer (74 acres) of land within the Eccles alternative segment construction right-of-way. The Eccles-North Staging Yard would reduce animal unit months by 2.

Caliente Common Segment 1 (Dry Lake Valley Area): Caliente common segment 1 would cross the Comet, Rocky Hill, Bennett Spring, Black Canyon, Ely Springs Cattle, Rattlesnake, Wilson Creek, Timber Mountain, Sunnyside, and Needles Allotments. Figures 3-27 and 3-28 show these grazing allotments and their stockwater features. Overall, using the nominal width of the construction right-of-way, common segment 1 would encompass approximately 35 square kilometers (8,600 acres) of grazing allotment land and could result in an overall loss of up to 453 animal unit months (see Table 4-16) across the 10 affected allotments (a potential 0.7-percent loss overall).

Garden Valley Alternative Segments: Garden Valley alternative segments 1 and 3 would cross the Needles, Batterman Wash, Pine Creek, Cottonwood, and McCutcheon Springs Allotments. Garden Valley 2 and 8 would cross the Coal Valley Lake, Pine Creek, Cottonwood, McCutcheon Springs, and Needles Allotments. Figure 3-29 shows the grazing allotments along the Garden Valley alternative segments. Table 4-17 lists the potential reduction in animal unit months for allotments the Garden Valley alternative segments would cross.

Table 4-15. Potential loss of animal unit months associated with the Caliente and Eccles alternative segments.

Alternative segment/facility/ allotment	Construction right-of-way or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Calculated loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Caliente alternative segment				
Comet	0.71	214 on 37 square kilometers	4	1.9
Panaca Cattle	0.02	453 on 66 square kilometers	1	0.2
Peck[c]	0.08	397 on 72 square kilometers	1	0.2
Totals	0.8[d]	1,064 animal unit months	6	0.6
Eccles alternative segment				
Clover Creek	0.15	613 on 93 square kilometers	1	0.2
Little Mountain	1.8	Grazing permit relinquished to BLM; allotment closed	Not applicable	Not applicable
Peck[c]	2.4	397 on 72 square kilometers	14	3.5
Comet	0.44	214 on 37 square kilometers	3	1.4
Totals	4.8[d]	1,224 animal unit months	18	1.5
Potential quarry CA-8B				
Highway	1.3	118 on 17 square kilometers	9	7.6
Peck	0.07	397 on 72 square kilometers	1	0.3
Eccles-North Staging Yard				
Peck	0.3	397 on 72 square kilometers	2	0.5

a. Source: DIRS 174518-BLM 2005, Table R-1.
b. To convert square kilometers to acres, multiply by 247.10.
c. Includes construction camp 1.
d. Rounded to two significant digits.

Caliente Common Segment 2 (Quinn Canyon Range Area): Caliente common segment 2 would cross the McCutcheon Springs, Sand Springs, and Reveille Allotments (see Figures 3-29 and 3-30). The Sand Springs Allotment has two permittees. Overall, using the nominal width of the construction right-of-way, common segment 1 would encompass approximately 16 square kilometers (4,000 acres) of allotment land and could reduce animal unit months across the three allotments by 0.4 percent (128 animal unit months total) (see Table 4-18).

South Reveille Alternative Segments: The South Reveille alternative segments (see Figure 3-30) would be on the southern portion of the Reveille Allotment. There are no stockwater features within the South

Reveille alternative segments construction rights-of-way. South Reveille alternative segments 2 and 3 could reduce animal unit months on the Reveille Allotment by 54 and 58, respectively (see Table 4-19).

Potential quarry sites NN-9A and NN-9B would also be on the Reveille Allotment. These quarries would occupy 2 and 1.3 square kilometers (500 and 320 acres), respectively. Individually, either quarry would result in less than a 0.1-percent reduction in land area on the Reveille Allotment and between 13 and 19 lost animal unit months (see Table 4-19).

Caliente Common Segment 3 (Stone Cabin Valley Area): Caliente common segment 3 would pass through the Reveille, Stone Cabin, and Ralston Allotments (see Figures 3-30 and 3-31). At present, the Ralston Allotment is not occupied (DIRS 176942-Metscher 2006, all).

Common segment 3 would encompass approximately 36 square kilometers (9,000 acres) of allotment land. The loss of this amount of grazing land could reduce assigned animal unit months by 250, a potential 0.6-percent loss overall (see Table 4-20).

The Maintenance-of-Way Trackside Facility would span the boundary of the Stone Cabin and Ralston Allotments. The facility would be entirely within the rail line construction right-of-way. Therefore, loss of animal units months associated with this facility is accounted for in the assessment of the common segment 3 construction right-of-way shown above.

Goldfield Alternative Segments: All of the Goldfield alternative segments would cross the northern portion of the Montezuma Allotment (see Figure 3-31). At present, this allotment has no permittees. The northernmost parts of Goldfield alternative segments 1 and 4 would pass through the Ralston Allotment, which is also inactive (DIRS 176942-Metscher 2006, all).

Potential quarry sites NS-3A, NS-3B, and ES-7 would all be within the Montezuma Allotment. These quarries would require up to 3.8, 1.5, and 1.5 square kilometers (930, 370 and 360 acres), respectively. Because the allotment is inactive, there would be no impacts to grazing associated with any of these quarries.

Caliente Common Segment 4 (Stonewall Flat Area): Caliente common segment 4 would also pass through the inactive Montezuma Allotment (see Figures 3-31 and 3-32). Because the allotment is inactive, there would be no impacts to grazing activities or stockwater resources during rail line construction along common segment 4.

Bonnie Claire Alternative Segments: The Bonnie Claire alternative segments would cross a narrow stretch of the inactive Montezuma Allotment west of the Nevada Test and Training Range and east of the Magruder Mountain Allotment (see Figure 3-32). Because the Montezuma Allotment is inactive, there would be no impacts to grazing activities or stockwater resources during rail line construction along either of the Bonnie Claire alternative segments.

Common Segment 5 (Sarcobatus Flat Area): Common segment 5 would pass through the southern portion of the inactive Montezuma Allotment near the southwestern boundary of the Nevada Test and Training Range (see Figures 3-32 and 3-33). Because the Montezuma Allotment is inactive, rail line construction along common segment 5 would not impact grazing activities or stockwater resources.

Oasis Valley Alternative Segments: The Oasis Valley alternative segments would cross the inactive Montezuma Allotment and the active Razorback Allotment (see Figure 3-33). The Razorback Allotment has one permittee. Oasis Valley alternative segment 1 would pass near the northeastern corner of the small Springdale 2 Allotment, but its construction right-of-way would not fall within the allotment. There are no stockwater features within the construction right-of-way of either of the Oasis Valley alternative segments.

Table 4-16. Potential loss of animal unit months associated with Caliente common segment 1.

Allotment	Construction right-of-way area or impact area (square kilometers)[a,b]	Current animal unit months (maximum) and allotment area[c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Comet	1.1	214 on 37 square kilometers	6	2.8
Rocky Hill	0.2	Grazing permit relinquished to BLM	Not applicable	Not applicable
Bennett Spring	5.1	3,498 on 200 square kilometers	89	2.6
Black Canyon	1.6	1,105 on 34 square kilometers	52	4.7
Ely Springs Cattle	5.8	4,248 on 220 square kilometers	112	2.6
Rattlesnake	0.53	1,180 on 120 square kilometers	5	0.4
Wilson Creek	7.4	48,250 on 4,360 square kilometers	82	0.2
Timber Mountain	3.1	2,373 on 180 square kilometers	41	1.8
Sunnyside	5.5	5,402 on 890 square kilometers	33	0.6
Needles	4.3	2,679 on 350 square kilometers	33	1.2
Totals	35.0[c]	68,949 animal unit months	453	0.7[d]

a. To convert square kilometers to acres, multiply by 247.10.
b. Land area values are rounded to two significant figures except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.
c. Source: DIRS 174518-BLM 2005, Table R-1.
d. This is not column total; it is a value calculated using the totals from columns 3 and 4.

Table 4-17. Potential loss of animal unit months associated with the Garden Valley alternative segments (page 1 of 2).

Alternative segment/allotment	Construction right-of-way area or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Garden Valley 1				
Needles	2.9	2,679 on 350 square kilometers	22	0.8
Batterman Wash	2.6	2,093 on 160 square kilometers	34	1.6
Pine Creek	2.4	2,667 on 140 square kilometers	46	1.7
Cottonwood	2.2	1,177 on 170 square kilometers	15	1.3

Table 4-17. Potential loss of animal unit months associated with the Garden Valley alternative segments (page 2 of 2).

Alternative segment/allotment	Construction right-of-way area or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Garden Valley 1 (continued)				
McCutcheon Springs	0.44	446 on 74 square kilometers	3	1.8
Totals	11[c]	9,062 animal unit months	120	1.43
Garden Valley 2				
Needles	2.7	2,679 on 350 square kilometers	21	1.4
Coal Valley Lake	0.438	4,821 on 470 square kilometers	4	0.1
Pine Creek	4.6	2,667 on 140 square kilometers	88	3.1
Cottonwood	2.6	1,177 on 170 square kilometers	18	0.2
McCutcheon Springs	0.38	446 on 74 square kilometers	2	1.8
Totals	11[c]	11,790 animal unit months	133	1.1
Garden Valley 3				
Needles	2.9	2,679 on 350 square kilometers	22	0.8
Batterman Wash	4.5	2,093 on 160 square kilometers	59	2.8
Pine Creek	1.4	2,667 on 140 square kilometers	27	1.0
Cottonwood	2.0	1,177 on 170 square kilometers	14	1.2
McCutcheon Springs	0.68	446 on 74 square kilometers	4	0.9
Totals	12[c]	9,062 animal unit months	126	1.4
Garden Valley 8				
Needles	2.7	2,679 on 350 square kilometers	21	8.0
Coal Valley Lake	0.42	4,821 on 470 square kilometers	4	0.1
Pine Creek	4.2	2,667 on 140.4 square kilometers	80	3
Cottonwood	2.6	1,177 on 170 square kilometers	18	1.5
McCutcheon Springs	0.38	446 on 74 square kilometers	2	0.5
Totals	10[c]	11,790 animal unit months	131	1.1[d]

a. To convert square kilometers to acres, multiply by 247.10.
b. Land area values are rounded to two significant figures, except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.
c. Source: DIRS 174518-BLM 2005, Table R-2.
d. This is not column total; it is a value calculated using the totals from columns 3 and 4.

Table 4-18. Potential loss of animal unit months associated with Caliente common segment 2.

Allotment	Construction right-of-way area or impact area (square kilometers)[a,b]	Current animal unit months (maximum) and allotment area[c,d]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
McCutcheon Springs	2.5	446 on 74 square kilometers	15	3.4
Sand Springs	6.7	7,055 on 1,010 square kilometers	47	0.7
Reveille	6.8	25,730 on 2,660 square kilometers	66	0.3
Totals	16[e]	33,231 animal unit months	128	0.4[d]

a. To convert square kilometers to acres, multiply by 247.10.
b. Source: DIRS 174518-BLM 2005, Table R-1.
c. Source: DIRS 173224-BLM 1997, p. A-12.
d. This is not column total; it is a value calculated using the totals from columns 3 and 4.
e. Land area values are rounded to two significant figures, except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.

Table 4-19. Potential loss of animal unit months on the Reveille Allotment associated with the South Reveille alternative segments.

Alternative segment/quarry	Construction right-of-way area or impact area (square kilometers)[a,b]	Current animal unit months (maximum) and allotment area (Reveille)[c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
South Reveille 2	5.6	25,730 animal unit months on 2,660 square kilometers	54	0.2
South Reveille 3	6.0	25,730 animal unit months on 2,660 square kilometers	58	0.2
Potential quarry NN-9A	2.0	25,730 animal unit months on 2,660 square kilometers	19	0.07
Potential quarry NN-9B	1.3	25,730 animal unit months on 2,660 square kilometers	13	0.05

a. To convert square kilometers to acres, multiply by 247.10.
b. Land area values are rounded to two significant figures, except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.
c. Source: DIRS 173224-BLM 1997, p. A-12.

Table 4-20. Potential loss of animal unit months associated with Caliente common segment 3.

Allotment	Construction right-of-way area or impact area (square kilometers)[a,b]	Current animal unit months (maximum) and allotment area[c,d]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Reveille	13	25,730 on 2,660 square kilometers	126	0.5
Stone Cabin	14	13,963 on 1,580 square kilometers	124	0.9
Ralston	8.6	Inactive allotment[c]	Not applicable	Not applicable
Totals	36	39,693 animal unit months	250	0.6[e]

a. To convert square kilometers to acres, multiply by 247.10.
b. Land area values are rounded to two significant figures except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.
c. Source: DIRS 173224-BLM 1997, p. A-12.
d. Source: DIRS 176942-Metscher 2006, all.
e. This is not column total; it is a value calculated using the totals from columns 3 and 4.

Oasis Valley alternative segments 1 and 3 could result in the loss of 8 and 12 animal unit months, respectively, within the Razorback Allotment (see Table 4-21).

Table 4-21. Potential loss of animal unit months associated with the Oasis Valley alternative segments.

Alternative segment/allotment	Construction right-of-way area or impact area (square kilometers)[a,b]	Current animal unit months (maximum) and allotment area[c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Oasis Valley 1 – Razorback	2.3	959 animal unit months on 290 square kilometers	8	0.8
Oasis Valley 3 – Razorback	3.8	959 animal unit months on 290 square kilometers	13	1.4

a. To convert square kilometers to acres, multiply by 247.10.
b. Land area values are rounded to two significant figures, except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.
c. Source: DIRS 173224-BLM 1997, p. A-14.

Common Segment 6 (Yucca Mountain Approach): Common segment 6 would cross a corner of the inactive Montezuma Allotment near the beginning of the common segment. At present, there are no permittees on this allotment (DIRS 176942-Metscher 2006, all). Common segment 6 would also pass through the Razorback Allotment (see Figure 3-33) and encompass approximately 5.4 square kilometers (1,300 acres) of the allotment. This would correspond to a potential loss of 18 animal unit months (1.9-percent loss of the grazing allotment) (see Table 4-22).

Table 4-22. Potential loss of animal unit months associated with common segment 6.

Allotment	Construction right-of-way area or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Razorback	5.4	959 animal unit months on 290 square kilometers	18	1.9

a. To convert square kilometers to acres, multiply by 247.10.
b. Source: DIRS 173224-BLM 1997, p. A-14.

4.2.2.2.4 Department of Defense-Managed Land

The Department of Defense provided comments during the first scoping period for this Rail Alignment EIS in 2004, which resulted in DOE modifying Bonnie Claire alternative segment 2 and proposing Bonnie Claire alternative segment 3 as a new alternative segment to avoid crossing the Nevada Test and Training Range. Specifically, the Air Force commented that the earlier proposed rail segments were "within the weapons safety footprint for test and training munitions" and that the rail line would "impinge on Range testing and training activities."

The closest segments to the Nevada Test and Training Range would be South Reveille alternative segment 3 and Bonnie Claire alternative segment 2, the centerlines of which would be approximately 100 meters (330 feet) from the Range boundary. DOE has narrowed the proposed construction right-of-way along these 2 segments to specifically avoid entering Range land. Other segments that would be closer to the Range boundary and the distances from the edge of the construction right-of-way to the boundary include Goldfield alternative segment 3 (485 meters [1,600 feet]), common segment 5 (560 meters [1,800 feet]), and Oasis Valley alternative segment 3 (280 meters [920 feet]). While the Caliente rail alignment would not directly affect land use on the Nevada Test and Training Range, portions of Bonnie Claire alternative segment 2 and common segment 5 would cross land formerly within the western border of the Range. The land released by the Range now falls under the BLM Tonopah planning area. Portions of the rail line (common segment 5 and common segment 6) would be beneath restricted air space or military operations areas associated with the Range. However, testing and training activities within the restricted air spaces would generally not exceed the western boundary of the Range and the Department of Defense would not institute controls so that activities across all related air spaces would not pose harm to the rail line. The proposed railroad would not interfere with Range activities and would not conflict with the Range's Resource and Management Plan.

4.2.2.2.5 DOE-Managed Land

The Rail Equipment Maintenance Yard, Cask Maintenance Facility, and a portion of common segment 6 would be within the Yucca Mountain Site boundary. These proposed maintenance facilities would be on land that is currently part of the Nevada Test Site, and used for Yucca Mountain Project characterization. Because the proposed railroad project would proceed only after control of the Yucca Mountain Site was transferred to DOE, the Rail Equipment Maintenance Yard and Cask Maintenance Facility and portions of common segment 6 within the Yucca Mountain Site boundary would not conflict with future land uses on the Nevada Test Site.

4.2.2.2.6 Construction Impacts to Mineral and Energy Resources (Public and Private Land)

Because of the relatively high mineral and energy potential to lands along the Caliente rail alignment, DOE evaluated potential impacts to these resources. To construct the rail line, DOE would need to gain access to lands that contain patented or ***unpatented mining claims*** or have active energy leases (oil, gas, or geothermal). DOE would also need substantial quantities of ballast and subballast that would be obtained from existing or new quarry and borrow sites (see Sections 2.2.2.3.2 and 2.2.2.3.3). Section 4.2.11, Utilities, Energy, and Materials, describes the impacts on regional material availability of removing material from the proposed quarries and ballast sites.

The land encompassing the Caliente rail corridor was withdrawn through Public Land Orders from surface and mineral entry through December 2015 so DOE could evaluate the land for the rail alignment. If the BLM granted DOE a right-of-way for the rail line before the Public Land Orders expired, the surface and mineral entry prohibitions would be removed from lands not part of the right-of-way. Therefore, the BLM could issue new unpatented mining claims and energy leases on lands near the rail line during the construction and operations phases. While the presence of the rail line would not necessarily preclude non-surface resources extraction activities, the applicant would be required to work closely with the BLM and DOE to ensure they would not interfere with the safe operation of the railroad. Engineering solutions for the safe extraction of mineral and energy resources near or beneath the rail line could include directional (lateral) drilling of wells or ensuring all mine shafts or tunnels were sufficiently deep and reinforced to prevent subsidence.

4.2.2.2.6.1 Alternative Segments at the Interface with Union Pacific Railroad Mainline. A commercial hotel and spa in Caliente uses a hot spring just outside the Caliente alternative segment construction right-of-way (DIRS 173841-Shannon & Wilson 2005, pp. 113 to 117). Because the Caliente alternative segment would utilize the footprint of the former Pioche and Prince Branchline, there would be no additional disruption to these geothermal resources. There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way of either alternative segment at the interface with the Union Pacific Railroad mainline.

There would be no patented mining claims or underground mines, tunnels, or shafts within the construction right-of-way for either the Caliente or Eccles alternative segment (see Figure 3-35).

Potential quarry CA-8B would be within the Chief Mining District, which was organized in 1870. There is no active mining and there are no patented mining claims within this district; therefore, there would be no impacts to mining from the introduction of a quarry in this area.

4.2.2.2.6.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would cross the northernmost portion of the Seaman Range Mining District (see Figure 3-36). Most of the past mining activity in this district occurred more than 5 kilometers (3 miles) south and southwest of the common segment. Therefore, there would be no impacts to mining from the construction of common segment 1. Common segment 1 would not affect energy leases (oil, gas, or geothermal) or resources.

4.2.2.2.6.3 Garden Valley Alternative Segments. The western junction of Garden Valley alternative segments 2 and 3 is approximately 0.8 kilometer (0.5 mile) north of the Freiberg Mining District (see Figure 3-37). Most of the past mining activity in this district occurred more than 5 kilometers (3 miles) south of this point (DIRS 173841-Shannon & Wilson 2005, pp. 99 to 101). Mineralization does not appear to trend toward the alternative segments, and the distance of the Freiberg mining activities from the Garden Valley alternative segments would preclude construction-related impacts to mining in this area. There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way for any of the Garden Valley alternative segments.

4.2.2.2.6.4 Caliente Common Segment 2 (Quinn Canyon Range Area). There would be no ***mining districts or areas***, or patented mining claims within the Caliente common segment 2 construction right-of-way (see Figure 3-37 and 3-38). The closest mining district would be the Queen City Mining District, 3.2 kilometers (2.0 miles) south of Caliente common segment 2, and it has only small localized areas of potential mineralization that trend away from the rail alignment (DIRS 173841-Shannon & Wilson 2005, pp. 97 to 99). Therefore, construction of Caliente common segment 2 would not impact mining in this area. There are no energy leases (oil, gas, or geothermal) that would be in the common segment 2 construction right-of-way.

4.2.2.2.6.5 South Reveille Alternative Segments. There would be no mining districts or areas, energy leases, or patented mining claims within the construction rights-of-way of the South Reveille alternative segments (see Figure 3-38). In terms of unpatented mining claims within or near the construction right-of-way, South Reveille alternative segments 2 and 3 would intersect two Township and Range Sections containing 72 mining claims. Because information is available only at the section level (where the area of a section is several times larger than a nominal area of a rail line segment that would fully bisect it), the actual number of claims within the construction right-of-way would likely be fewer. DOE would negotiate surface rights across affected unpatented mining claims with claim holders.

The closest mining area is the Reveille Valley mining area, approximately 0.8 kilometer (0.5 mile) from South Reveille alternative segment 3 and 3 kilometers (2 miles) from South Reveille alternative segment 2. Although exploration and drilling in this mining area were observed in June 2004 and the existence of a 90-year lease agreement under the Alien Gold Project indicates that exploration efforts will be ongoing, this area would not be directly impacted by the South Reveille segments (DIRS 173841-Shannon & Wilson 2005, pp. 95 to 97). There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way for either South Reveille alternative segment.

4.2.2.2.6.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Only the Clifford Mining District would be near Caliente common segment 3 (see Figures 3-38 and 3-39). The Clifford Mining District is approximately 3 kilometers (2 miles) south of U.S. Highway 6 in Stone Cabin Valley, about 10 kilometers (6 miles) southwest of Warm Springs. Numerous claims have been staked in the area and exploration and mining are underway (DIRS 173841-Shannon & Wilson 2005, pp. 83 to 86). There are no patented mining claims that would be within the common segment 3 construction right-of-way, although the common segment construction right-of-way would intersect 10 Township and Range Sections containing 166 unpatented mining claims. Because data related to unpatented mining claims are available only at the section level, the actual number of unpatented claims within the construction right-of-way would likely be many fewer. DOE would negotiate the surface rights across unpatented claims that fall within the construction right-of-way. There is one underground mine (now abandoned) that would be outside the construction right-of-way, approximately 240 meters (790 feet) from common segment 3. As discussed in Chapter 2, DOE would conduct further investigations, including drilling ***boreholes***, ground-penetrating radar, and seismic analysis, to determine the extent of nearby underground features. The Department would then develop appropriate engineered solutions to address underground features.

There are no energy leases (oil, gas, or geothermal) that would be in the common segment 2 construction right-of-way.

4.2.2.2.6.7 Goldfield Alternative Segments. The only patented mining claims that would be within the rail line construction right-of-way are associated with the three Goldfield alternative segments (see Figure 3-39). Although DOE would reduce the area of disturbance to minimize impacts to these claims, Goldfield alternative segment 1 would intersect six patented mining claims; Goldfield 3 would intersect two; and Goldfield 4 would intersect four. The area of these parcels is reflected in the private land impacts in Section 4.2.2.2.1.2. Goldfield alternative segment 1 would intersect 14 sections containing 474 unpatented mining claims; Goldfield 3 would intersect 14 sections containing 359 unpatented mining claims; and Goldfield 4 would intersect 19 sections containing 538 unpatented mining claims (see Table 3-8). Because data related to unpatented mining claims are available only at the section level, the actual number of unpatented claims within the construction right-of-way would likely be many fewer. DOE would negotiate surface rights across affected unpatented mining claims with claim holders. There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way for any of the Goldfield alternative segments.

There are a number of recorded underground tunnels, shafts, and mines that would be within the construction right-of-way of these alternative segments, and those could pose construction challenges or operational safety issues. There is one tunnel along Goldfield alternative segment 1; four associated with Goldfield 3; and one associated with Goldfield 4. Railroad construction and operations could affect these features and vice versa. As discussed in Chapter 2, DOE would conduct further investigations, including drilling boreholes, ground-penetrating radar, and seismic analysis, to determine the extent of nearby underground features. The Department would then develop appropriate engineered solutions to address underground features.

4.2.2.2.6.8 Caliente Common Segment 4 (Stonewall Flat Area). Caliente common segment 4 would cross the westernmost portion of the Stonewall Mining District (see Figures 3-39 and 3-40). However, most of the past mining activity in this district occurred approximately 5 kilometers (3 miles) east of common segment 4. The Cuprite Mining District would be west of common segment 4 but outside the construction right-of-way. Caliente common segment 4 would intersect five Township and Range Sections containing 169 unpatented mining claims. Because information is available only at the section level (where the area of a section is several times larger than a nominal area of a rail line segment that would fully bisect it), the actual number of claims within the construction right-of-way would likely be less. DOE would negotiate surface rights across affected unpatented mining claims with claim holders. There would be no patented mining claims, geothermal occurrences, or energy leases within the common segment 4 construction right-of-way. Therefore, common segment 4 would not affect mining activity or energy resources.

4.2.2.2.6.9 Bonnie Claire Alternative Segments. The Wagner Mining District would lie between the two Bonnie Claire alternative segments, just to the west of Bonnie Claire 3 (see 3.2.2-23). There are patented mining claims in this district, but they would all be outside the construction right-of-way of each alternative segment. There are no geothermal or oil and gas leases within the construction right-of-way of either alternative segment. Therefore, there would be no direct impacts to mining or energy resource extraction along either alternative segment. Section 4.2.2.2.7.2 describes potential impacts associated with road access to the patented mining claims in the Wagner Mining District.

4.2.2.2.6.10 Common Segment 5 (Sarcobatus Flat Area). The southwestern portion of the Clarkdale Mining District would be approximately 0.8 kilometer (0.5 mile) northeast of common segment 5, outside the construction right-of-way (see Figure 3-40 and 3-41). Almost two-thirds of the Clarkdale Mining District is on the Nevada Test and Training Range, and the historically mined areas of the district are far enough away from common segment 5 that there would be no impacts to mining activities as a result of rail line construction (DIRS 173841-Shannon & Wilson 2005, pp. 50 to 52). Section 4.2.2.2.7.2 describes potential impacts to access to this mining district.

There are geothermal resources along U.S. Highway 95 in Sarcobatus Valley, but none would be within the rail line construction right-of-way. There is one warm spring that would be approximately 0.8 kilometer (0.5 mile) northeast of common segment 5, and a geothermal well that would be approximately 0.4 kilometer (0.25 mile) northeast (DIRS 173841-Shannon & Wilson 2005, p. 50). There are no identified uses of these geothermal resources, and they would be far enough away from common segment 5 that they would not be affected by the rail line. The common segment 5 construction right-of-way would not cross any oil or gas lease areas.

4.2.2.2.6.11 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would intersect two sections containing 14 unpatented mining claims (DIRS 173841-Shannon & Wilson 2005, pp. 48 and 49); DOE would negotiate surface rights across affected unpatented mining claims with claim holders for either alternative segment. There are oil and gas leases north of Beatty along the southwest flank of Pahute Mesa in southern Nye County (see Figure 3-41). Oasis Valley alternative segments 1 and 3 would cross portions of this oil and gas lease block (DIRS 173837-Sweeney 2005, pp. 49 and 50). At present, the lease is not in production, and records show that there has been no exploration in these areas since the 1970s. Therefore, the Oasis Valley alternative segments would not affect ongoing operations associated with this oil and gas lease.

4.2.2.2.6.12 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would cross the northern section of the Bare Mountain Mining District. Most past mining activity in the district occurred more than 3 kilometers (2 miles) south of the common segment (see Figure 3-41). There are recently active gold mining operations within the district, approximately 6 to 8 kilometers (4 to 5 miles) from common segment 6. The Silicon Mine and Thompson Quicksilver Mine would be north of common segment 6. The Silicon Mine would be approximately 800 meters (2,500 feet) and the Thompson Quicksilver Mine would be approximately 1,400 meters (4,500 feet) outside the construction right-of-way. Recent mining activity in these areas would be outside the rail line construction right-of-way, and would not be directly affected by common segment 6. The common segment 6 construction right-of-way would intersect four sections containing 34 unpatented mining claims. DOE would negotiate the surface rights across unpatented mining claims with claim holders. Common segment 6 would not affect energy leases (oil, gas, or geothermal) or resources.

4.2.2.2.7 Construction Impacts to Recreation and Access (Private and Public Land)

DOE developed the Caliente rail alignment alternative segments and common segments to avoid crossing sensitive areas, such as Wilderness Areas, ***Wilderness Study Areas***, state and national forests and parks, and other prominent recreational and scenic areas (see Figures 3-42 through 3-49). DOE would maintain access for all existing roads the rail line would cross at or near their current location by constructing ***at-grade crossings*** (the road and the rail line would cross paths at the same elevation) or ***grade-separated crossings*** (the road and the rail line would cross paths via an overpass or an underpass), resulting in no long-term adverse impacts to traffic patterns and land access. However, there could be temporary small impacts to access to these areas during rail line construction due to temporary road closures and detours.

At locations where there would be several road crossings close to one another (generally over a distance of 0.8 kilometer [0.5 mile] or less), there could be some minor rerouting and consolidation of crossings, but these would not prevent crossing the rail line. The regulatory authority to make decisions regarding roads, road closures, and rail line crossings rests with the BLM and county and local governments. DOE would work in close consultation with these groups to ensure access would be maintained.

Although many undeveloped recreation opportunities exist over much of the public lands surrounding the rail alignment (such as off-highway vehicle use and dispersed hunting), descriptions of potential impacts in Sections 4.2.2.2.7.1 through 4.2.2.2.7.3 are limited to defined recreation areas. While impacts to non-designated recreation areas are not specifically addressed, individuals might have to alter their access routes to particular recreation areas near the rail line. Construction of the rail line might also cause some dispersed recreationists (such as hunters) who use non-designated areas nearby to temporarily relocate. Future Special Recreation Permits issued by applicable BLM offices would take the presence of the rail line into consideration to minimize impacts to both the applicant and the construction and operation of the railroad. Most organized off-highway vehicle events with previously approved race routes are on existing roads and trails, and access across the rail line for these events would not be compromised. However, some previously permitted routes that the rail line would cross might need to alter their crossing locations in areas where crossing are consolidated.

4.2.2.2.7.1 Lincoln County. Rail line alternative segments and common segments crossing through Lincoln County would intersect a number of roads that provide access to nearby public and private lands (see Table 3-9).

Both the Caliente and Eccles alternative segments would cross the Rainbow Canyon ***Back Country Byway*** (see Figure 3-43). However, DOE would install at-grade crossings at these points; thus, there would be no long-term impacts to the Byway. The Caliente alternative segment would be 3.2 kilometers (2 miles) northeast of Kershaw-Ryan State Park. The rail line would not affect the park or access thereto from existing roads.

Potential quarry CA-8B along the Caliente alternative segment would be within the 400-square-kilometer (100,000-acre) Chief Mountain Off-Highway Vehicle Emphasis Area, which is proposed under the preferred alternative of the Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, Map 2.4-36). This recreation area has three primary trails – the Red Rhyolite Trail, the Grey Dome Rim Trail, and portions of the Silver State Trail. Access to these trails is primarily at Oak Springs Summit on the north side of U.S. Highway 93, 8 kilometers (5 miles) west of the City of Caliente. At their closest points, these trails would be more than 10 kilometers (6 miles) away from the quarry. Because the quarry would not interfere with the primary access to these trails and it would be many miles from active trails, there would be no impacts to these recreational areas.

Caliente common segment 1 would pass within 1.6 kilometers (1 mile) of the Weepah Spring Wilderness. However, there would be no impact to access to this area because access would be primarily south of the rail line along State Highway 318. Approximately one-third of the length of common segment 1 would pass through the northern portion of the Chief Mountain Off-Highway Vehicle Emphasis Area. The primary access to this area is from the south along U.S. Highway 93. Common segment 1 would be 5.3 kilometers (3.3 miles) southwest of Cathedral Gorge State Park and would not impact access to this park.

The Silver State Trail would be the only trail the rail alignment would intersect within the Chief Mountain area (see Figure 3-44). Bennett Pass Road, the Silver State Trail, and the rail line would all occupy the same route for approximately 1 kilometer (0.6 mile) on the west side of Bennett Pass. There is a 0.3-kilometer (0.2-mile) section on the east side of the pass where the road and the rail line would occupy the same route (DIRS 176796-Winslow 2006, p. 1).

The Humboldt-Toiyabe National Forest would lie north of Garden Valley alternative segment 3, 3.2 kilometers (2 miles) from the Garden Valley alternative segments where they converge at the easternmost end of common segment 2. Access to this national forest is by unimproved roads, which would be north of and would not intersect the rail alignment. Therefore, the rail line would not impact access to the Humboldt-Toiyabe National Forest.

Caliente common segment 2 would pass the Worthington Range Wilderness within 0.9 kilometer (0.6 mile) at its closest point. Primary access to this wilderness area is to travel on State Highway 375 northwest toward the town of Rachel and approximately 2.4 kilometers (1.5 miles) before reaching Rachel, and then turn right on an unnamed county road northbound for approximately 29 kilometers (18 miles). This primary route to the Worthington Range Wilderness includes roads that would be south of and would not intersect the rail alignment. Therefore, there would be no impacts to access to the Worthington Range Wilderness.

There are a number of privately owned parcels of land between Garden Valley alternative segments 1 and 2, but they would be outside the rail line construction right-of-way. Access to private property in Garden Valley would be through existing county roads. DOE would maintain access where the rail line would cross existing roads.

4.2.2.2.7.2 Nye County. Rail line alternative segments and common segments crossing through Nye County would intersect a number of roads that provide access to nearby public and private lands (see Table 3-9).

South Reveille alternative segment 2 would follow the southern boundary of the South Reveille Wilderness Study Area and would be 30 meters (100 feet) from the study area at its closest point. Rail line workers would be instructed not to trespass into the area. In addition, DOE would use institutional markers, such as temporary fencing, ropes, or other markers, to limit access. DOE would consult with the BLM about construction practices that could be used to minimize impacts to Wilderness Study Areas.

The easternmost portion of Caliente common segment 3 would pass between the South Reveille Wilderness Study Area and the Kawich Wilderness Study Area. Primary access to the South Reveille Wilderness Study Area is from roads off State Highway 375, which would be approximately 16 kilometers (10 miles) north of the rail alignment. Common segment 3 could cross access roads to the Kawich Wilderness Study Area near U.S. Highway 6 near Warm Springs, and networks of roads from the east or west of the Study Area. DOE would instruct rail line workers not to trespass into the area. In addition, DOE would use institutional markers, such as temporary fencing, ropes, or other markers, to limit access. The road between the common segment 3 construction right-of-way and the Kawich Wilderness Study Area could also serve as a visual guide for workers to avoid trespass. DOE would consult with the BLM about construction practices that could be used to minimize impacts to Wilderness Study Areas.

Bonnie Claire alternative segments 2 and 3 would cross few roads or trails (see Figure 3-48 and Table 3-9). There is no active grazing on the land surrounding these alternative segments. However, Bonnie Claire 3 would be west of and Bonnie Claire 2 would be east of patented mining claims within the Wagner Mining District (see Figure 3-48). If DOE selected Bonnie Claire 3, the rail line would cross one access road to these mining claims.

There are more than a dozen privately owned properties that would be west of common segment 5 clustered at Scottys Junction. These properties lie on either side of U.S. Highway 95. Because the rail line would be to the east of these properties and not interfere with access from U.S. Highway 95, it would not impact access to land near Scottys Junction. Common segment 5 would cross one road that provides primary access from U.S. Highway 95 to oil and gas leases that would be north of the rail line and provides access to the Nevada Test and Training Range. DOE proposes an active at-grade crossing for this location (DIRS 176165-Nevada Rail Partners 2006, pp. D-1 and D-2). However, temporary small impacts to access could occur during the construction phase.

Each of the Oasis Valley alternative segments would cross a limited number of roads (see Figure 3-49 and Table 3-9). Roads in this area provide access to private property owned by a cattle company; the northern portion of the Razorback Allotment; oil and gas leases; and the northwestern portion of the Nevada Test and Training Range. Oasis Valley alternative segment 3 would pose minimal restriction to road access from U.S. Highway 95 to the oil and gas leases and privately owned land, and access within the Razorback Allotment because it would be farthest away from these established areas.

Common segment 6 would cross six public roads, some of which provide access to the Nevada Test and Training Range and the northern portion of the Razorback Allotment (see Figure 3-49). The only privately owned properties in the vicinity of common segment 6 are west of the rail alignment at its northernmost point. These properties are adjacent to U.S. Highway 95 and the rail line would not impact access thereto.

4.2.2.2.7.3 Esmeralda County. Rail line alternative segments and common segments crossing through Esmeralda County would intersect a number of roads that provide access to nearby public and private lands (see Table 3-9).

There is privately owned land, primarily within the community of Goldfield, where access to the community is chiefly from U.S. Highway 95. Only Goldfield alternative segment 4 would cross U.S. Highway 95, and it would cross twice. If DOE selected this alternative segment, the Department would construct a grade-separated road crossing at both these intersections (DIRS 176165-Nevada Rail Partners 2006, p. D-2).

There are a number of patented and unpatented mining claims near Goldfield alternative segments 1 and 4, with a large network of roads between the two alternative segments (see Figure 3-47). If DOE selected Goldfield alternative segment 4, there would be no impacts to access to the claims east of the rail alignment. If DOE selected Goldfield alternative segment 1, the rail line would cross six roads in Esmeralda and Nye County that are not considered primary access routes.

Common segment 4 would cross a number of roads and trails (see Figure 3-47 and Table 3-9).

4.2.2.2.8 Land-Use Conflicts with Utility Corridors and Rights-of-Way

Where the rail line would cross an existing utility right-of-way, DOE would take precautions to minimize disturbance and disruption of the utilities. Section 4.2.11, Utilities, Energy, and Materials, describes measures the Department would implement to protect existing utilities.

Of the 543 kilometers (337 miles) of rail line proposed under the longest possible alignment, only 134 kilometers (83 miles), or 25 percent, would fall within corridors designated by the applicable resource management plans. However, the resource management plans allow for transportation rights-of-way outside these designated corridors if no other option is feasible and the right-of-way would not substantially conflict with other land-use goals and designations. No parts of the rail line segments would cross right-of-way avoidance areas. DOE would perform field verifications of utility right-of-way locations and would incorporate the information into the final rail line design.

Because final engineering design for utility connections is not complete, DOE does not know the exact tie-in locations for electricity along the rail alignment. While the Department expects that transmission lines could be tapped where they currently cross the proposed rail line location, there is a possibility that the project could require additional utility rights-of-way for small feeder lines.

4.2.2.3 Operations Impacts

Land-use and ownership impacts would occur before or during the railroad construction phase. The operations right-of-way would be generally narrower than the construction right-of-way along most of the rail alignment, and some of the land could therefore be returned to its previous uses.

Topics related to the quality-of-life aspects of land use include visual quality, air quality, and noise and vibration, as described in other sections of this Rail Alignment EIS (see Section 4.2.3, Aesthetic Resources; Section 4.2.4, Air Quality and Climate; and Section 4.2.8, Noise and Vibration).

Railroad operations could affect the use of grazing land. For example, the presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes after construction of the rail line was complete and could acclimate to and cross the rail line in most areas. The noise and presence of people along the rail alignment during construction activities could cause livestock to avoid nearby areas at first, although they could become accustomed to the presence of people over time (DIRS 176920-Metscher 2005, p. 4).

Nevada is an open-range state, where it is the responsibility of private landowners to fence their properties to prevent livestock from damaging their property and where ranchers could be compensated for the loss of their livestock killed by vehicles and trains. If DOE trains struck and killed livestock, DOE or the commercial carrier (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate.

As discussed in Section 4.2.2.2.6, the BLM could issue new unpatented mining claims and energy leases on lands near the rail line during the construction and operations phases. While the presence of the rail line would not necessarily preclude non-surface resources extraction activities, the applicant would be required to work closely with the BLM and DOE to ensure they would not interfere with the safe operation of the railroad. Engineering solutions for the safe extraction of mineral and energy resources near or beneath the rail line could include directional (lateral) drilling of wells or ensuring all mine shafts or tunnels were sufficiently deep and reinforced to prevent subsidence.

The parallel rail alignment access roads (unpaved) could improve land access along most of the rail alignment. While most of the rail alignment would follow or be within a few kilometers of existing unpaved roads and trails that are currently open for public use, the new access roads could be of better quality in some areas than nearby existing roads, increasing the likelihood of use. Off-road vehicle use, hunting intensity, and other recreational activities could increase along the rail alignment access roads, Improved human and vehicle access to surrounding areas could result in indirect impacts to vegetation and wildlife, as described in Section 4.2.7, Biological Resources. Recreational uses of public land along the access roads (as with other similar roads on public land) would be monitored by the BLM to ensure compliance with its land management goals, as stated in applicable BLM resource management plans. It is important to note that DOE would not maintain the access roads as public roads, except in locations where they would be used for rerouting to consolidate rail line crossings, and the Department would post signs indicating potential users would proceed on the roads at their own risk.

Lastly, future Special Recreation Permits issued by applicable BLM offices would take the presence of the rail line into consideration to minimize impacts to both the applicant and operation of the rail line. This might require new routes to minimize or avoid crossing the rail line and greater manpower to implement and monitor these new routes during recreation events.

4.2.2.4 Impacts under the Shared-Use Option

Impacts to land use and ownership under the Shared-Use Option would be similar to those described for the Proposed Action without shared use, with a small addition of impacts from the construction and operation of commercial sidings. Under the Shared-Use Option, commercial trains would haul a range of products to and from businesses, including stone and other nonmetallic minerals, oil and petroleum products, and nonradioactive waste materials (see Section 2.2.6.3). DOE cannot predict the exact locations of these possible commercial-use sidings, but they could include Caliente, Panaca/Bennett Pass, the Warm Springs Summit area, Tonopah, Goldfield, and the Beatty Wash/Oasis Valley area. The sidings would likely be constructed within the railroad operations right-of-way; if so, there would be no additional impacts to land use and ownership (see Figure 2-55). Because only approximately 1 percent of land within the rail line construction right-of-way is privately owned, any commercial sidings or commercial facilities that would be outside the construction right-of-way would likely be on BLM-administered land, and implemented under a separate BLM-issued right-of-way.

Implementation of the Shared-Use Option could facilitate the expansion or introduction of industrial (mining) or commercial operations in the region. This could have future, long-term impacts on land use, such as new or revised land-use zoning plans to accommodate industrial and commercial land uses in the vicinity of the rail line. The expansion of industrial or commercial activity from shared use of the rail line could also indirectly result in land-use changes in relation to additional residential development. Increased rail traffic could also increase the likelihood of livestock mortality along the rail line within active grazing allotments.

4.2.2.5 Summary

The Caliente rail alignment construction right-of-way would occupy between 156 and 164 square kilometers (38,500 and 40,600 acres) of land. Most of the land would be public land, although DOE would need to gain access to up to 0.72 square kilometer (178 acres) of private land for the rail alignment and another possible 1.15 square kilometers (284 acres) required to accommodate support facilities. This amount of private land would be very small (about 1 percent) compared to the total amount of land that would be required for the project.

The Caliente rail alignment would not displace existing or planned land uses over a substantial area, nor would it substantially conflict with applicable land-use plans or goals. The areas with the highest densities of private land the rail alignment would cross are near Caliente and Goldfield. If DOE selected the Caliente alternative segment, some structures at the existing Union Pacific Railroad train yard and three structures along the former Pioche and Prince Branchline would need to be demolished or relocated. This alternative segment would also occupy portions of the access road and parking lot of the Caliente Hot Springs Motel. Alternative segments near Goldfield would cross private (although vacant) land, including patented mining claims and state and county land.

DOE developed the Caliente rail alignment to avoid American Indian lands. The closest rail line segment, common segment 5, would be approximately 3 kilometers (2 miles) east of the Timbisha Shoshone Trust Lands near Scottys Junction.

The Caliente rail alignment would use up to 161.9 square kilometers (40,000 acres) of BLM-administered land. Some of the rail line segments would pass through lands the BLM has identified for potential disposal (sale). However, the land withdrawals already in place for the rail alignment and the potential use by another federal agency would take precedence over disposal actions that could affect the project.

Where the rail line segments and facilities would cross active grazing allotments on BLM-administered land, some grazing land would be lost. Because the land would be restored after the construction phase and the operations right-of-way would be smaller than the construction right-of-way, long-term impacts to grazing allotments would be small. In total, the Caliente rail alignment would result in less than a 2-percent loss of animal unit months across all affected allotments. The greatest percentage loss of animal unit months for any one grazing allotment would occur on the Black Canyon Allotment under Common Segment 1 (4.7 percent loss). Of the potential quarries, quarry CA-8B would result in the highest percentage loss of animal unit months (7.6 percent on the Highway Allotment). The presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes and acclimate to and cross the rail line in most areas. The rail line could affect ranching operations because livestock could be struck by passing trains. DOE or the railroad's commercial operator (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate. DOE would consult with the BLM during the final design phase to determine if any of the rail line would need to be fenced.

Construction wells located on grazing allotments outside the construction right-of-way would have small and temporary impacts in terms of loss of grazing area. Once each well was drilled, DOE would reclaim the site in accordance with DOE and BLM requirements. The Department would construct a 10- to 15-centimeter (4- to 6-inch)-diameter temporary pipeline on top of the ground along access roads to transport water to the construction right-of-way. Wells not needed for railroad operations would be properly abandoned in compliance with State of Nevada regulations and sites and access roads would be reclaimed (DIRS 176172-Nevada Rail Partners 2006, p. 4-12).

Most of the local mining activity would be outside the rail line construction right-of-way. DOE would need to negotiate the surface rights to cross the few affected unpatented mining claims the rail line would cross. All the Goldfield and Oasis Valley alternative segments and common segment 6 would cross several sections that contain many unpatented mining claims. The actual number of claims the rail line construction right-of-way would cross would need to be determined through additional record searches and field verification. DOE would negotiate surface rights across affected unpatented mining claims with the claim holders. There is also the possibility that the rail line could be affected by or affect underground mining tunnels or shafts. During the final engineering design phase of the project, DOE would perform a survey to verify the locations of tunnels and shafts to avoid adverse impacts.

DOE developed the Caliente rail alignment to avoid Wilderness Areas and other scenic and recreational areas. Road crossings would be constructed to prevent the rail line from obstructing access to private and public land. While there could be temporary road closures or detours during the rail line construction phase, there would be no impact to land access during the operations phase. In addition, organized off-highway vehicle events permitted in the past by BLM might need to alter their routes to avoid the rail line.

Depending on the alternative segments selected, the rail line would cross between 12 and 34 known utility lines. DOE would negotiate crossing agreements with the right-of-way holders and the BLM to determine the duration of use, access needs, mitigation, and compensation, as applicable. DOE would protect existing utilities from damage so that disruption to utility service or damage to lines would be at most small and temporary. The project would require a new BLM right-of-way outside the existing planning corridors, which would be outside of right-of-way avoidance areas. Under the longest potential route, approximately 25 percent of the Caliente rail alignment would fall within existing planning corridors. In addition, to avoid the proliferation of new rights-of-way, the BLM may elect to grant future rights-of-way for new utilities adjacent to the proposed rail line.

Construction and operation of a railroad along the Caliente rail alignment could result in the following general impacts to land use and ownership along the entire alignment:

- Changes in land uses on private and public lands within the construction and operations rights-of-way
- Possible increase in livestock mortality (collisions with trains)
- Reduced animal unit months on affected grazing allotments as determined by the BLM
- Reduction in land available for BLM disposal
- Alteration of past routes for BLM-permitted off-highway vehicle events
- Possible expansion of mining, manufacturing, industrial, or commercial land uses under the Shared-Use Option

Tables 4-23 through 4-30 summarize potential impacts to land use and ownership for each rail line segment and construction and operations support facility.

Table 4-23. Summary of potential impacts to land use and ownership – Caliente and Eccles alternative segments (Lincoln County).

Construction impacts	Caliente	Eccles
Private parcels the alignment would cross (construction right-of-way)	32	11
Affected property owners	22	10
Land area of private land affected (including patented mining claims)	0.31 square kilometers[a]	0.32 square kilometers
Grazing allotments the alignment would cross	2	4
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	6 or 0.6 percent	18 or 1.5 percent
Allotment land that would be within the construction right-of-way	0.81 square kilometers	4.8 square kilometers
Unpatented mining claims the alignment would cross	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	2 kilometers[b]	15.1 kilometers
Roads and trails the alignment would intersect	7	8
Utility lines/rights-of-way the alignment would cross or overlap	13	1

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-24. Summary of potential impacts to land use and ownership – Caliente common segments 1 through 6 (Lincoln and Nye Counties) (page 1 of 2).

Construction impacts	Common segment 1	Common segment 2	Common segment 3	Common segment 4	Common segment 5	Common segment 6
Private parcels the alignment would cross (construction right-of-way)	1	0	0	0	0	0
Affected property owners	1	0	0	0	0	0
Land area of private land affected (including patented mining claims)	0.0007 square kilometer[a]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Grazing allotments the alignment would cross	10	3	3	1, inactive	1, inactive	1, inactive

Table 4-24. Summary of potential impacts to land use and ownership – Caliente common segments 1 through 6 (Lincoln and Nye Counties) (page 2 of 2).

Stockwater pipelines the alignment would cross	3	2	5	0	0	0
Animal unit months lost (estimated) or percent of allotment(s)	453 or 0.7 percent	128 or 0.4 percent	250 or 0.6 percent	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)
Allotment land that would be within the construction right-of-way	35 square kilometers	16 square kilometers	36 square kilometers	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)
Unpatented mining claims the alignment would cross	0	0	10 sections with 166 claims	0	0	4 sections with 34 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0	1	0	0	0
Linear distance outside BLM utility corridors	113 kilometers[b]	42.8 kilometers	33 kilometers	12 kilometers	20.2 kilometers	39.2 kilometers
Roads and trails the alignment would intersect	39	13	30	14	14	7
Utility lines/rights-of-way the alignment would cross or overlap	4	0	4	0	1	0

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-25. Summary of potential impacts to land use and ownership – Garden Valley alternative segments (Lincoln and Nye Counties).

Construction impacts	Garden Valley 1	Garden Valley 2	Garden Valley 3	Garden Valley 8
Private parcels the alignment would cross (construction right-of-way)	0	0	0	0
Affected property owners	0	0	0	0
Grazing allotments the alignment would cross	5	4	5	4
Stockwater pipelines the alignment would cross	1	2	1	1
Animal unit months lost (estimated) or percent of allotment(s)	120 or 1.34 percent	131 or 1.1 percent	126 or 1.4 percent	131 or 1.1 percent
Allotment land that would be within the construction right-of-way	11 square kilometers[a]	11 square kilometers	12 square kilometers	10 square kilometers
Unpatented mining claims the alignment would cross	0	0	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0	0	0
Linear distance outside BLM utility corridors	35 kilometers[b]	36 kilometers	38 kilometers	37 kilometers
Roads and trails the alignment would intersect	8	12	10	14
Utility lines/rights-of-way the alignment would cross or overlap	1	2	1	1

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-26. Summary of potential impacts to land use and ownership – South Reveille alternative segments (Nye County).

Construction impacts	South Reveille 2	South Reveille 3
Private parcels the alignment would cross (construction right-of-way)	0	0
Affected property owners	0	0
Grazing allotments the alignment would cross	1	1
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	54 or 0.2 percent	58 or 0.2 percent
Allotment land that would be within the construction right-of-way	5.6 square kilometers[a]	6.0 square kilometers
Unpatented mining claims the alignment would cross	2 sections with 72 claims	2 sections with 72 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	19 kilometers[b]	19 kilometers
Roads and trails the alignment would intersect	1	1
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-27. Summary of potential impacts to land use and ownership – Goldfield alternative segments (Nye and Esmeralda Counties) (page 1 of 2).

Construction impacts	Goldfield 1	Goldfield 3	Goldfield 4
Private parcels the alignment would cross (construction right-of-way)	6	2	37
Affected property owners	0	0	20
Land area of private land affected (including patented mining claims)	0.37 square kilometer[a]	0.01 square kilometer	0.23 square kilometer
Grazing allotments the alignment would cross	2, both inactive	1, inactive	2, both inactive
Stockwater pipelines the alignment would cross	0	0	4 (unused)
Animal unit months lost (estimated) or percent of allotment(s)	Not applicable	Not applicable	Not applicable
Allotment land that would be within the construction right-of-way	Not applicable	Not applicable	Not applicable
Unpatented mining claims the alignment would cross	14 sections containing 474 claims	14 sections containing 359 claims	19 sections containing 538 claims
Underground mines, shafts, and tunnels the alignment would cross	14	4	5
Linear distance outside utility corridors	43.8 kilometers[b]	46.8 kilometers	47.9 kilometers
Roads and trails the alignment would intersect	15	5	44
Utility lines/rights-of-way the alignment would cross or overlap	0	0	8

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-28. Summary of potential impacts to land use and ownership – Bonnie Claire alternative segments (Nye County).

Construction impacts	Bonnie Claire 2	Bonnie Claire 3
Private parcels the alignment would cross (construction right-of-way)	0	0
Affected property owners	0	0
Land area of private land affected (including patented mining claims)		
Grazing allotments the alignment would cross	1, inactive	1 , inactive
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated)	Not applicable	Not applicable
Allotment land that would be within the construction right-of-way	Not applicable	Not applicable
Unpatented mining claims the alignment would cross	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside utility corridors	20 kilometers[a]	18.4 kilometers
Roads and trails the alignment would intersect	1	4
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert kilometers to miles, multiply by 0.62137.

Table 4-29. Summary of potential impacts to land use and ownership – railroad construction and operations support facilities (Lincoln, Nye, and Esmeralda Counties) (page 1 of 2).

Potential quarries	Construction impacts
CA-8B	This quarry would result in the loss of 1.3 square kilometers[a] of grazing land on the Highway Allotment, and the loss of nine animal unit months (7.6 percent loss). The quarry would also use 0.07 square kilometer of land on the Peck Allotment, resulting in a loss of less than one animal unit month (0.3 percent loss). The siding for the quarry would be on private land and would impact at least 0.27 square kilometer across two parcels (two owners).
NN-9A	This quarry would be within the Reveille Allotment, and would result in the loss of 2.0 square kilometers of grazing land and 19 animal unit months (less than 0.1 percent loss).
Potential quarries	Construction impacts
NN-9B	This quarry would be within the Reveille Allotment, and would result in the loss of 1.3 square kilometers of grazing land and 13 animal unit months (less than 0.1 percent loss).
ES-7	This quarry would be on 1.5 square kilometers of public land within an inactive grazing allotment.
NS-3A	This quarry would be on 3.8 square kilometers of public land within an inactive grazing allotment.
NS-3B	This quarry would be on 1.5 square kilometers of public land within an inactive grazing allotment.

Table 4-29. Summary of potential impacts to land use and ownership – railroad construction and operations support facilities (Lincoln, Nye, and Esmeralda Counties) (page 2 of 2).

Facility	Construction impacts
Interchange Yard	The Interchange Yard would be within existing Union Pacific Railroad right-of-way. Thus, there would be no impacts.
Staging Yard at Caliente-Indian Cove	The Staging Yard would be on 0.73 square kilometer of private land (across 6 parcels). There would be direct changes to land use on this property.
Staging Yard at Caliente-Upland	The Staging Yard would be on 0.45 square kilometer of private land (across 17 parcels). There would be direct changes to land use on this property.
Staging Yard at Eccles-North	The Staging Yard would be on public land, on an active grazing allotment. The yard would use 0.3 square kilometer of grazing land, resulting in an estimated loss of 2 animal unit months on the Peck Allotment.
Maintenance-of-Way Headquarters Facility	Building would be on vacant BLM-administered land and would use 0.013 square kilometer of land. This would be a permanent change in land use.
Maintenance-of-Way Trackside Facility	Facility would be within the rail line construction right-of-way, across two active grazing allotments.
Rail Equipment Maintenance Yard, Cask Maintenance Facility, Nevada Railroad Control Center and National Transportation Operations Center	These facilities would be on DOE-controlled land on the Yucca Mountain Site. There would be no change in land use or ownership.

a. To convert square kilometers to acres, multiply by 247.10.

Table 4-30. Summary of potential impacts to land use and ownership – Oasis Valley alternative segments (Nye County).

Construction impacts	Oasis Valley 1	Oasis Valley 3
Private parcels the alignment would cross (construction right-of-way)	1	0
Affected property owners	1	0
Land area of private land affected (including patented mining claims)	0.04 square kilometer[a]	Not applicable
Grazing allotments the alignment would cross	2 (1 active)	2 (1 active)
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	8 or 0.8 percent	13 or 1.4 percent
Allotment land that would be within the construction right-of-way	2.3 square kilometers	3.8 square kilometers
Unpatented mining claims the alignment would cross	2 sections containing 14 claims	2 sections containing 14 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	1.7 kilometers[b]	4 kilometers
Roads and trails the alignment would intersect	3	3
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

4.2.3 AESTHETIC RESOURCES

This section describes potential impacts to aesthetic (visual) resources from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.3.1 describes the methods DOE used to assess potential impacts; Section 4.2.3.2 describes potential impacts during the construction phase; Section 4.2.3.3 describes potential impacts during the operations phase; Section 4.2.3.4 describes potential impacts under the Shared-Use Option; and Section 4.2.3.5 summarizes potential impacts to aesthetic resources.

Section 3.2.3.1 describes the region of influence for aesthetic resources along the Caliente rail alignment.

4.2.3.1 Impact Assessment Methodology

4.2.3.1.1 Approach

Most of the lands along the Caliente rail alignment are BLM-administered public lands. For this reason, DOE utilized BLM methods to evaluate potential impacts to visual resources.

The BLM uses a process to rate visual resource contrast and evaluate the magnitude of a project's impact on existing visual resources (DIRS 173053-BLM 1986, all). The BLM evaluates the contrast between existing conditions and conditions expected during a project, drawing on information from the BLM visual resource management inventory, which the BLM uses to classify the aesthetic value of BLM-administered lands (DIRS 101505-BLM 1986, all). BLM management objectives allow different levels of project-related contrast for each visual resource management class (DIRS 101505-BLM 1986, Section VB). Figure 3-58 in Section 3.2.3 shows the visual resource management classes for lands surrounding the Caliente rail alignment. DOE used the BLM methodology to assign visual resource management classes to non-BLM public and private land.

To identify potential impacts to aesthetic resources, DOE applied the process for rating visual resource contrast specified in BLM Manual Handbook 8431-1. This process involved comparing the existing and proposed conditions in relation to:

- Landform, vegetative features, and structural features (such as existing and proposed rail roadbeds, power distribution lines, buildings, and communication towers)
- Form, line, color, and texture
- Other factors including distance, angle of observation, how long the project feature would be visible, relative size or scale, season of use, light conditions, recovery time for vegetation after construction, spatial relationships, and atmospheric conditions

DOE developed contrast ratings using the methodology in BLM Manual Handbook 8410-1 (DIRS 101505-BLM 1986, all) from the key observation points identified in Section 3.2.3 (see Figure 3-58). DOE prepared simulations to illustrate the expected project-related contrast at some key observation points. Appendix D, Aesthetics, Section D.1, provides baseline photographs and simulations for the Caliente rail alignment.

4.2.3.1.2 Criteria for Determining Impacts

DOE used the criteria listed in Table 4-31 to rank the contrast between existing conditions and conditions expected during the railroad construction and operations phases at each key observation point. DOE then considered contrast ratings against the BLM visual resource management objectives listed in Table 4-32, where applicable. In general, the BLM manages areas of high visual value (Classes I and II) to minimize contrast, while allowing more contrast in areas of lower visual value (Classes III and IV).

Table 4-31. Criteria for determining degree of visual contrast.[a]

Degree of contrast	Criteria
None	The element contrast is not visible or perceived.
Weak	The element contrast can be seen but does not attract attention.
Moderate	The element contrast begins to attract attention and begins to dominate the characteristic landscape.
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

a. Source: DIRS 173053-BLM 1986, Section III.D.2.a.

In this analysis, the primary basis for identifying potential adverse impacts to aesthetic resources is inconsistency with BLM management objectives for a ***viewshed***. This includes consideration of effects on the visual values of parks, recreation areas, and other scenic resources (recognized at the national, state, or local level) and visual intrusions or contrasts affecting the quality of landscapes. Along much of the Caliente rail alignment, where the landscape is sparsely populated and undeveloped, the visual impact of equipment, facilities, and activities could create a weak or moderate contrast, according to the criteria listed in Table 4-31. That is, from key observation points that are within a few miles, equipment, facilities, and activities could be seen (weak contrast) or would begin to attract attention and begin to dominate the viewshed (moderate contrast). However, as noted in BLM guidance, distance and duration of project activities affect perceptions of contrast (DIRS 173053-BLM 1986, Section III.D.2.b).

Table 4-32. BLM visual resource management classes and objectives.[a]

Visual resource class	Objective	Acceptable changes to land
Class I	Preserve the existing character of the landscape.	Provides for natural ecological changes but does not preclude limited management activity. Changes to the land must be small and must not attract attention.
Class II	Retain the existing character of the landscape.	Management activities may be seen but should not attract the attention of the casual observer. Changes must repeat the basic elements of form, line, color, and texture of the predominant natural features of the characteristic landscape.
Class III	Partially retain the existing character of the landscape.	Management activities may attract attention but may not dominate the view of the casual observer. Changes should repeat the basic elements in the predominant natural features of the characteristic landscape.
Class IV	Provides for management activities that require major modifications of the existing character of the landscape.	Management activities may dominate the view and be the major focus of viewer attention. An attempt should be made to minimize the impact of activities through location, minimal disturbance, and repeating the basic elements.

a. Source: DIRS 101505-BLM 1986, Section V.B.

Distance of an observer from project activities and facilities would greatly affect the observer's perception of project-related contrasts with the landscape. The likelihood that activities or facilities would divert an observer's attention away from the landscape would decrease as distance increased.

Thus, views from observation points where the project would appear in ***distance zones*** foreground or middleground would usually be affected more than views from observation points where the project was in the background.

Duration of activities also affects conclusions about a project's consistency with BLM visual resource management objectives in a particular location. For example, visible construction activities over 18 months could cause a moderate degree of contrast and be inconsistent with Class II objectives. Such activities would be recognized as a moderate adverse impact of construction in Class II areas, although BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7). In contrast, passage of a train on a track more than approximately 1.6 kilometers (1 mile) from observers for a few minutes three times a day for up to 50 years might comply with Class II objectives if the track itself did not attract attention or dominate the view of a casual viewer, thus creating only a weak degree of contrast. In such a case, presence of the rail line would be recognized as a small adverse impact of operation.

4.2.3.2 Construction Impacts

Table 4-33 lists contrast ratings for views from each key observation point along the Caliente rail alignment and consideration of project consistency with BLM management objectives. In cases where construction and operations activities would cause different levels of contrast, the table identifies the phase for each rating; otherwise, a single rating applies to both construction and operations. Figure 4-1 is the same as Figure 3-58 in Section 3.2.3, showing visual resource management classifications of lands around each key observation point. It is a useful reference when reading impact discussions in this section. Appendix D, Section D.1, provides photographs of views from each key observation point and simulations of views including the track, trains, or other features.

4.2.3.2.1 Construction Impacts Common to the Entire Caliente Rail Alignment

Construction-related equipment, facilities, and activities would be potential sources of short-term (temporary) impacts to visual resources during the construction phase. Most of the equipment, facilities, and activities would be situated within the nominal width of the construction right-of-way. From some viewpoints, the presence of workers, vehicles, equipment, supply trains, borrow sites, quarries, laydown yards, well pads, construction camps, and electric distribution lines, and the generation of dust and vehicle exhaust, might be seen or might attract the attention of a casual observer during construction. These would result in small impacts to visual setting except in areas discussed in Section 4.2.3.2.2.

New cut and fill slopes could temporarily result in a weak to strong contrast with adjacent soils and vegetation. The short-term level of impact to the visual setting from this contrast would be small to large, and would decrease with the reestablishment of vegetation. Cuts in virgin rock would initially show a weak to strong contrast between freshly exposed rock and previously weathered rock. Without mitigation, this contrast would result in long-term small to large impacts to the visual setting.

Construction supply trains consisting of 8 to 20 cars would pass eight times per day, at most (loaded on the trip out, empty on the return), along rail line segments under active construction. Construction trains would likely be visible for between 5 and 20 minutes from a single vantage point, depending on train speed and terrain. In addition, small pieces of equipment such as track tampers, ballast regulators, tie handlers, rail-clip applicators, and ballast consolidators would pass two to eight times per day (DIRS 180874 -Nevada Rail Partners 2007, Appendix A). The level of impact to visual resources would be small.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 1 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
1	U.S. Highway 93 at Dry Lake Valley, views toward common segment 1	Surrounding lands (III and IV), Highland and Chief Ranges (II and III)	None	Yes	Small	Rail line would not be visible to viewers.
2	Staging Yard Caliente-Indian Cove option, view north	Surrounding lands (III)	Moderate	Yes	Moderate	
3	Conveyer crossing U.S. Highway 93 to feed Staging Yard Caliente-Indian Cove option, view north-northwest	Surrounding lands (II)	Construction: moderate Operations: weak	No Yes	Constructio n: moderate Operation: small	DOE would dismantle the quarry conveyor system after construction was complete. Only the track would be source of operations impact.
4	Conveyor crossing U.S. Highway 93 to feed Staging Yard Caliente-Upland option, view south-southwest	Surrounding lands (III)	Construction: moderate Operations: none	Yes	Constructio n: moderate Operation: small	DOE would dismantle the quarry conveyor system after construction was complete.
5	Staging Yard Caliente-Upland option, view north-northeast	Surrounding lands (III)	Weak to none	Yes	Small	Presence of other structures would minimize contrast.
6	Rail line crossing of U.S. Highway 93, view north-northeast to common segment 1	Surrounding lands (III)	Weak	Yes	Small	
7	U.S. Highway 93 north of rail line crossing, view west toward common segment 1	Surrounding lands (III), Big Hogback (II)	Weak	Yes	Small	Rail line would not be visible in view toward Big Hogback.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 2 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
8	U.S. Highway 93 at State Route 319	Surrounding lands (III)	None to weak	Yes	Small	Class II lands of Cathedral Gorge would not be visible to the north; rail line could be faintly visible to the south.
9	Miller Point - Cathedral Gorge, view south toward common segment 1	Surrounding lands (III), Cathedral Gorge State Park (II)	Weak	Yes	Small	Rail line would barely be visible from the park.
10	State Route 318 crossing, view northwest toward common segment 1	Surrounding lands (III), Weepah Springs Wilderness (I)	Weak	Yes	Small	Typical highway crossing structure would not draw attention.
11	Off county road west of State Route 318 north of rail line crossing, view west toward common segment 1	Surrounding lands (III), Timber Mountain (II), Weepah Springs Wilderness (I)	Weak	Yes	Small	Distance from key observation point would reduce contrast.
12	Rail line crossing Timber Mountain Pass Road, view east-northeast	Surrounding lands (III), Timber Mountain (II), Weepah Springs Wilderness (I)	Moderate	Yes	Moderate	

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 3 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
13 and 15	County road on south side of Garden Valley, views toward Garden Valley alternative segments	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)	Construction of Garden Valley 1 or Garden Valley 3: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer and; would not detract from views of surrounding mountains.
			Construction of Garden Valley 2 or Garden Valley 8: strong to none	No	Large to small	Contrast would be reduced with increased distance from viewer and; would not detract from views of surrounding mountains.
			Operation of Garden Valley 1 or Garden Valley 3: weak to none	Yes	Small	
			Operation of Garden Valley 2 or Garden Valley 8: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer; an earthwork berm with soil and vegetation consistent with surrounding landscape would reduce contrast of nearby track to weak.

Table 4-33. Contrast ratings along the proposed rail alignment and consistency with BLM objectives (page 4 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
14	County road in middle of Garden Valley, view south to Garden Valley alternative segments 1, 2, and 8	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)	Construction of Garden Valley 1: strong to none	No	Large to small	Would demand attention where close to viewer and would be less noticeable with increasing distance from viewer.
			Construction of Garden Valley 3: moderate to none	No	Moderate to small	Contrast would be reduced with increased distance from viewer.
			Construction of Garden Valley 2, Garden Valley 8: weak to none	Yes	Small	
			Operation of Garden Valley 1: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer; an earthwork berm with soil and vegetation consistent with surrounding landscape would reduce contrast of nearby track to weak.
			Operation of Garden Valley 2, 3, or 8 weak to none	Yes	Small	

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 5 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
16 to 18	Top of *City* structure element, views toward Garden Valley alternative segments	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)	Construction of Garden Valley 1: moderate to weak	No	Moderate to small	Contrast would be reduced with increased distance from viewer.
			Construction of Garden Valley 2 or Garden Valley 8: strong to none	No	Large to small	Contrast would be reduced with increased distance from viewer.
			Construction of Garden Valley 3: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer.
			Operation of Garden Valley 1, Garden Valley 2, or Garden Valley 8: weak to none	Yes	Small	Track and train would cause weak contrast; contrast would be reduced with increased distance from viewer.
			Operation of Garden Valley 3: none	Yes	Small	
19	State Route 375 near rail line crossing, view south-southwest toward common segment 2 and construction camp	Surrounding lands (IV)	Weak	Yes	Small	Construction camp and grade-separated crossing would be visible but would not draw attention.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 6 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
20	Cedar Pipeline Ranch, view northeast toward common segment 2	Surrounding lands (IV), Kawich Range (II), Reveille Range (II), Quinn Canyon Range (III), South Reveille Wilderness Study Area (I)	Moderate to weak	Yes	Moderate to small	
21, 22	Near intersection of U.S. Highway 6 and State Route 375, views toward common segment 3	Surrounding lands (IV), Kawich Range (II), Kawich Wilderness Study Area (I)	Weak	Yes	Small	Rail line would cross Class IV; contrast against Class II; distance would reduce contrast against Class II background or topography would impede view of rail line.
23	U.S. Highway 6 on east side of Warm Springs Summit, view south-southwest toward common segment 3	Surrounding lands (IV), Kawich Range (II)	Weak	Yes	Small	Rail line would cross Class IV; hilly topography would reduce contrast against Class II background.
24	Warm Springs Summit, view east-southeast toward common segment 3	Surrounding lands (IV), Kawich Range (II)	None	Yes	Small	Rail line would be in a cut, not visible from highway; no contrast with Class II background.
25	U.S. Highway 6 at a mine access road, view southeast toward common segment 3	Surrounding lands (IV), Kawich Range (II), Kawich Wilderness Study Area (I)	None	Yes	Small	Rail line would be in a cut, not visible from highway; no contrast with Class II background.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 7 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
26	Nevada Test and Training Range Road near rail line crossing, view east-northeast toward common segment 3	Surrounding lands (IV), Kawich Wilderness Study Area (I)	Weak	Yes	Small	
27	Nevada Test and Training Range Road, view east-northeast toward common segment 3	Surrounding lands (IV), Kawich Wilderness Study Area (I)	Weak	Yes	Small	Distance would eliminate contrast with Class I background.
28	U.S. Highway 6 at Nevada Test and Training Range Road, view southwest toward common segment 3	Surrounding lands (IV)	Weak	Yes	Small	
29	U.S. Highway 95 north of Goldfield, view east-northeast toward quarry	Surrounding lands (IV)	Weak	Yes	Small	Distance of quarry facilities would minimize contrast.
30	U.S. Highway 95 at north end of Goldfield, view south-southeast toward Goldfield 4	Surrounding lands (IV)	Weak	Yes	Small	Topography and distance would minimize contrast.
31	Rail line crossing U.S. Highway 95 south of Goldfield, view south-southeast toward Goldfield 4	Surrounding lands (IV)	Weak	Yes	Small	Typical highway crossing structure would not draw attention.
32	U.S. Highway 95 at State Route 266, view east to common segment 4	Surrounding lands (IV), State Route 266 (III), Stonewall Mountain (II)	Weak	Yes	Small	Rail line would be distant from Class II feature, which would be in background; Class III lands would not be visible in views from highway over the track.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 8 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
33	U.S. Highway 95 at State Route 267, view north-northeast over common segment 5	Surrounding lands (IV), State Route 267 (III)	Weak	Yes	Small	
34	U.S. Highway 95 (typical cut), view toward common segment 5 hill cuts	Surrounding lands (IV)	Strong to moderate	Yes	Large to moderate	
35	U.S. Highway 95 north of Oasis Valley (typical landscape)	Surrounding lands (IV)	Weak	Yes	Small	Rail line would be visible but would not attract attention away from topography in background.
36	U.S. Highway 95 and Beatty Wash access road, view northeast to construction access road	Surrounding lands (IV)	None to weak	Yes	Small	Rail line would not be visible from key observation point; increased traffic along access road would be visible but would not attract attention.
37	U.S. Highway 95 at proposed Maintenance-of-Way Headquarters Facility, view northeast to facility	Surrounding lands (IV)	Weak	Yes	Small	

a. Source: DIRS 101505-BLM 1986, Section V.B.
b. Contrast rating definitions from DIRS 173053-BLM 1986, Section III.D.2.a; see Table 4.4-1.
c. BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).
d. Impact level definitions from Section 4.1.

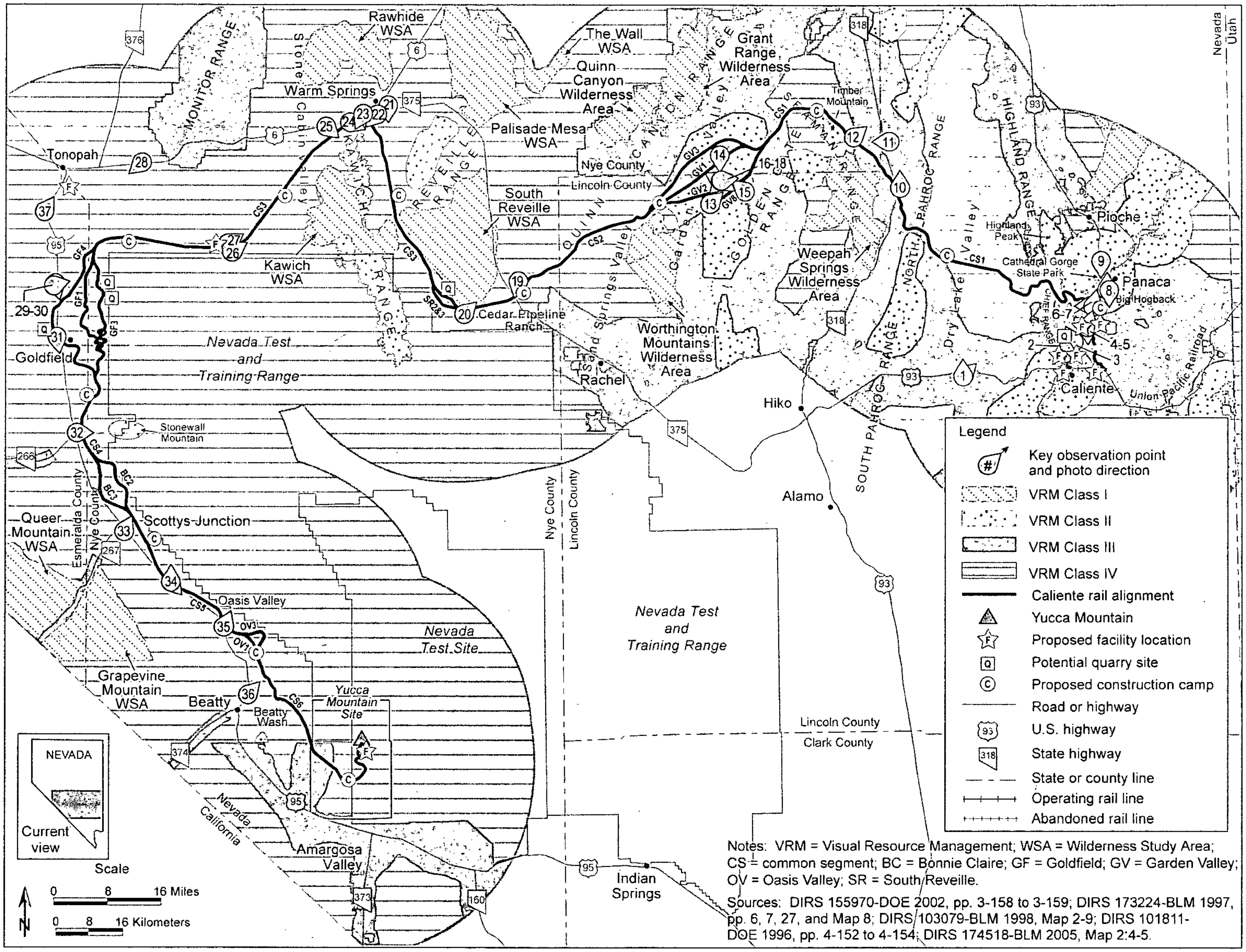


Figure 4-1. Visual resource management classifications and key observation points along the Caliente rail alignment.

Activities associated with two of the potential quarry sites would be visible from highways. One, quarry NS-3A (see Figure 2-9) northeast of Goldfield, would be in Class IV lands more than 8 kilometers (5 miles) from U.S. Highway 95. Because of their distance from the viewer, the quarry and ballast production facilities would cause weak or no contrast from the nearest key observation point (29); see Figure D-68 in Appendix D. A potential quarry site north of Caliente, CA-8B (see Figure 2-25), would not be visible to passersby, but a conveyor to carry material from the quarry to the Staging Yard, either at Caliente-Indian Cove or Caliente-Upland, would be visible from U.S. Highway 93 at key observation point 3 or 4 (see Figure 4-2, and Figures D-7 through D-9 in Appendix D) while it was under construction and during quarry operation. DOE would remove the conveyor once quarry operations ended. Activities associated with potential quarry sites NA-9A or NA-9B between the Reveille and Kawich Ranges would cause moderate to high contrast to viewers on a lightly traveled county road. This level of contrast is compatible with objectives for the Class IV lands in which the quarries would be located. Potential quarry sites ES-7 west of Goldfield and NS-3B east of Goldfield would not be visible from highways or county roads.

In situations where water wells could not be constructed within the nominal width of the construction right-of-way (see Figure 2-3), they would lie within a 23-square-meter (250-square-foot) drilling area, connected to the construction right-of-way by small pipelines feeding temporary 9.3-square-meter (100-square-foot) reservoirs. These would cause localized short-term weak-to-moderate contrast, compatible with BLM management objectives in surrounding lands, except for Class II lands in Garden Valley.

Up to 12 temporary construction camps would be situated along the rail alignment at intervals of approximately 50 kilometers (30 miles) (see Figure 2-22). The camps, which would each average 0.1 square kilometer (25 acres) in size, would have a long and narrow layout of approximately 730 meters by 120 meters (2,400 feet by 400 feet) and would be within the nominal width of the rail line construction right-of-way as close as possible to intersections of existing public roads and the rail alignment access roads. Each camp would consist of single-story housing, offices, support facilities (commissary, kitchen, cafeteria, recreation facilities, service station, fueling area, and medical facilities), utilities (power lines, water- and wastewater-treatment facilities, and trash storage), a contractor work area (sections for maintenance and parts and materials storage), and parking (DIRS 180922-Nevada Rail Partners 2007, Chapter 4). The most visible structures at each construction camp would be the housing facilities. The camps would contrast weakly against the landscape as observed by passing motorists, resulting in short-term small impacts to the visual setting. See Figure 4-3 for a simulation showing a construction camp.

Electricity distribution lines would be buried within the operations right-of-way over the length of the rail line. Where the lines connected to the commercial power grid, an electrical substation and a line of power poles extending from the substation to the rail line would be visible. These would cause weak contrast against the existing transmission lines of the commercial power grid, with corresponding small impacts to the visual setting. Temporary poles would also be visible carrying power to facilities within construction camps, contributing to short-term small impacts to the visual setting around the camps.

Construction duration at most individual locations along the rail line would be a period of weeks or a few months under a 4-year construction schedule. Under a 10-year schedule, there would be multiple phases of work (of weeks or a few months) separated by years of inactivity. Active construction would be longer at locations of major structures, such as bridges and railroad operations support facilities, but nowhere would construction be expected to exceed 18 continuous months except at the bridge over Beatty Wash, which DOE expects would take 2 years to construct. DOE would withdraw construction camps from service and keep them in reserve during periods of construction inactivity, and would close camps and reclaim the land as sections of the rail line were completed.

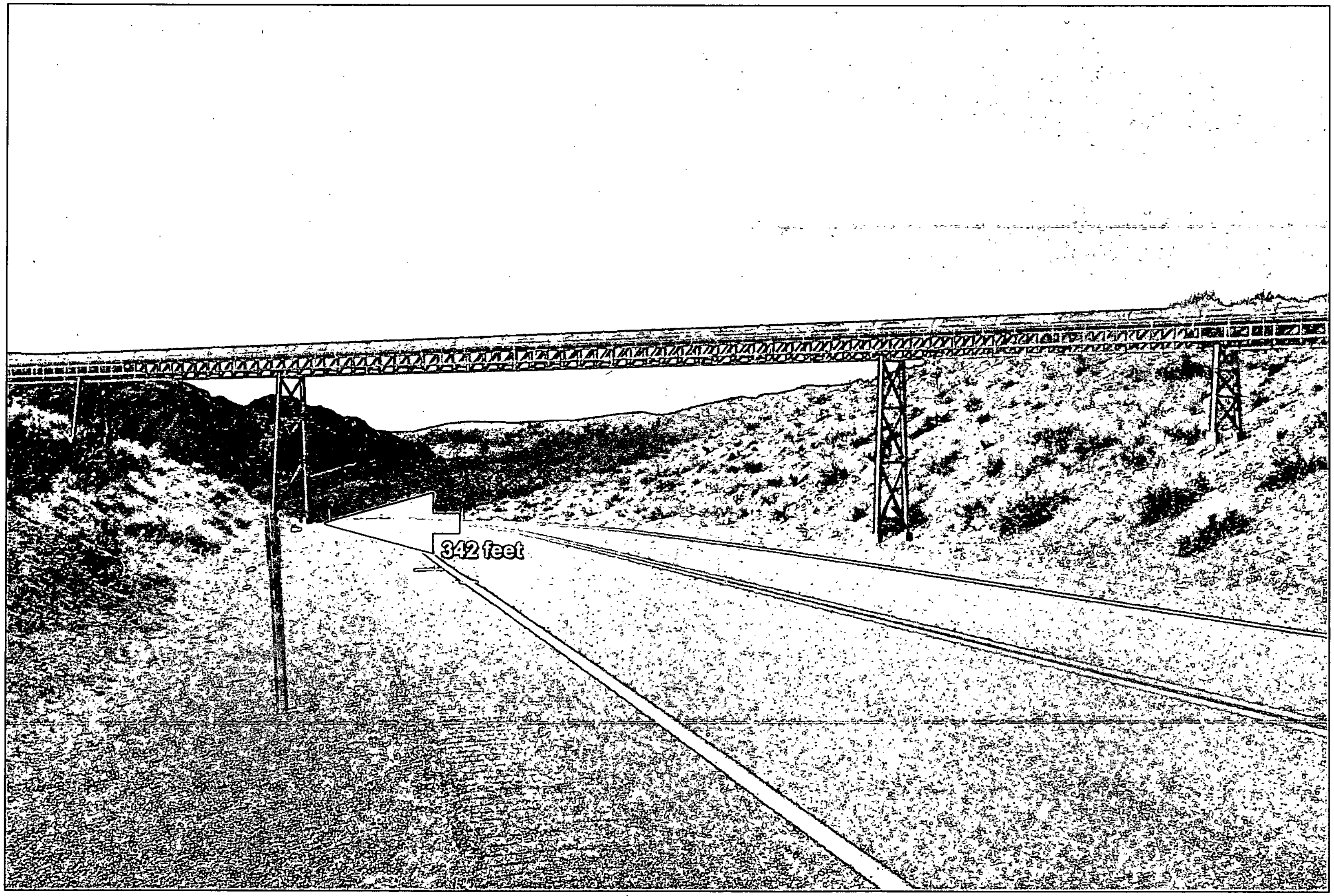


Figure 4-2. Simulation of rock conveyor in view south-southwest from key observation point 4 on U.S. Highway 93.

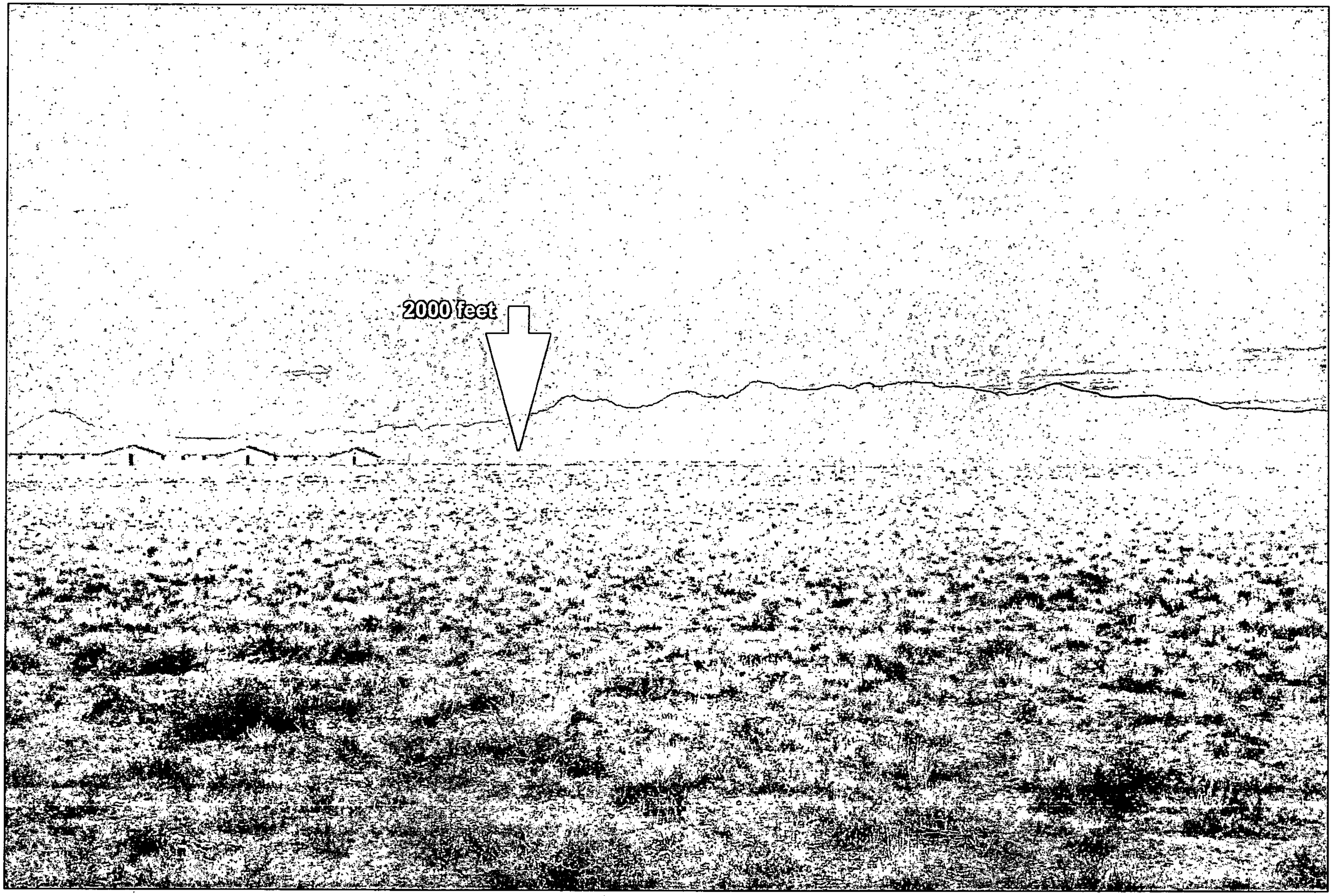


Figure 4-3. Simulation of track and construction camp in view south-southwest from key observation point 19 on State Route 375.

Thus, a longer construction schedule would not increase the level of visual impact because inactivity would minimize the visual contrast at individual locations where construction was halted, although the impact of disturbed soil and vegetation would be prolonged. Under either construction schedule, DOE would consider requests by local governments to leave individual construction camp sites (the cleared and hardened site the camp occupied) in place after permanent closure of the facility for possible use by these governments or their designees. The visual impacts from these sites would likely be small because the Department would remove equipment and structures prior to transfer, and rail line-related construction activities would cease.

Considering the effects of distance and duration, construction activities or facilities would either not be visible or would be noticeable during the construction phase but would not dominate the attention of a viewer. That is, they would create no contrast or a weak degree of contrast at key observation points, with the exception of those discussed in Section 4.2.3.2.2. A weak degree of contrast, even where Class I and II lands are present in the viewshed, is compatible with BLM management objectives for all classes of land. Thus, there would be small, temporary project-related impacts to the visual setting during construction of any of the Caliente rail alignment alternative segments and common segments, except as described in Section 4.2.3.2.2. As noted in Section 4.2.3.1.2, BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).

4.2.3.2.2 Construction Impacts along Alternative Segments and Common Segments

The aesthetic resources impact analysis identified moderate or strong contrast ratings associated with rail line construction along four portions of the Caliente rail alignment, as described in Sections 4.2.3.2.2.1 through 4.2.3.2.2.4.

4.2.3.2.2.1 Facilities at the Interchange with the Union Pacific Railroad Mainline. The Staging Yard, Caliente-Indian Cove option, would be within non-BLM-administered lands that would be considered as Class III with application of the BLM methodology (DIRS 176988-Quick 2006, all). Because it would lie so close to U.S. Highway 93, construction of the Staging Yard in these Class III lands would likely draw the attention of passing motorists, resulting in a moderate contrast rating from key observation point 2 (see Figures D-4 through D-6 in Appendix D). Construction and use of a rock conveyor across the highway to bring ballast from potential quarry site CA-8B to the north end of the Staging Yard would also cause moderate contrast from adjacent key observation point 3 against the Class II BLM-administered lands north of the Staging Yard (see Figure D-7 in Appendix D). If DOE selected the Caliente-Upland option for the Staging Yard, the conveyor would cross the highway farther north, near key observation point 4; construction and use of a conveyor there would also cause a moderate contrast, but against Class III lands (see Figure 4-2, and Figures D-8 and D-9 in Appendix D). A contrast rating of moderate means that construction activity would meet BLM management objectives for the Class III lands in the Upland area, but not for the Class II lands in the Indian Cove area.

4.2.3.2.2.2 Common Segment 1. Caliente common segment 1 would pass through the Chief and Highland Ranges, where portions of the landscape are Class II. Construction activities would attract the attention of viewers, if any, and result in a moderate contrast rating if a key observation point existed within the area. However, because the Caliente common segment 1 crossing of the Class II lands in this area would not be visible from public roads there would be no contrast from key observation points (see Appendix D, Figures D-2 and D-15 through D-17, which show views from key observation points 1 and 7), and construction would be consistent with BLM management objectives for this Class II area.

4.2.3.2.2.3 Garden Valley Alternative Segments. The rail line would cross the Class II lands of Garden Valley. To evaluate impacts, DOE established contrast ratings from key observation points (13 and 15) on a county road in the south of Garden Valley, from a key observation point (14) on a county road in the middle of Garden Valley, and from key observation points (16 to 18) on top of one of the structures comprising City, a sculpture. Appendix D, Figures D-29 through D-50, provide views across the Garden Valley alternative segments from these key observation points. In rating contrast, DOE assumed that construction activities would be confined to laying track along one of the alternative segments, with one construction camp near the west end of the valley and with laydown yards situated within the construction right-of-way. One general finding from all key observation points was that the contrast expected from construction activities would decrease with distance from the viewer.

Views from key observation points 13 and 15, on a county road in the south of Garden Valley, would show strong to moderate contrast of construction activities along Garden Valley alternative segment 2 and Garden Valley alternative segment 8 within approximately 10 kilometers (6 miles), especially where Garden Valley alternative segment 8 would run parallel and immediately adjacent to one of the county roads. Construction would show moderate contrast against foothills to the east and west when viewed from these county roads, diminishing to weak or none when construction activities reached approximately more than 20 kilometers (12 miles) to the west. Views to the north and northwest would show weak contrast along Garden Valley alternative segment 1, diminishing to none with distance; and weak contrast, if any, with activities along Garden Valley alternative segment 3.

From key observation point 14, on a county road in the middle of Garden Valley, the view across the immediately adjacent portion of Garden Valley alternative segment 1 would show strong contrast during construction, but construction along more distant portions would show less contrast. From key observation point 14, activities along Garden Valley alternative segment 2, Garden Valley alternative segment 3, and Garden Valley alternative segment 8 would cause weak contrast, except where Garden Valley alternative segment 3 would be within approximately 10 kilometers (6 miles), where the construction activities would contrast moderately with the surroundings.

These findings indicate that construction along any of the Garden Valley alternative segments, when viewed from county roads near the construction activities, would not meet the BLM Class II objectives for the area over a period of a few months under the 4-year construction schedule, or for several periods of a few months under a longer construction schedule, because the BLM objectives provide only for management activities that "may be seen but should not attract the attention of the casual observer."

Views toward Garden Valley alternative segment 1 from key observation points 16 to 18 on top of a structure within *City* would show moderate to weak contrast between construction activities and the landscape. Activities would be visible from the tops of *City* structures, though not visible from portions of the sculpture that are below grade. Project construction would be more visible along the flat lands of Garden Valley, especially along portions of Garden Valley alternative segment 1 within a few kilometers of the key observation point. Construction would be less visible against the foothills to the east and west, both because of distance and because of a more complex visual background. The distance of the construction from the observer would help to minimize visual impacts. The construction camp at the west end of the valley would not be discernible. The resulting contrast rating of moderate to weak would not meet BLM Class II management objectives over a period of a few months under the 4-year construction schedule, or for several periods of a few months under a longer construction schedule.

Views toward Garden Valley alternative segment 2 and Garden Valley alternative segment 8 from the key observation points on top of a structure within *City* would show strong to moderate contrast of construction activities against the landscape, diminishing to weak or none with distance. Construction activities along Garden Valley alternative segment 2 and Garden Valley alternative segment 8 would be visible from the tops of *City* structures though not visible from portions of the sculpture that are below grade. Construction activities would be highly visible along the nearby flat lands of Garden Valley and less visible in the more distant and more variegated foothills to the east and west. Because Garden Valley alternative segment 8 is farther away from the *City* key observation points than Garden Valley alternative segment 2 for most of its length, construction activities would be less noticeable on Garden Valley 8 than on Garden Valley 2. The resulting contrast rating of strong to none for Garden Valley alternative segment 2 and Garden Valley alternative segment 8 would not meet BLM Class II management objectives during construction of parts of Garden Valley alternative segment 2 or Garden Valley alternative segment 8 in the flat lands over a period of a few months under the 4-year construction schedule or several periods of a few months under a longer construction schedule.

Construction of Garden Valley alternative segment 3 would barely be visible from key observation points within *City* and at most would create a weak level of contrast. The contrast rating of weak to none would meet BLM management objectives for Class II.

4.2.3.2.2.4 South Reveille Alternative Segments. Activities associated with potential quarry sites NA-9A or NA-9B would cause moderate contrast visible to viewers on the lightly traveled county road that passes within a few hundred meters of the potential quarry sites. The sites and surrounding area between them and the county road all fall on Class IV lands. The contrast rating of moderate would meet BLM Class IV management objectives.

4.2.3.3 Operations Impacts

4.2.3.3.1 Operations Impacts Common to the Entire Caliente Rail Alignment

Sources of potential impacts to the visual setting during the operations phase would be the presence of the rail line and the operations support facilities in the landscape, and the passage of trains to and from the repository. There would be less impact to the visual setting during the operations phase than during the construction phase, because there would be less activity (fewer, shorter trains and equipment, and fewer people), the operations right-of-way (nominally 61 meters [200 feet] on either side of the centerline of the rail line) would be narrower in some areas, and disturbed areas outside the operations right-of-way would be reclaimed (see Chapter 7 for a discussion of best management practices).

The primary visual impact of railroad operations would be the existence of the linear track for up to 540 kilometers (340 miles), with ***wayside signals*** and communications towers visible from short distances. In addition to the impact of the track itself, the passage of a train would attract the attention of a casual observer, both because of the sound associated with the train and its appearance on the track, but this would be an infrequent, short-duration visual distraction. DOE anticipates an approximate peak frequency of 17 one-way trips per week (DIRS 180874-Nevada Rail Partners 2007, Appendix C). This would average fewer than three one-way trips per day. Trains would be up to 19 cars long, and would likely be visible for between 5 and 20 minutes from a single vantage point, depending on train speed and terrain. Passage of these trains would create a small impact to the visual setting.

DOE would install 4.6-meter (15-foot)-tall wayside signals to control train movements along the rail alignment at intervals sufficient to connect each by line-of-sight. DOE would place 23-to-30-meter (75- to-100 foot)-tall radio communications towers at the beginning and the end of the line and at intervals along the rail line as needed to ensure signal transmission (DIRS 180923-Nevada Rail Partners 2007, Chapter 6). See Figures 4-4 and 4-5 for simulations showing signals and communications towers. The wayside signals, radio communication towers, and distribution lines all would create small impacts to the visual setting unless placed in visually sensitive areas close to observers, where impacts could be moderate or large. DOE established contrast ratings at key observation points considering the view of the rail line or operations support facilities and the nature and extent of operations activities that would be visible. The Department compared ratings with BLM visual resource management objectives for the lands in the viewshed.

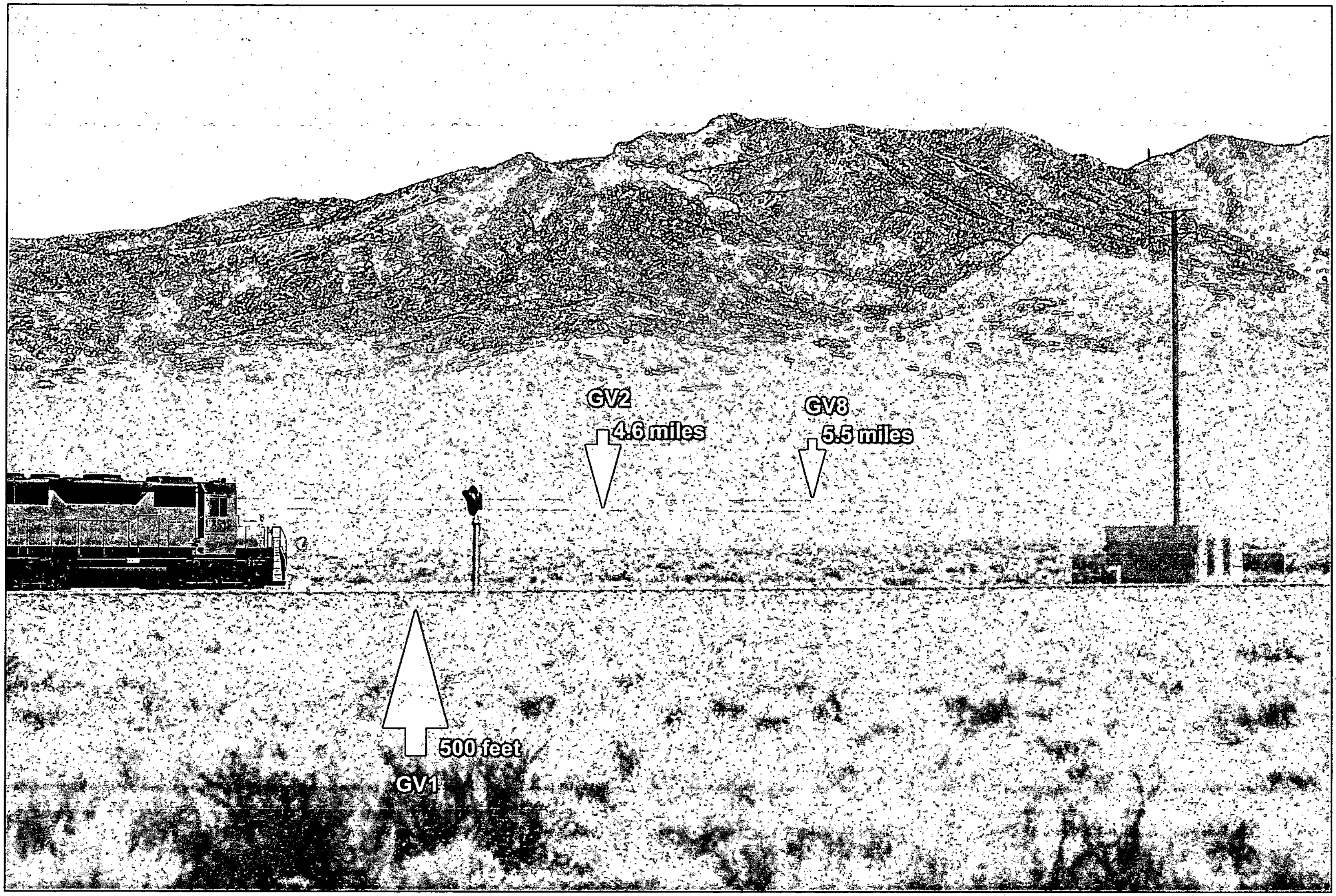


Figure 4-4. Simulation of view south from key observation point 14 on a county road in the middle of Garden Valley, showing track on three alternative segments, and a train and signal and communications tower along Garden Valley 1.

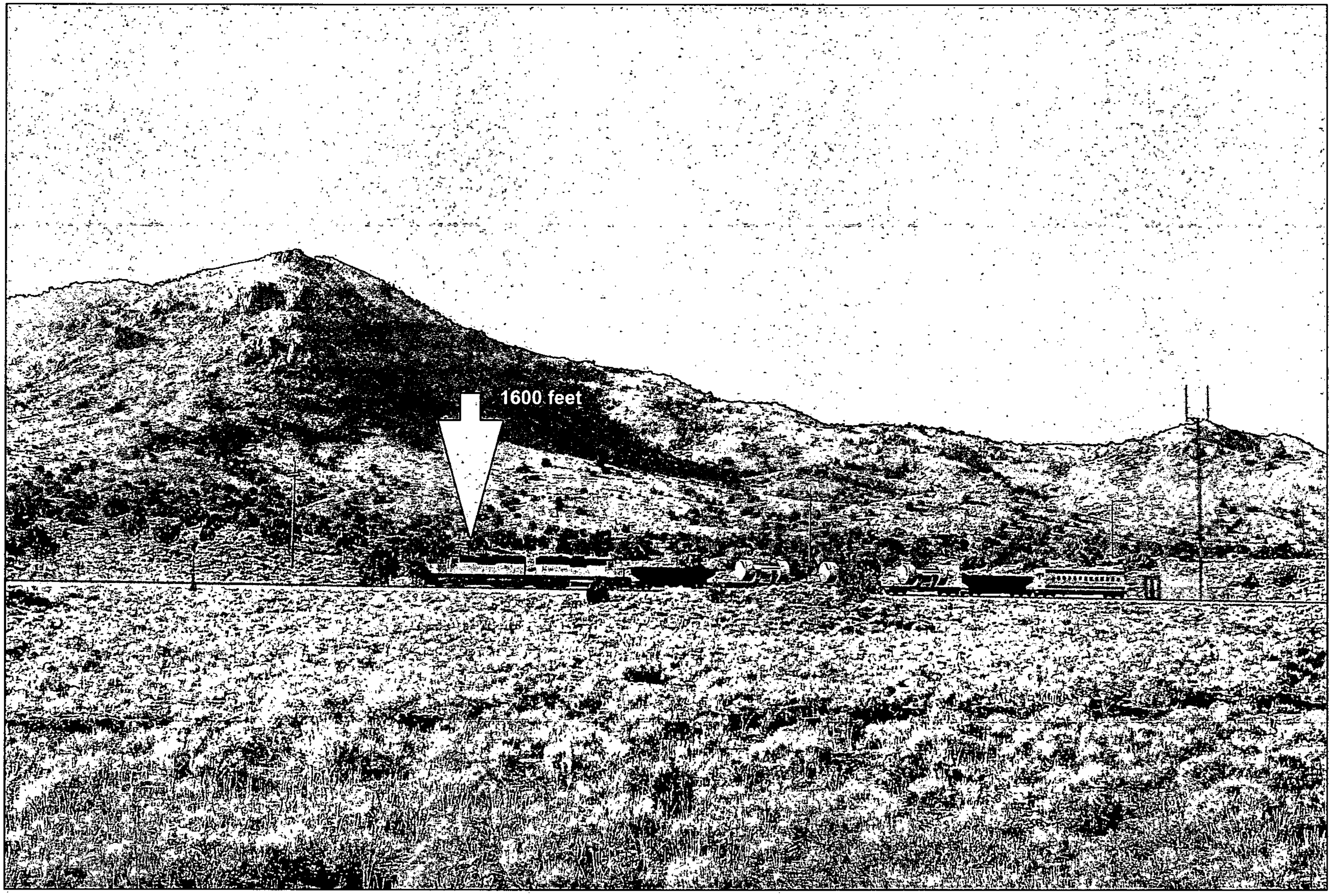


Figure 4-5. Simulation of train, track, and communications tower in view south-southwest from key observation point 23 on U.S. Highway 6 east of Warm Springs Summit (power poles in photo are not related to proposed project).

Contrast ratings at all key observation points confirmed that the presence of the rail line itself, while noticeable in some cases, would not dominate a viewer's attention and would result in a weak level of contrast (see Figure 4-6), except in some cases where the rail line would be within approximately 1.6 kilometers (1 mile) of the viewer and the linear track would cause a moderate contrast (see Section 4.2.3.3.2). A weak level of contrast is compatible with BLM management objectives for all classes of land; a moderate level of contrast is compatible with BLM management objectives for Class III and IV lands, but not for Class II lands. Ratings from key observation points with views of operations support facilities found contrasts would range from moderate to none, compatible with the Class III and IV lands that would surround the locations of the facilities. These include the grade-separated crossings of U.S. Highways 93 and 95 and State Routes 318 and 375 (see Figures 4-7 and 4-8, and Figures D-13, D-14, and D-22 in Appendix D). As transportation structures familiar to motorists, these would not draw attention away from the surrounding landscape.

Contrast ratings confirmed that the level of contrast between a passing train and the landscape would be strong (demanding a viewer's attention) or moderate (beginning to attract attention) where the rail line would fall in the foreground or middleground of the viewshed. Contrast between the landscape and a passing train would be less where the rail line would be in the background. In such cases, the level of contrast would be moderate or weak, where the passing of a train could be noticeable but would not demand attention (see Figure 4-6). The extremely short duration of the passage would diminish the effect, so that BLM management objectives would be met for Class II, III, and IV lands, even if the rail line were to fall in the foreground or middleground of the viewshed, as long as it would not create a linear feature across the landscape that would attract attention or would begin to dominate the landscape.

4.2.3.3.2 Operations Impacts along Alternative Segments and Common Segments

The analysis of impacts to aesthetic resources identified moderate contrast ratings associated with railroad operations along two portions of the Caliente rail alignment, as discussed in Sections 4.2.3.3.2.1 and 4.2.3.3.2.2.

4.2.3.3.2.1 Facilities at the Interface with the Union Pacific Railroad Mainline. Operation of the Staging Yard, Caliente-Indian Cove option, would likely draw the attention of passing motorists on U.S. Highway 93, resulting in a moderate contrast rating from key observation point 2. This moderate adverse impact would be consistent with BLM Class III management objectives, applicable to the non-BLM-administered lands here that would be considered Class III with application of the BLM methodology (DIRS 176988-Quick 2006, all). Presence of the track north of the Staging Yard would create only a weak contrast because it would follow the line of a former rail roadbed that is currently visible as a linear berm near the highway. This weak contrast would be consistent with BLM Class II management objectives applicable to these lands.

4.2.3.3.2.2 Garden Valley Alternative Segments. Views toward all four Garden Valley alternative segments from the key observation points on county roads show weak contrast of the rail line against the landscape, depending on the distance and intervening topography and vegetation. The communications tower would be much less noticeable at a distance of approximately 0.8 kilometer (0.5 mile) in Figure 4-9 than at approximately 150 meters (500 feet) in Figure 4-4. At short distances, passage of a train would increase the contrast to strong for the short duration of the passage, but not enough to raise the overall contrast rating.

Based on views from the key observation points and the simulations for Figures D-29 through D-37 in Appendix D of track, train, and communications signals in the views, it can be concluded that where the track would be more than approximately 1.6 kilometers (1 mile) from a viewer on a county road in Garden Valley, it would not create a new linear feature that would begin to attract attention or begin to dominate the landscape; that is, it would not create a moderate level of contrast.

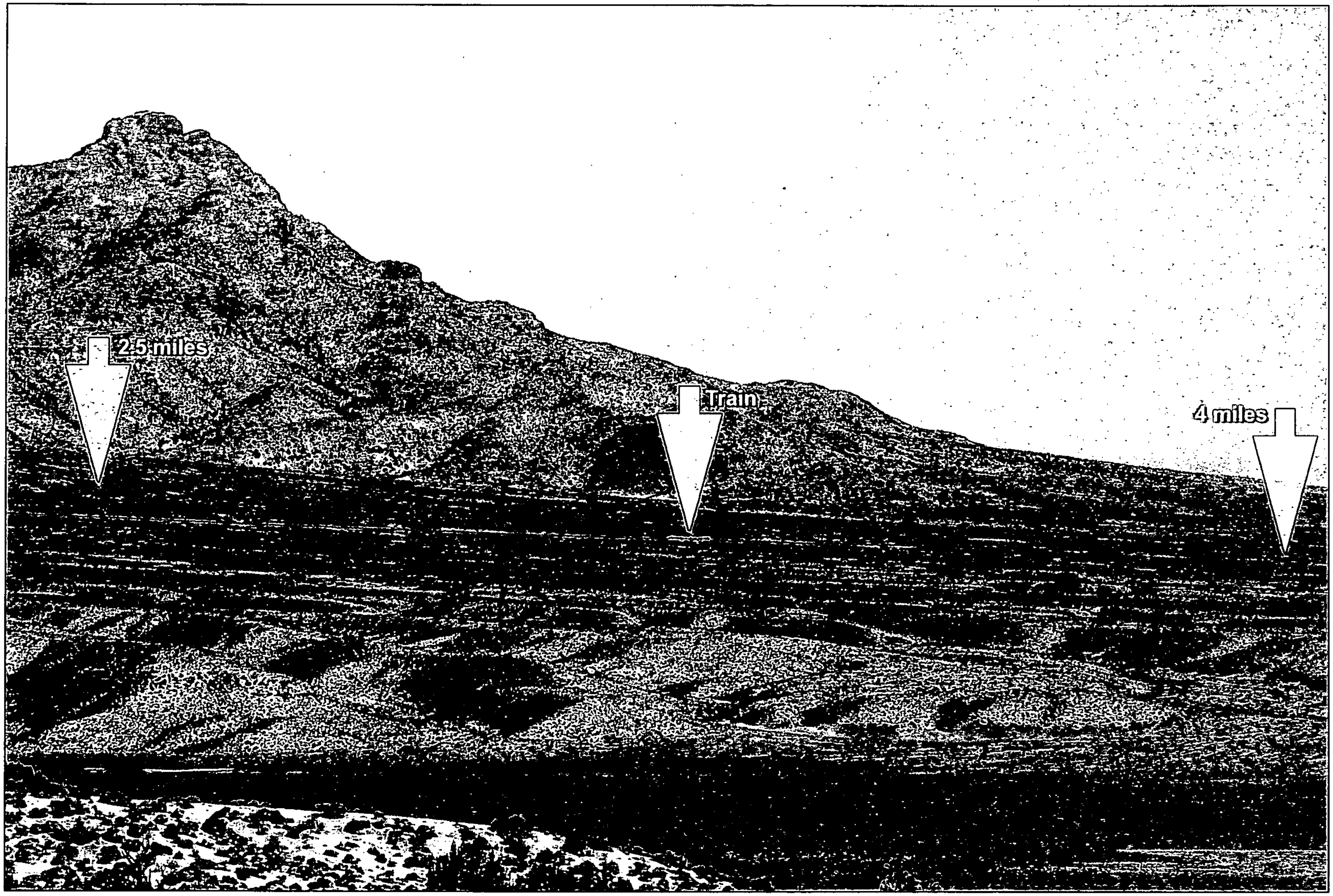


Figure 4-6. Simulation of train and track in view west from key observation point 11 off county road west of State Route 318.

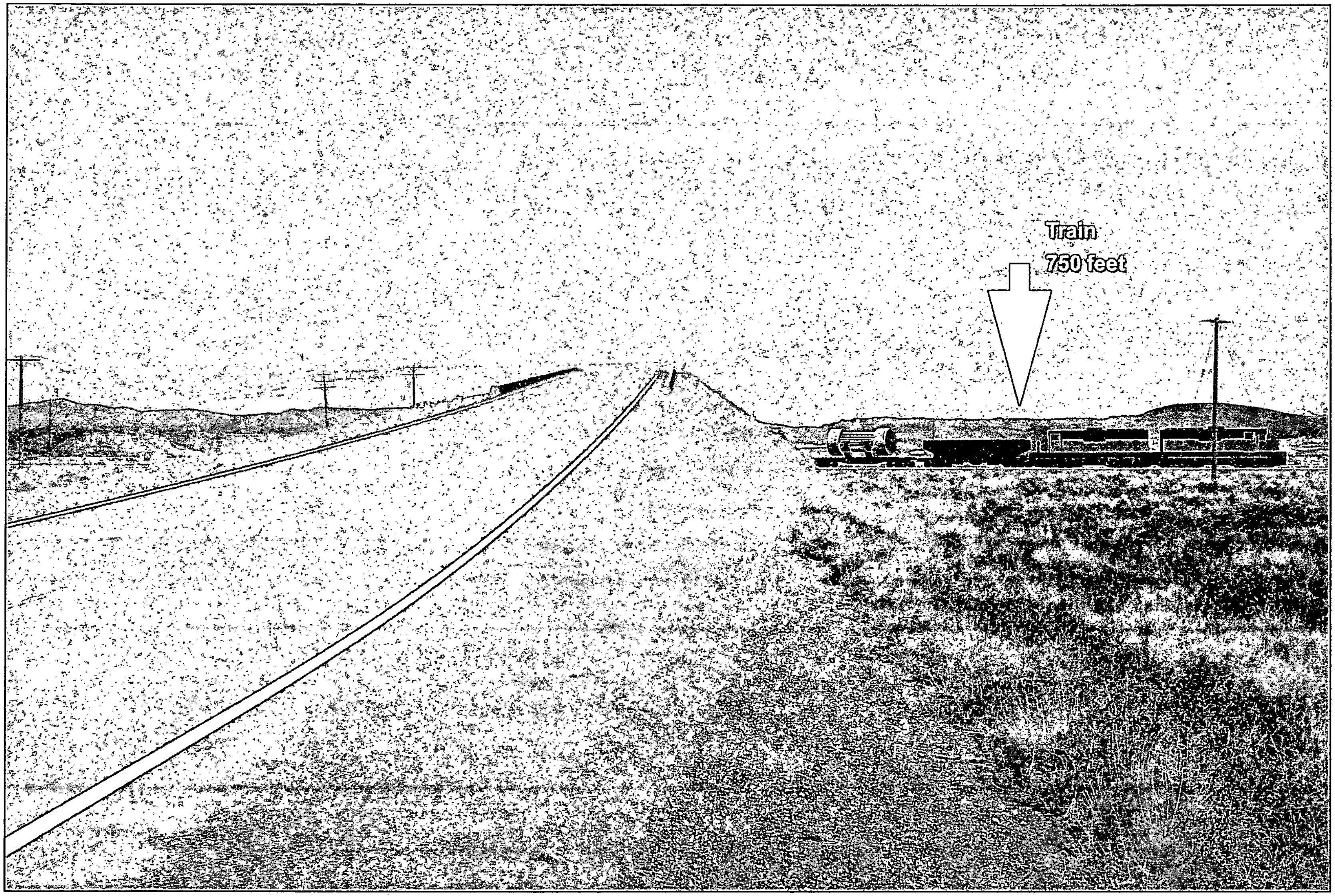


Figure 4-7. Simulation of U.S. Highway 93 crossing over rail line in view north-northeast from key observation point 6 (power poles in photo are not related to proposed project).

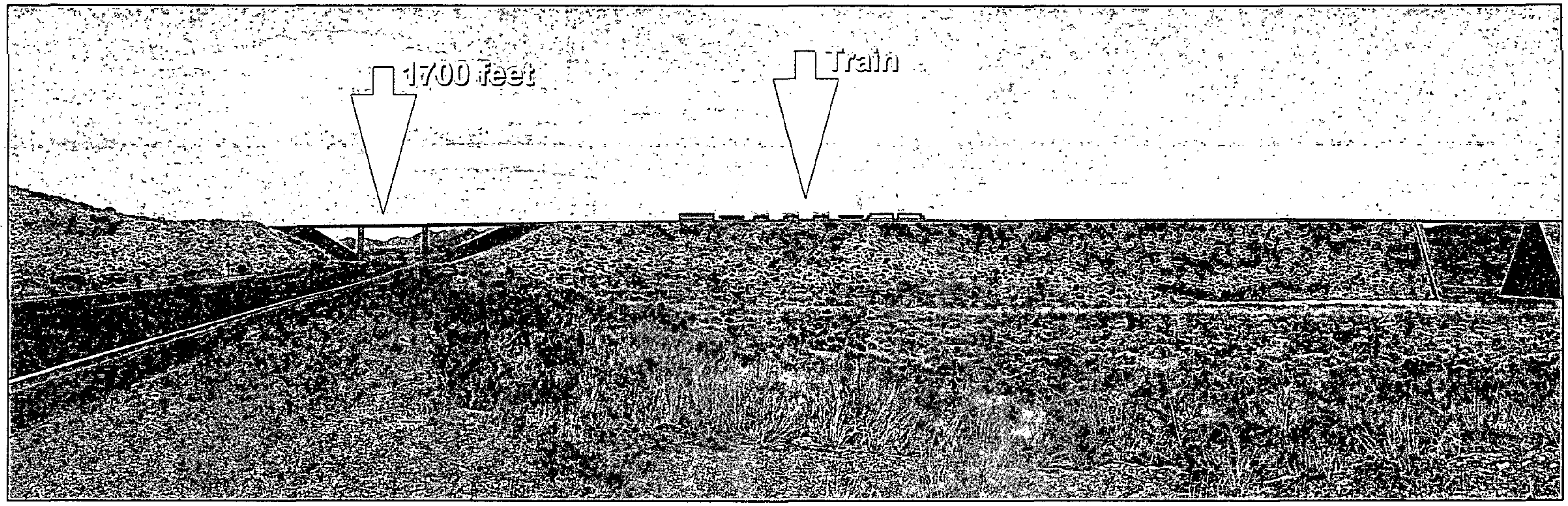


Figure 4-8. Simulation of crossing structure and train on rail line in view northwest to northeast from key observation point 10 on State Route 318.

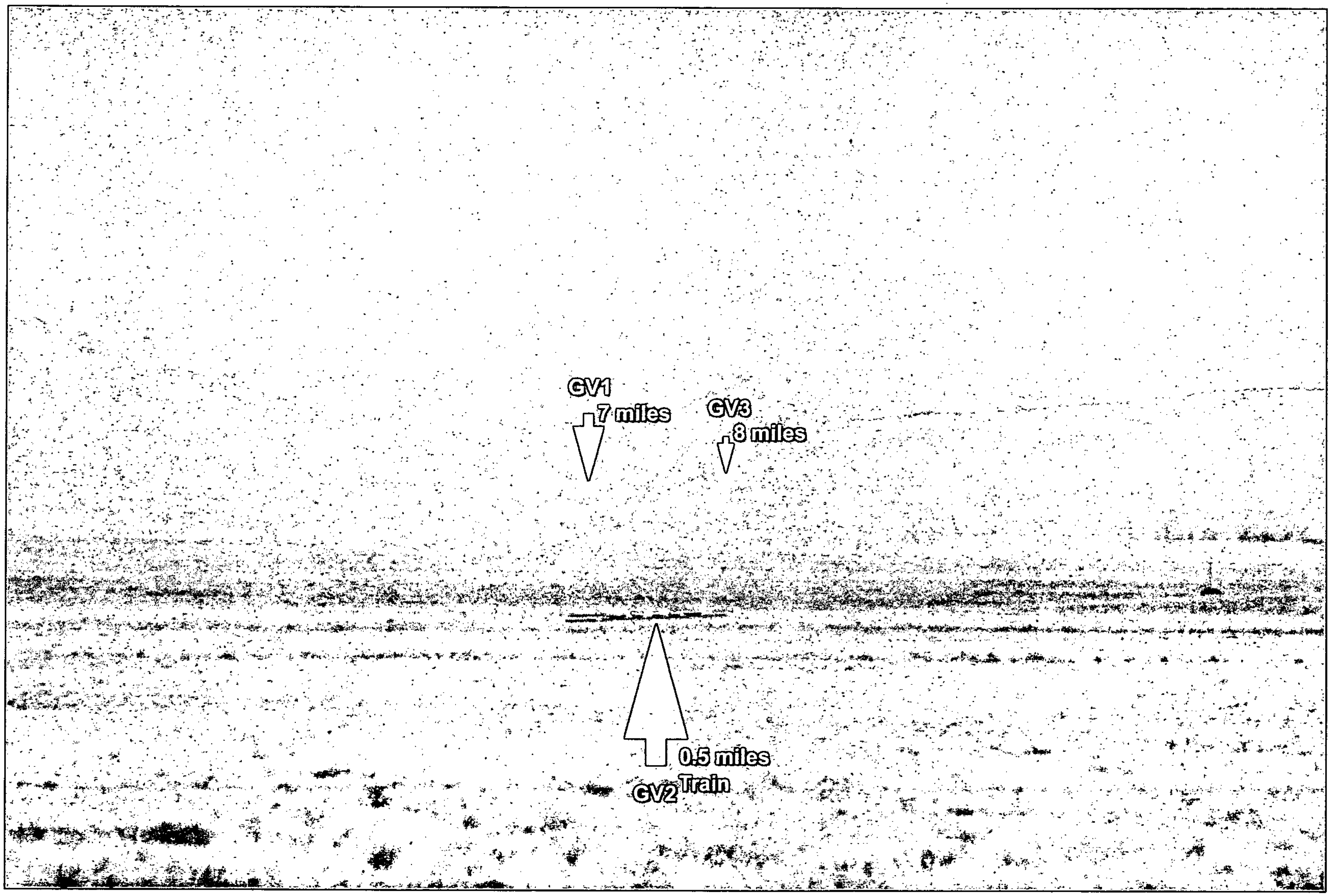


Figure 4-9. Simulation of track in view northeast from key observation point 13 on a county road south of Garden Valley. (Not in picture is an earthwork berm that would mask the linear feature of Garden Valley 2.)

While observations would be necessary along the entire length of each county road to determine the precise places where an alternative segment within 1.6 kilometers or less would cause a moderate contrast, Table 4-34 provides a conservative approximation. The table lists the total length of each alternative segment that would fall within 1.6 kilometers of a county road in Garden Valley. Portions of three of the alternative segments would lie immediately adjacent and parallel to a county road; along these portions, the rail line would not create a new linear feature because the road itself is a linear feature; therefore, this distance is excluded from the total distance where the alternative segment could create a moderate contrast. Table 4-34 indicates that Garden Valley alternative segment 8 and Garden Valley alternative segment 1 would cause moderate contrast in views from county roads to a lesser degree than Garden Valley alternative segment 2 or Garden Valley alternative segment 3. In locations in Garden Valley where the track would otherwise cause a moderate contrast in Class II lands, DOE would construct low, rolling earthwork berms with soils and vegetation that match the surroundings to mask the linear track from viewers. Construction of these berms would reduce the level of contrast to weak. If DOE could not avoid placing communications towers in such areas, the Department would use non-contrasting, non-reflective paint on the towers and associated buildings and place them as far from public viewpoints as feasible.

Table 4-34. Lengths of Garden Valley alternative segments near county roads.

Alternative segment	Length within 1.6 kilometers of county road (kilometers)[a]	Length immediately adjacent and parallel to county road (kilometers)[a]	Length where new linear feature could cause moderate contrast (kilometers)[a]
Garden Valley 1	15	3	12
Garden Valley 2	22	3	19
Garden Valley 3	18	0	18
Garden Valley 8	21	11	11

a. To convert kilometers to miles, multiply by 0.62137.

Views toward Garden Valley alternative segment 2 and Garden Valley alternative segment 8 from the key observation points on top of a structure within *City* would show weak contrast of the rail line against the landscape (see Figure 4-10 and simulations shown in Figures D-43 through D-50 in Appendix D). Because of distance, views toward Garden Valley alternative segment 1 would show weaker contrast and, toward Garden Valley alternative segment 3, no contrast (see simulations in Figures D-38 through D-42). None of the alternative segments would be visible from portions of the sculpture that are below grade. Garden Valley alternative segments 1, 2, and 8 would be more noticeable along the nearby flat lands of Garden Valley and less so in the more distant flat lands and the more variegated foothills to the east and west. Passage of a train would create a greater degree of contrast between the rail line and the surrounding landscape, especially along the nearby flat lands, but this would be an infrequent, short-duration contrast. The resulting contrast ratings of weak to none for Garden Valley alternative segment 1, 2, and 8, and none for Garden Valley alternative segment 3 would meet BLM Class II management objectives.

4.2.3.4 Impacts under the Shared-Use Option

Impacts to aesthetic resources during the construction phase under the Shared-Use Option would be the same as those under the Proposed Action without shared use (see Section 4.2.3.3.1). Construction of additional sidings or short spurs would create small impacts to the visual setting because of the short duration of construction.

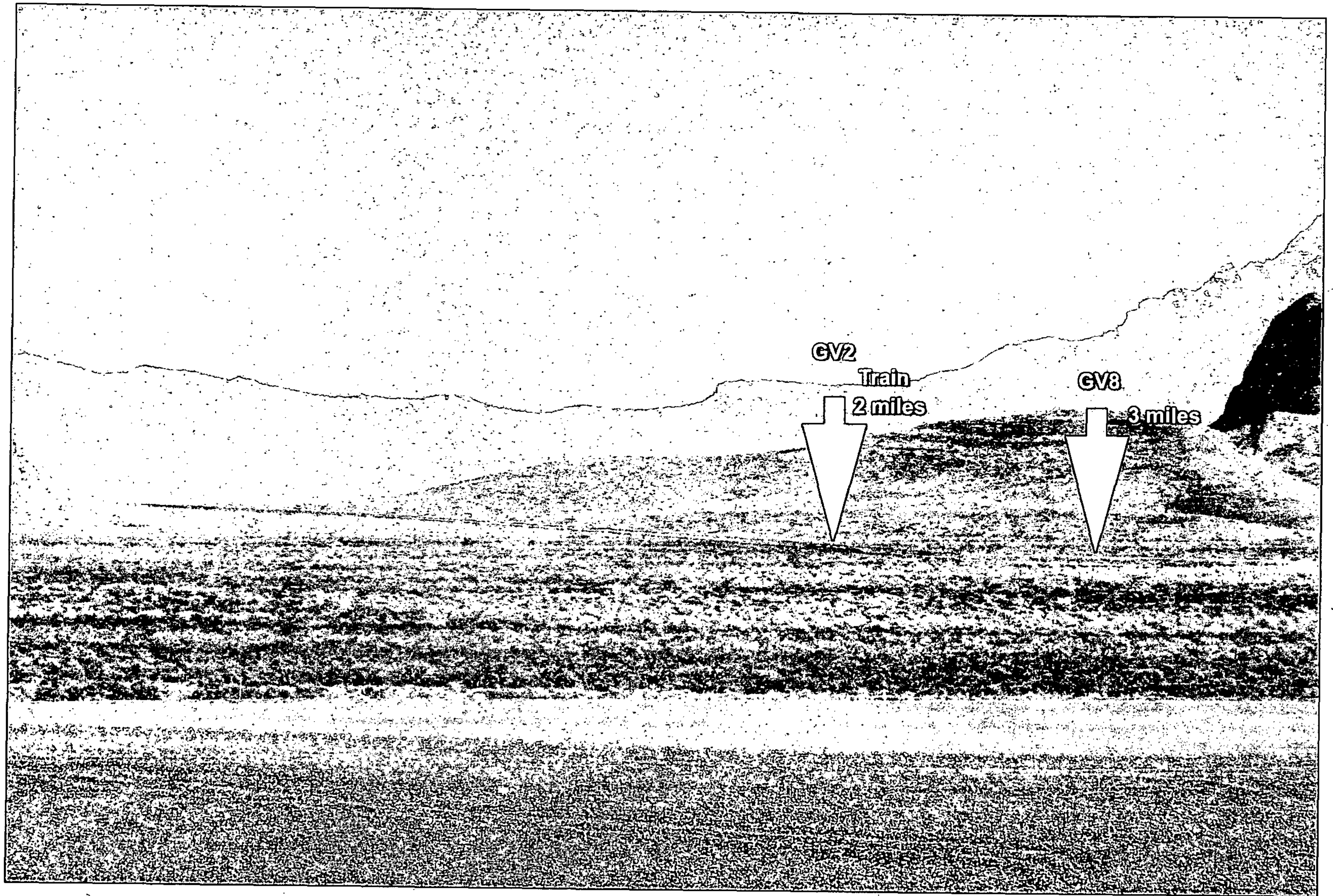


Figure 4-10. Simulation of train along Garden Valley alternative segment 2 and track along Garden Valley alternative segment 8 in view slightly northeast from key observation point 18 on top of a *City* structure.

Impacts to the visual setting during the operations phase under the Shared-Use Option would be the same as those under the Proposed Action without shared use (see Section 4.2.3.3.1). Under the Shared-Use Option, there would be three additional round-trip trains per week, but this would not substantially increase the assumed three trains per day DOE used to establish visual contrast ratings under the Proposed Action without shared use.

4.2.3.5 Summary

Table 4-35 summarizes potential impacts to aesthetic resources from constructing and operating the proposed railroad along the Caliente rail alignment.

Table 4-35. Summary of potential impacts to aesthetic resources – Caliente rail alignment.[a]

Location (county)	Construction impacts[b]	Operations impacts
Rail alignment		
Impacts common to all portions of the Caliente rail alignment	Small impact. Weak to moderate contrast in the short term from dust and exhaust; lighting, temporary power poles, construction camps, and material laydown yards; operation of supply trains. Small to large impact. Weak to strong contrast in the short term from visible construction equipment either operating or in storage, and from scars on soil and vegetated landscape from cuts, fills, and well pads. Small to large impact. Weak to strong contrast in the long term from scars on rock from cuts, and from access roads.	Small to moderate impact. No to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads. Small impact. No to strong contrast in the short term from passing trains.
Garden Valley alternative segments 1, 2, 3, and 8 (Lincoln County and Nye County)	Small to large, but temporary, impact. Weak to strong contrast in the short term, which would not meet BLM management objectives for Class II visual resources.	Small impact. Track on some parts of Garden Valley alternative segments 1, 2, 3, and 8 could create a new linear feature. Vegetated earthwork berms would mask the linear feature and reduce the contrast to levels consistent with Class II.
Operations support facilities		
Staging Yard, Caliente-Indian Cove option (Lincoln County)	Moderate, but temporary, impact. Moderate contrast during the installation and construction of the facility, consistent with surrounding non-BLM-administered lands treated as Class III, but inconsistent with BLM management objectives for Class II visual resources on the BLM lands at the north end of the yard.	Moderate impact. Moderate contrast from the operation of the facility in the Class III non-BLM lands, weak contrast from the track on BLM Class II lands at the north end; in each area, consistent with applicable BLM management objectives.
Quarries		
Caliente quarry (CA-8B) (Lincoln County)	Moderate impact. Moderate contrast in the short term from installation and use of the conveyor from the quarry across U.S. Highway 93, consistent with surrounding non-BLM-administered lands treated as Class III.	No impact under the Proposed Action; conveyor would be removed at end of construction phase.

a. Unless noted otherwise, impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).

4.2.4 AIR QUALITY AND CLIMATE

This section describes potential impacts to ***air quality*** from constructing and operating a railroad along the Caliente rail alignment. Section 4.2.4.1 describes the methodology DOE used to assess potential impacts; Section 4.2.4.2 discusses conformity with the appropriate State Implementation Plan(s); Section 4.2.4.3 describes potential construction and operations impacts; Section 4.2.4.4 describes potential impacts under the Shared-Use Option; and Section 4.2.4.5 summarizes potential impacts to air quality.

Section 3.2.4.1 describes the region of influence for the air quality impacts analysis.

4.2.4.1 Impact Assessment Methodology

DOE examined emissions inventories to determine county-level increases in air pollutant emissions, and performed air quality simulations to determine potential changes in air pollutant concentrations at specific receptors (population centers). Appendix E, Air Quality Assessment Methodology, is a more detailed description of the approach DOE used to perform the air quality assessment.

For areas along the Caliente rail alignment for which no local air quality data are available, DOE compared projected emissions under the Proposed Action with the U.S. Environmental Protection Agency county-level emissions data in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all). DOE compared emissions from proposed railroad construction and operations in Lincoln, Nye, and Esmeralda Counties to existing emissions in three categories: highway emissions, off-highway emissions, and all area sources. Section 4.2.4.3.1 describes projected emissions associated with construction of the proposed railroad and Section 4.2.4.3.2 describes emissions from railroad operations.

To assess potential impacts to air quality in the region of influence, DOE modeled air quality at two population centers that would be near the proposed railroad (Caliente in Lincoln County and Goldfield in Esmeralda County) and compared the modeling results to the Nevada and National ***Ambient Air Quality Standards*** (NAAQS). These two standards are nearly identical (Section 3.2.4 explains differences), but DOE primarily references the NAAQS in this section with noted exceptions. The Department also modeled air quality to assess potential impacts for railroad construction and operations (using both minimum and maximum rail line lengths in each county) and railroad facilities for locations in Caliente and for construction-related activities at potential quarry site CA-8B northwest of Caliente and potential quarry site NN-9B in South Reveille Valley. Appendix E provides a detailed description of the air quality modeling methodology and assumptions.

There would be an adverse impact to air quality if the Proposed Action:

- Would conflict with or obstruct implementation of a state or regional air quality management plan
- Would violate a NAAQS primary standard or contribute to existing or projected violations

4.2.4.2 The Conformity Rule

Section 176(c) of the Clean Air Act (42 U.S.C. 7401 *et seq.*) requires that federal actions conform to the appropriate State Implementation Plan. The final rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (called the Conformity Rule) is codified in 40 CFR Parts 6, 51, and 93. This Conformity Rule established the conformity criteria and procedures necessary to ensure that federal actions conform to the State Implementation Plans and meet the provisions of the Clean Air Act. In general, this rule ensures that all emissions of ***criteria air pollutants*** and ***volatile organic compounds*** are specifically identified and accounted for in the State Implementation Plan's attainment or maintenance demonstration, and conform to the State Implementation Plan's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards.

The provisions of the Conformity Rule apply only where the action is undertaken in a federally classified ***nonattainment*** or maintenance ***area***. Apart from Clark and Washoe Counties, the rest of the State of Nevada is classified as ***in attainment*** for all criteria air pollutants. There are no nonattainment or maintenance areas in the proposed rail alignment's host counties of Lincoln, Nye, and Esmeralda. Hence, the provisions of the Conformity Rule do not apply to the Proposed Action.

4.2.4.3 Impacts to Air Quality

4.2.4.3.1 Construction Impacts

Potential impacts to air quality from construction of a rail line and railroad construction and operations support facilities along the Caliente rail alignment would include (1) exhaust emissions from construction equipment and (2) fugitive dust ***particulate matter*** emissions resulting from construction activities. These impacts would be small, except in the vicinity of potential South Reveille quarry NN-9B.

Appendix E describes the modeling approach and methodology DOE used to estimate emissions and air quality impacts that would result from these activities.

DOE evaluated emissions and air quality impacts by county because the most complete and comprehensive annual emissions data available from the U.S. Environmental Protection Agency National Emission Inventory are at the county level (DIRS 177709-MO0607NEI2002D.000). DOE assessed emissions impacts by comparing construction/design emissions with 2002 annual county-wide emissions for ***nitrogen oxides*** (NO_x), particulate matter with aerodynamic diameters equal to or less than 10 micrometers (***PM_{10}***) and 2.5 micrometers (***$PM_{2.5}$***), ***sulfur dioxide*** (SO_2), ***carbon monoxide*** (CO), and volatile organic compounds (VOCs). DOE assessed air quality impacts by comparing resulting concentrations of these air pollutants against NAAQS.

Nye, Esmeralda, and Lincoln Counties are all in attainment for ***ozone(O_3)***. Ozone is generally recognized as a regional-scale air quality problem. The potential increase in the emissions of VOCs (a precursor to ozone formation) associated with rail line construction would be small in relation to the existing regional emissions of VOCs. Thus, the impact on ozone formation would not be anticipated to cause a violation of the ozone standard.

Sections 4.2.4.3.1.1 through 4.2.4.3.1.3 describe potential exhaust emissions and air quality impacts from constructing the proposed rail line and railroad construction and operations support facilities along the Caliente rail alignment in Lincoln, Nye, and Esmeralda Counties.

4.2.4.3.1.1 Lincoln County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.2.1.2.1 provides additional detail on the Lincoln County emissions inventory.

Table 4-36 compares the highest modeled annual total emissions under a 4-year construction schedule in Lincoln County to the county's 2002 emissions estimates in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the rail line through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Table 4-36. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Caliente rail alignment through Lincoln County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Construction exhaust	440	410	3,270	2,970	3,790	3,440	230	210	220	200	3	2
Construction fugitive dust	-	-	-	-	-	-	2,720	2,590	550	530	-	-
Totals	440	410	3,270	2,970	3,790	3,440	2,950	2,800	770	730	3	2
Off highway (2002)[e]	34		192		706		20		18		42	
Highway vehicles (2002)[e]	402		4,356		352		12		9		9	
All county sources (2002)[e]	504		4,684		1,068		1,880		310		56	

a. To convert metric tons to tons, multiply by 1.1023.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Lincoln County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Lincoln County would be 132 kilometers (82 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Estimated construction-related emissions for VOCs, CO, and SO_2 are less than the county's 2002 annual emissions for these air pollutants. PM_{10} emissions during the construction phase would be approximately 1,070 metric tons (1,800 tons) per year higher than the 2002 county-wide emissions and $PM_{2.5}$ 460 metric tons (507 tons) per year higher, while emissions of NO_x would be 2,700 metric tons (3,000 tons) per year greater than the 2002 county-wide emissions. However, these emissions would be distributed over the entire length of the rail alignment in Lincoln County (132 to 148 kilometers [82 to 92 miles]) and would not lead to a localized problem; thus, no air quality standard would be exceeded, as shown below for construction near Caliente.

As shown in Table 4-36, fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. Access roads (including the alignment access roads) fugitive dust emissions would contribute about 40 percent (or 1,510 metric tons [1,660 tons] per year) of this amount; while construction of the Interchange Yard would contribute about 1 percent, construction camps 1, 2, 3, 4, and 5 would contribute about 0.4 percent each, and all of the wells less than 1 percent.

Air Quality Impacts, Construction Activities DOE modeled air quality to determine how construction of the proposed railroad would be likely to impact air pollutant concentrations in Caliente, Nevada. Air quality modeling efforts included the impact from constructing the rail line and the Interchange Yard in Caliente. Because the Staging Yard would be outside town, either at Indian Cove, Upland, or Eccles-North, the Department did not model air quality for the Staging Yard. Appendix E, Section E.2.1.2.2.1, summarizes the modeling methodology DOE used to assess construction-related air quality impacts in Lincoln County.

Table 4-37 shows the modeled maximum concentrations at any receptor point within the modeled domain of criteria air pollutants that could be emitted during the construction phase. DOE modeled a 3-year period using 3 years of actual meteorological data. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations during the construction phase in Caliente would be below the NAAQS for all air pollutants. The modeled maximum fraction of the NAAQS was 40 percent for $PM_{2.5}$.

Table 4-38 shows the modeled maximum concentrations at any receptor point of criteria air pollutants that would be emitted over the 3-year modeling period and that would result from construction of the Interchange Yard. The table also shows the highest background concentration since 1991 (second highest for 24-hour PM_{10}) of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations from construction of the Interchange Yard at Caliente would be below NAAQS for all air pollutants. Figure 4-11 shows the predicted 24-hour PM_{10} concentration near the proposed site of the Interchange Yard in Caliente to illustrate construction-related air pollutant concentrations in this area. The modeled maximum fraction of the NAAQS would be 36 percent for $PM_{2.5}$.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than construction of the rail line and the Interchange Yard and would be expected to show even lower concentrations; therefore, emissions would be well below NAAQS for all air pollutants.

Table 4-37. Maximum air pollutant concentrations during the construction phase along the Caliente rail alignment near Caliente, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.41	0.61	35	2
3-hour	SO_2	ppm	0.002	0.0001	0.002	0.5	< 1
8-hour	CO	ppm	0.2	0.07	0.27	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	5.5	45	150	30
	$PM_{2.5}$	$\mu g/m^3$	12	1.4	13	35	38
	SO_2	ppm	0.002	0.005	0.007	0.14	5
Annual	NO_2	ppm	0.002	0.001	0.003	0.053	6
	PM_{10}	$\mu g/m^3$	12	2.1	14	50[e]	28
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.6	4.2	15	28
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-38. Maximum air pollutant concentrations from construction of the proposed Interchange Yard in Caliente, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[c]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.18	0.38	35	1
3-hour	SO_2	ppm	0.002	0.002	0.004	0.5	1
8-hour	CO	ppm	0.2	0.03	0.23	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	2	41	150	27
	$PM_{2.5}$	$\mu g/m^3$	12	1	13	35	36
	SO_2	ppm	0.002	0.003	0.005	0.14	4
Annual	NO_2	ppm	0.002	0.001	0.003	0.053	5
	PM_{10}	$\mu g/m^3$	12	1.2	13	50[d]	26
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.37	4	15	26
	SO_2	ppm	0.002	0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers ; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. NAAQS = National Ambient Air Quality Standards.
d. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

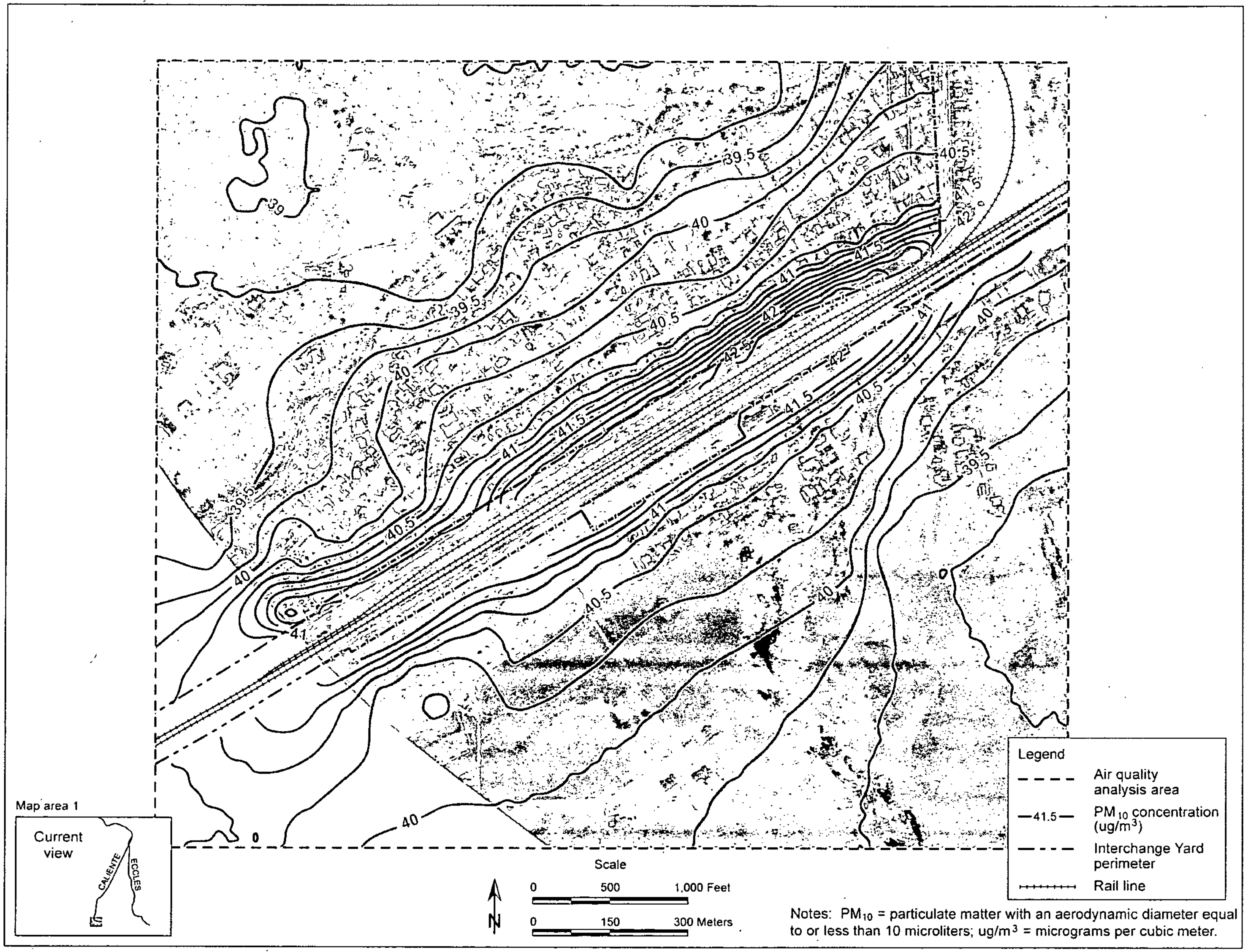


Figure 4-11. Maximum 24-hour PM_{10} concentration (maximum background plus modeled maximum project impact) from construction of the proposed Interchange Yard in Caliente, Nevada.

Air Quality Impacts, Quarry Activities DOE also performed simulations to determine potential impacts to air quality associated with activity at potential quarry site CA-8B northwest of the City of Caliente (DIRS 180922-Nevada Rail Partners 2007, Appendix A; DIRS 176182-Shannon & Wilson 2006, pp. 43 to 45). Appendix E, Section E.2.1.2.2.2, describes the methodology DOE used to simulate quarry-related impacts to air quality.

Table 4-39 shows the modeled maximum concentrations at any receptor point of criteria air pollutants that would be emitted over the 3-year period and that would result from quarry-related activities. The table also shows the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The modeled maximum fraction of the NAAQS would be 45 percent for PM_{10}.

Table 4-39. Maximum air pollutant concentrations from construction and operation of potential quarry CA-8B near Caliente, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.43	0.64	35	2
3-hour	SO_2	ppm	0.002	0.0001	0.002	0.5	less than 1
8-hour	CO	ppm	0.2	0.11	0.31	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	26[e]	65	150	44
	$PM_{2.5}$	$\mu g/m^3$	12	1.2[f]	13	35	38
	SO_2	ppm	0.002	0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.0001	0.002	0.053	4
	PM_{10}	$\mu g/m^3$	12	2.6	15	50[g]	29
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.38	4	15	27
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. Maximum second highest high over any 1-year period.
f. Maximum 3-year average of the 98th percentile of 24-hour concentrations.
g. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

For all air pollutants and all averaging periods, the peak concentrations under conservative modeling assumptions (see Appendix E, Section E.1) would be below the NAAQS levels, with most values well below NAAQS.

4.2.4.3.1.2 Nye County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.2.1.3 provides additional detail on the Nye County emissions inventory.

Table 4-40 compares the modeled highest annual total emissions during the 4-year construction phase in Nye County (including construction of the Rail Equipment Maintenance Yard and Maintenance-of-Way Trackside Facility) with the county's 2002 National Emission Inventory database emissions

Table 4-40. Maximum and minimum peak annual emissions anticipated during the construction phase along the Caliente rail alignment through Nye County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Construction exhaust	1,110	950	8,060	6,950	9,530	8,200	570	490	550	470	7	6
Construction fugitive dust	-	-	-	-	-	-	5,580	5,060	1,160	1,050	-	-
Totals	1,110	950	8,060	6,950	9,530	8,200	6,150	5,550	1,710	1,520	7	6
Off highway (2002)[e]	338		1,788		199		27		25		22	
Highway vehicles (2002)[e]	1,335		13,977		1,050		32		25		28	
All county sources (2002)[e]	2,279		17,071		1,436		3,324		650		237	

a. To convert metric tons to tons, multiply by 1.1023.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Nye County would be 398 kilometers (247 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Nye County would be 342 kilometers (213 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through the county, and increased equipment activity that would be necessary for construction in rugged terrain.

Construction-related emissions of VOCs, CO, and SO_2 would be less than half the county's 2002 annual emissions of these air pollutants. During the construction phase, emissions of $PM_{2.5}$ and PM_{10} could increase by as much as 1,060 and 2,800 metric tons (1,168 and 3,086 tons) per year, respectively, over the 2002 county annual emission values, and NO_x emissions could be as much as 8,100 metric tons (8,900 tons) per year over the county's 2002 annual emissions. However, these emissions would be distributed over the entire length of the rail alignment in Nye County (342 to 398 kilometers [213 to 247 miles] and would not lead to a localized problem; thus, no air quality standard would be exceeded during the construction phase in Nye County.

As shown on Table 4-40, construction fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with construction of the rail line. Access roads (including the alignment access roads) fugitive dust construction emissions would contribute about 40 percent (or 2,230 metric tons [2,460 tons] per year) of this amount; while construction of the Maintenance-of-Way Trackside Facility would contribute about 1 percent, the Rail Equipment Maintenance Yard and Cask Maintenance Facility would contribute less than 1 percent, construction camps 6, 7, 8, 10, 11, and 12 about 0.4 percent each, and all of the wells less than 1 percent.

Air Quality Impacts, Quarry Activities DOE performed simulations to determine potential impacts to air quality associated with construction and operations activity at potential quarry site NN-9B in South Reveille Valley (DIRS 176182-Shannon & Wilson 2006, pp. 35 and 36; DIRS 180922-Nevada Rail Partners 2007, Appendix C). Appendix E, Section E 2.1.3.2.1, describes the methodology DOE used to simulate quarry-related air quality impacts.

Table 4-41 lists the maximum concentrations at any receptor point within the modeled domain of criteria air pollutants that could be emitted from quarry-related activities (or peak 3-year average 98^{th} percentile values for $PM_{2.5}$ and the maximum second highest high over a 1-year period for PM_{10}). The maximum concentrations from operation of the potential South Reveille quarry occurs during the construction of the quarry. DOE modeled two consecutive 3-year periods using 4 years of meteorological data. The table also lists the highest (second highest for 24-hour PM_{10}) background concentration of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS.

Under conservative modeling assumptions (see Appendix E, Section E.1) peak air pollutant concentrations would be below the NAAQS levels, except for 24-hour average PM_{10}. The 24-hour PM_{10} NAAQS would be met if the NAAQS level of 150 micrograms per cubic meter was not exceeded more than once a year. However, under the conservative modeling assumptions used here, in each modeled year at least one receptor beyond the quarry fence line had a 24-hour PM_{10} concentration greater than the NAAQS level of 150 micrograms per cubic meter; therefore, the NAAQS could be exceeded. However, under Nevada Administrative Code 445B.22037, DOE would be required to prepare a Surface Area Disturbance Permit Dust Control Plan, which would address in detail the best types of fugitive dust control methods to be used. Specifics about the best control methods would depend on the specific layout, operation, and activity level at the quarry. These details are not fully available at this time, but would be when DOE filed the Surface Disturbance Permit Dust Control Plan with the State of Nevada. More than one method to control fugitive dust could be necessary to prevent fugitive dust generation, and use of multiple methods to control fugitive dust must be addressed, if needed. The Permit Plan could require such measures as paving quarry access roads, cessation of operations when winds make control of fugitive dust difficult. DOE anticipates that these measures would greatly reduce the PM_{10} emissions, making an exceedance of the 24-hour PM_{10} NAAQS highly unlikely. During quarry operations, PM_{10} emissions would be more than 80 percent lower than during construction and no exceedance of the 24-hour PM_{10} NAAQS would be expected. Further, DOE could reduce this concern by acquiring additional land and moving public access (the fence line) farther away from the quarry activity (see Chapter 7, Best Management Practices and Mitigation).

Table 4-41. Maximum air pollutant concentrations from construction and operation of potential quarry NN-9B in South Reveille Valley.

Averaging period	Air pollutant[a]		Background[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	1.5	1.7	35	5
3-hour	SO_2	ppm	0.002	0.0001	0.002	0.5	< 1
8-hour	CO	ppm	0.2	0.29	0.49	9	5
24-hour	PM_{10}	$\mu g/m^3$	39	200[e]	239	150	160
	$PM_{2.5}$	$\mu g/m^3$	12	14[f]	26	35	74
	SO_2	ppm	0.002	0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.001	0.003	0.053	6
	PM_{10}	$\mu g/m^3$	12	23	35	50[g]	71
	$PM_{2.5}$	$\mu g/m^3$	3.6	2.8	6.4	15	43
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. Maximum second highest high over any 1-year period.
f. Maximum 3-year average of the 98th percentile of 24-hour concentrations.
g. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Maintenance-of-Way Trackside Facility This facility would occupy about 0.06 square kilometer (15 acres) in Nye County (DIRS 180921-Nevada Rail Partners 2007, Appendix B, p. B-11), and would be located approximately 18 miles south from U.S. Highway 6 on AR 504 in Nye County (DIRS 180919-Nevada Rail Partners 2007, p. 7-10). DOE did not model air quality for construction of this facility because construction activities would be similar to those for the Interchange Yard modeled in Lincoln County. Because DOE would expect air pollutant concentrations resulting from construction of the Interchange Yard to be below the NAAQS, the Department considers it unlikely that air pollutant concentrations resulting from construction of the Maintenance-of-Way Trackside Facility, which would have greater restricted public access (enclosed fence), would exceed the NAAQS. Similarly, DOE did not perform air quality modeling for construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility inside the Yucca Mountain Site boundary, because the distance from the facilities to the nearest public access point would be more than 11 kilometers (7 miles). At that distance, emissions from construction of the facilities would be small. However, DOE performed this analysis for the Repository SEIS (DOE/EIS-0250F-51), and results are included in the combined impacts table in Chapter 5 of this Rail Alignment EIS.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than emissions during rail line construction and would be expected to show even lower concentrations; therefore, those emissions would be well below NAAQS for all air pollutants.

4.2.4.3.1.3 Esmeralda County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.2.1.4.1 contains additional detail on the Esmeralda County emissions inventory.

For each air pollutant considered in this analysis, Table 4-42 compares the peak annual emissions associated with construction of the proposed rail line and railroad construction and operations support facilities in Esmeralda County with the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through Esmeralda County, and increased equipment activity necessary for construction in rugged terrain.

Construction-related emissions of VOCs, CO, PM_{10}, $PM_{2.5}$, and SO_2 would be less than the 2002 county-level emissions estimates for each pollutant. The emissions of oxides of NO_x during the construction phase could increase emissions by 940 metric tons (1,040 tons) per year over the county's 2002 annual emissions. However, these emissions would be distributed over the entire length of the rail alignment in Esmeralda County (22 to 44 kilometers [14 to 27 miles]) and would not lead to a localized problem; thus, no air quality standard would be exceeded during the construction phase in Esmeralda County, as shown in Table 4-43 for Goldfield.

As shown in Table 4-42, rail line fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. Access roads (including the alignment access roads) fugitive dust emissions would contribute about 40 percent (or 168 metric tons [185 tons] per year) of this amount; while construction of the Maintenance-of-Way Headquarters Facility would contribute less than 1 percent, construction camp 9 about 0.4 percent, and wells less than 1 percent.

Air Quality Impacts DOE modeled air quality to determine how construction would be likely to impact air pollutant concentrations at Goldfield, Nevada. Appendix E, Section E.2.1.4.2, describes the modeling methodology DOE used to assess construction-related air quality impacts in Esmeralda County.

Table 4-43 lists the maximum concentrations at any receptor point within the modeled domain of criteria air pollutants that could be emitted during the construction phase. DOE modeled two consecutive 3-year periods using 4 years of meteorological data. The table also lists the highest background concentration since 1991 (second highest for 24-hour PM_{10}) of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration (or peak 3-year average 98^{th} percentile values for $PM_{2.5}$ and the maximum second highest high over a 1-year period for PM_{10}) as a fraction of the NAAQS. In all cases, the maximum concentrations during the construction phase near Goldfield would be below NAAQS for all air pollutants. The maximum fraction of the NAAQS would be 87 percent for PM_{10}.

DOE did not model the Maintenance-of-Way Headquarters Facility south of Tonopah in Esmeralda County because construction emissions associated with this facility would be much smaller (less than 1 percent) than the Interchange Yard in Lincoln County. Because DOE expects air pollutant concentrations resulting from construction of the Interchange Yard to be below the NAAQS, the Department considers it unlikely that air pollutant concentrations resulting from construction of the Maintenance-of-Way Headquarters Facility would exceed the NAAQS.

Table 4-42. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Caliente rail alignment through Esmeralda County, Nevada, compared to 2002 existing county emissions

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Construction exhaust	130	60	920	450	1,090	540	60	40	60	30	1	0
Construction fugitive dust	-	-	-	-	-	-	420	200	90	50	-	-
Totals	130	60	920	450	1,090	540	480	240	150	80	1	0
Off highway (2002)[e]	9		68		26		3		3		3	
Highway vehicles (2002)[e]	131		1,247		107		3		3		3	
All county sources (2002)[e]	240		1,352		149		1,105		194		55	

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Esmeralda County would be 44 kilometers (27 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Esmeralda County would be 22 kilometers (14 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-43. Maximum air pollutant concentration from construction of a railroad along the Caliente rail alignment near Goldfield, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	2.5	2.7	35	8
3-hour	SO_2	ppm	0.002	0.003	0.005	0.5	1
8-hour	CO	ppm	0.2	0.32	0.52	9	6
24-hour	PM_{10}	$\mu g/m^3$	39	92	131	150	87
	$PM_{2.5}$	$\mu g/m^3$	12	14	26	35	74
	SO_2	ppm	0.002	0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.006	0.008	0.053	15
	PM_{10}	$\mu g/m^3$	12	23	35	50[e]	70
	$PM_{2.5}$	$\mu g/m^3$	3.6	4.9	9	15	57
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than emissions during rail line construction and would be expected to show even lower concentrations; therefore, these emissions would be well below NAAQS for all air pollutants.

4.2.4.3.2 Railroad Operations Impacts

Exhaust emissions during the operations phase would impact air quality. However, these impacts would be small.

Appendix E describes the modeling approach and methodology DOE used to estimate operations exhaust emissions and impacts to air quality.

DOE evaluated exhaust emissions and impacts to air quality by county because the most complete and comprehensive emissions data are available only at the county level. To assess emissions impacts, DOE compared modeled operations emissions with 2002 annual county-wide emissions for NO_x, PM_{10}, $PM_{2.5}$, SO_2, CO, and VOCs. To assess impacts to air quality, DOE compared modeled concentrations of these air pollutants to NAAQS. Nye, Esmeralda, and Lincoln Counties are all in attainment for ozone. Ozone is generally recognized as a regional-scale air quality problem. The potential increase in the emissions of

VOCs (a precursor to ozone formation) associated with the operations phase would be small in relation to the existing regional emissions of VOCs. Thus, the impact on ozone formation would not cause a violation of the ozone standard.

Sections 4.2.4.3.2.1 through 4.2.4.3.2.3 detail the potential emissions and air quality impacts during the railroad operations phase in Lincoln, Nye, and Esmeralda Counties.

4.2.4.3.2.1 Lincoln County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Appendix E, Section E 2.2.2.1, provides additional detail on the Lincoln County emissions inventory.

Table 4-44 compares the modeled highest annual total emissions during operation of the rail line and Facilities at the Interchange with the Union Pacific Railroad Mainline in Lincoln County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000, all). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through Lincoln County.

The projected operations-related emissions for all air pollutants considered in this analysis would be less than 20 percent of the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Lincoln County (132 to 148 kilometers [82 to 92 miles]; thus, no air quality standard would be exceeded.

Air Quality Impacts DOE modeled air quality to determine how railroad operations would be likely to impact air pollutant concentrations at Caliente. Air quality modeling efforts included the impact from operation of (1) the rail line and (2) the Interchange Yard in Caliente. Because the Staging Yard would be outside town, either at Indian Cove, Upland, or Eccles-North, the Department did not model air quality for the Staging Yard. Appendix E, Section E.2.2.2.2, describes the modeling methodology DOE used to assess operations-related impacts to air quality in Lincoln County.

Table 4-45 lists the maximum concentrations at any receptor point within the modeled domain of criteria air pollutants that could be emitted during operation of the proposed rail line. DOE modeled a 3-year period using 3 years of meteorological data. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations from operation of the proposed railroad near Caliente would be well below NAAQS for all air pollutants. The maximum fraction of the NAAQS would 34 percent for $PM_{2.5}$.

DOE modeled emissions from operation of the 0.06-square-kilometer (15-acre) Interchange Yard (DIRS 180919-Nevada Rail Partners 2007, p. 4-2) in the City of Caliente, Nevada. Table 4-46 lists the maximum resulting concentrations for all criteria air pollutants at any receptor in the modeled domain during all modeled years as a result of operating this facility. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations from operation of the Interchange Yard at the Caliente, Nevada, site would be well below NAAQS for all air pollutants. The maximum fraction of the NAAQS would be 36 percent for $PM_{2.5}$. Figure **4-12** shows the modeled 24-hour PM_{10} concentration in the vicinity of the Interchange Yard in Caliente to illustrate the air pollutant impacts in this area.

Table 4-44. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Caliente rail alignment through Lincoln County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Operations exhaust	13	12	50	50	180	170	6	5	5	5	< 1	< 1
Off highway (2002)[e]	34		192		706		20		18		42	
Highway vehicles (2002)[e]	402		4,356		352		12		9		9	
All county sources (2002)[e]	504		4,684		1,068		1,880		310		56	
Percent increase (projected emission/ county emission multiplied by 100)	2.6	2.4	1	1	17	16	< 1	< 1	1.6	1.6	< 0.1	< 0.1

a. To convert metric tons to tons, multiply by 1.1023; < = less than.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Lincoln County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not given by the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Lincoln County would be 132 kilometers (82 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-45. Maximum air pollutant concentrations from operation of the proposed railroad near Caliente, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	< 0.001	0.2	35	1
3-hours	SO_2	ppm	0	< 0.001	0.002	0.5	< 1
8-hours	CO	ppm	0.2	< 0.001	0.2	9	2
24-hours	PM_{10}	$\mu g/m^3$	39	0.01	39	150	26
	$PM_{2.5}$	$\mu g/m^3$	12	0.01	12	35	34
	SO_2	ppm	0.002	< 0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	< 0.0001	0.002	0.053	4
	PM_{10}	$\mu g/m^3$	12	0.01	12	50[e]	24
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.01	3.6	15	24
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-46. Maximum air pollutant concentrations from operation of the proposed Interchange Yard in Caliente, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.11	0.31	35	1
3-hours	SO_2	ppm	0.002	< 0.0001	0.002	0.5	< 1
8-hours	CO	ppm	0.2	0.03	0.23	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	1	40	150	27
	$PM_{2.5}$	$\mu g/m^3$	12	0.65	13	35	36
	SO_2	ppm	0.002	< 0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.002	0.004	0.053	7
	PM_{10}	$\mu g/m^3$	12	0.44	12	50[e]	25
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.4	4	15	27
	SO_2	ppm	0.002	< 0.001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

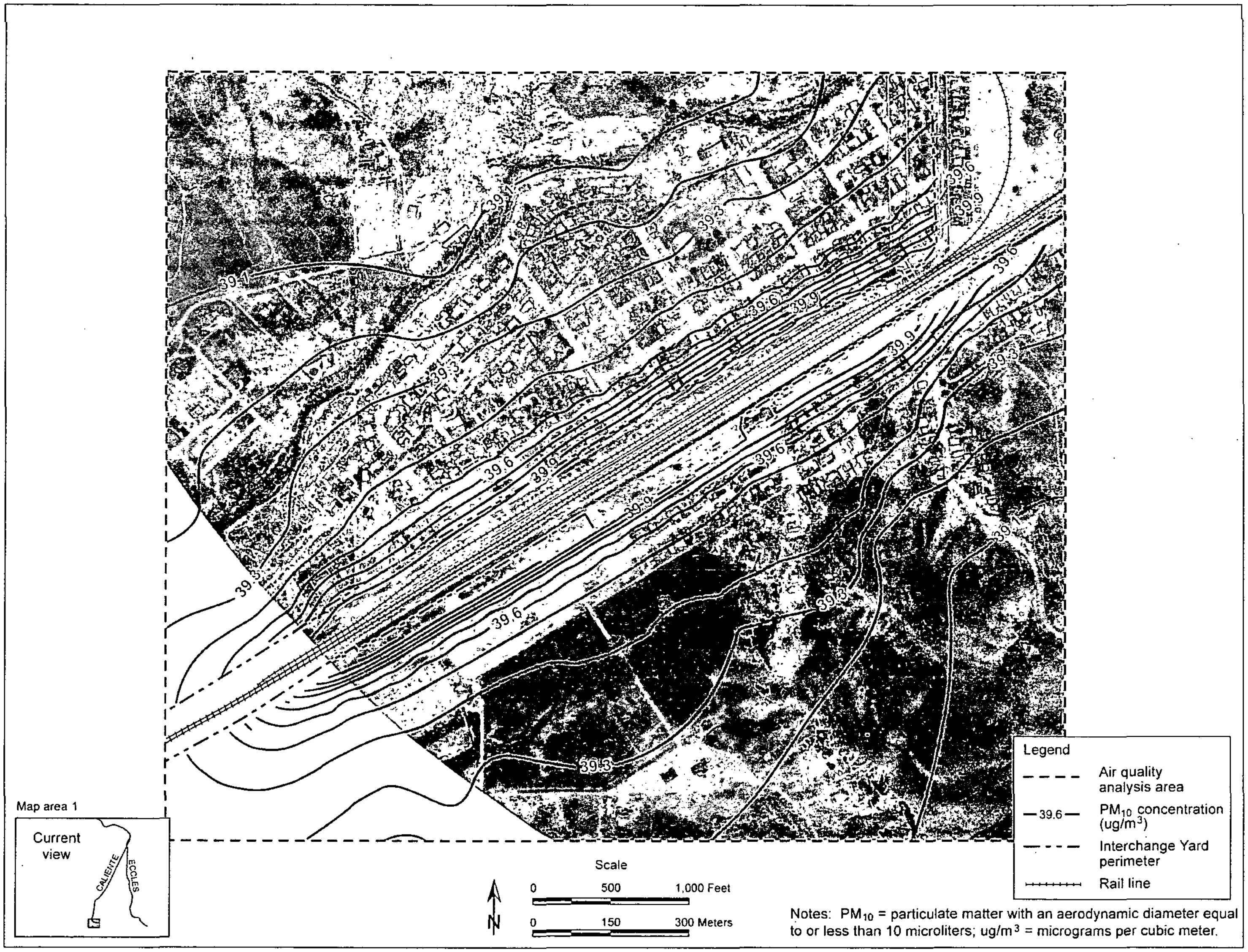


Figure 4-12. Maximum 24-hour PM_{10} concentration (maximum background plus modeled maximum project impact) from operation of the proposed Interchange Yard in Caliente, Nevada.

4.2.4.3.2.2 Nye County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.2.2.3.1 provides additional detail on the Nye County emissions inventory.

Table 4-47 compares the modeled highest annual total emissions during operation of the proposed rail line, the Rail Equipment Maintenance Yard, and the Maintenance-of-Way Trackside Facility in Nye County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). Project-related emissions are presented as a maximum and minimum range according to the possible lengths of the rail alignment through Nye County. Operations-related emissions for all air pollutants considered in this analysis represent a fraction of the county's 2002 annual emissions. The highest percentage increase is projected for NO_x at between 36 and 37 percent over the county's 2002 annual emissions. However, these emissions increases would not be expected to cause an exceedance of any air quality standard because most of the emissions would be distributed over the 342- to 398-kilometer (213- to 247-mile) length of the rail line through Nye County.

Air Quality Impacts The Maintenance-of-Way Trackside Facility would occupy about 0.06 square kilometer (15 acres) in Nye County, about 30 miles southeast of Tonopah (DIRS 180919-Nevada Rail Partners 2007, pp. 7-1 and 7-10). DOE did not model air quality for the operation of this facility because the Department expects that emissions associated with operation of this facility would be similar to those for the Interchange Yard in Lincoln County. Because DOE expects that air pollutant concentrations resulting from operation of the Interchange Yard would be well below the NAAQS, air pollutant concentrations resulting from operation of the Maintenance-of-Way Trackside Facility, which would have greater restricted public access (enclosed fence), would not be likely to exceed the NAAQS.

Similarly, DOE did not perform air quality modeling for operation of the Cask Maintenance Facility and Rail Equipment Maintenance Yard within the Yucca Mountain Site boundary, because the distance from those facilities to the nearest point of public access would be more than 11 kilometers (7 miles). At that distance, there would be no to small impacts on air quality from operation of the facilities.

4.2.4.3.2.3 Esmeralda County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions under the Proposed Action. Section E.2.2.4.1 provides additional detail on the Esmeralda County emissions inventory.

Table 4-48 compares the annual total emissions during the railroad operations phase in Esmeralda County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). Project-related emissions are presented as a maximum and minimum range according to the possible lengths of the rail alignment through the county. The highest percentage increase is projected for NOx at between 3 and 6 percent over the county's 2002 annual emissions. However, these emissions increases would not be expected to cause an exceedance of any air quality standard because most of the emissions would be distributed over the 22- to 44-kilometer (14- to 27-mile) length of the rail line through Esmeralda County.

Air Quality Impacts DOE modeled air quality to determine how the operations phase would be likely to impact air pollutant concentrations at Goldfield, Nevada, because a portion of Goldfield alternative segment 4 (see Figure 2-7 in Chapter 2) would pass to the south and west of Goldfield. Appendix E, Section E.2.2.4.2, summarizes the modeling methodology DOE used to assess operations-related impacts to air quality in Esmeralda County.

Table 4-47. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Caliente rail alignment through Nye County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Operations exhaust	47	46	180	170	490	470	15	15	14	13	1	1
Off highway (2002)[e]	338		1,788		199		27		25		22	
Highway vehicles (2002)[e]	1,335		13,977		1,050		32		25		28	
All county sources (2002)[e]	2,279		17,071		1,436		3324		650		237	
Percent increase (projected emission/ county emission multiplied by 100)	2	2	1	1	37	36	0	0	2	2	0	0

a. To convert metric tons to tons, multiply by 1.1023.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Nye County would be 398 kilometers (247 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Nye County would be 342 kilometers (213 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-48. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Caliente rail alignment through Esmeralda County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Operations exhaust	1	< 1	2	1	10	5	< 1	< 1	< 1	< 1	< 1	< 1
Off highway (2002)[e]	9		68		26		3		3		3	
Highway vehicles (2002)[e]	131		1,247		107		3		3		3	
All county sources (2002)[e]	240		1,352		149		1,105		194		55	
Percent increase (projected emission/county emission multiplied by 100)	0.4	< 0.4	0.2	0.1	6	3	< 0.1	< 0.1	< 0.5	< 0.5	< 2	< 2

a. To convert metric tons to tons, multiply by 1.1023; < = less than.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Esmeralda County would be 44 kilometers (27 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Esmeralda County would be 22 kilometers (14 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-49 lists the maximum concentrations at any receptor point of the criteria air pollutants that would result from operation of the proposed railroad near Goldfield. DOE modeled a 4-year period using 4 years of actual meteorological data. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration), the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations during the operations phase near Goldfield would be below NAAQS for all air pollutants. The modeled maximum fraction of the NAAQS was 34 percent for $PM_{2.5}$. DOE did not model the Maintenance-of-Way Headquarters Facility south of Tonopah in Esmeralda County because the operations emissions associated with this facility would be much smaller (less than 1 percent) than for operation of the Interchange Yard in Lincoln County. Because DOE expects air pollutant concentrations resulting from operation of the Interchange Yard to be below the NAAQS, the Department considers it unlikely that air pollutant concentrations resulting from operation of the Maintenance-of-Way Headquarters Facility would exceed the NAAQS.

4.2.4.4 Shared-Use Option

Impacts to air quality along the Caliente rail alignment under the Shared-Use Option would be similar to those under the Proposed Action without shared use.

Under the Shared-Use Option, commercial entities could construct additional sidings of 300 meters (980 feet) in length at a number of locations along the rail alignment in Lincoln and Nye Counties. Operationally, the Shared-Use Option would consist of up to 60 railcars pulled by three or four locomotives at a frequency of up to three round trips per week.

Table 4-49. Maximum air pollutant concentrations from operation of the proposed railroad near Goldfield, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	< 0.001	0.2	35	1
3-hour	SO_2	ppm	0.002	< 0.0001	0.002	0.5	< 1
8-hour	CO	ppm	0.2	< 0.001	0.20	9	2
24-hour	PM_{10}	$\mu g/m^3$	39	0.06	39	150	26
	$PM_{2.5}$	$\mu g/m^3$	12	0.05	12	35	34
	SO_2	ppm	0.002	< 0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	< 0.0001	0.002	0.053	4
	PM_{10}	$\mu g/m^3$	12	0.02	12	50[e]	24
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.02	3.6	15	24
	SO_2	ppm	0.002	< 0.000001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

The additional sidings would be placed parallel to track within the construction right-of-way and would not require additional rail roadbed foundation, only additional laying of track. Overall, additional construction-related emissions in Lincoln and Nye Counties would be very small. Appendix E, Section E.2.3, describes the rationale for not conducting additional emissions inventory calculations or air quality simulations to assess construction-related impacts under the Shared-Use Option.

Appendix E, Section E.2.3, also describes the methodology DOE used to calculate potential emissions that would result from the three additional round trips per week of commercial train activity associated with the Shared-Use Option.

For Lincoln County, Nye County, and Esmeralda County, Tables 4-50 through 4-52 compare the maximum annual incremental emissions expected from operation of commercial trains under the Shared-Use Option with each county's 2002 National Emission Inventory database emissions (DIRS 177709-MO0607NEI2002D.000). Also shown is the range of peak county-wide emissions that would result from the Proposed Action, as discussed in Section 4.2.4.3, and the resulting range of peak emissions totals by county. In both Lincoln and Esmeralda counties and for all air pollutants, the Shared-Use Option would increase emissions by less than 20 percent over the Proposed Action. The relative increase in Nye County would be larger (as much as 41 percent). However, both the Proposed Action and Shared-Use Option still would produce a relatively small increase over 2002 county-wide emissions totals. In all cases, after adding emissions associated with the Shared-Use Option to those predicted for the Proposed Action, emissions associated with railroad operations under the Shared-Use Option would remain less than 50 percent of 2002 county-wide emissions for all air pollutants in all counties.

As shown in Tables 4-50, 4-51, and 4-52, under the Shared-Use Option, total emissions would be increased marginally (as discussed above) beyond those associated with railroad operations under the Proposed Action. Likewise, the maximum air pollutant concentrations expected under the Shared-Use Option would be marginally increased. These levels have been shown to be low (see Tables 4-45, 4-46, and 4-49). Therefore, DOE did not perform additional and separate air quality modeling of air pollutant concentrations for the Shared-Use Option.

4.2.4.5 Summary

Potential impacts to air quality from construction and operation of the proposed railroad along the Caliente rail alignment would be as follows:

- The project would not cause conflicts with state or regional air quality management plans.
- The highest increase in air emissions from railroad operations would occur in the vicinity of the operations support facilities.
- Air pollutant concentrations would not exceed the NAAQS during the construction or operation phase, with the possible exception of the 24-hour NAAQS for PM_{10} that could be exceeded from quarry operations in South Reveille Valley during the construction phase. However, DOE would be required to obtain a Surface Area Disturbance Permit Dust Control Plan prior to quarry development and it would be likely that this would greatly reduce fugitive dust emissions, thus reducing the possibility of NAAQS exceedances.
- The highest increase in air pollutant emissions would occur during the construction phase.
- The highest increase in emissions would be for NO_x in Nye County, where construction emissions could be as much as 8,100 metric tons (8,900 tons) per year over the county's 2002 annual NO_x emissions.
- The Shared-Use Option would result in a slightly higher increase in air pollutant emissions and air pollutant concentrations than the Proposed Action.

Table 4-50. Maximum and minimum peak annual emissions anticipated from operation of commercial trains along the Caliente rail alignment under the Shared-Use Option through Lincoln County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Commercial trains/shared-use operations exhaust	1	1	3	3	16	15	1	1	1	1	< 1	< 1
Proposed railroad operations exhaust	13	12	50	50	180	170	6	5	5	5	< 1	< 1
Totals	14	13	53	53	196	185	7	6	6	6	< 1	< 1
Off highway (2002)[e]	34		192		706		20		18		42	
Highway vehicles (2002)[e]	402		4,356		352		12		9		9	
All county sources (2002)[e]	504		4,684		1,068		1,880		310		56	
Percent increase (projected emission/ county emission multiplied by 100)	2.8	2.6	1.1	1.1	18	17	< 1	< 1	2	2	< 2	< 2

a. To convert metric tons to tons, multiply by 1.1023; < = less than.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Lincoln County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Lincoln County would be 132 kilometers (82 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-51. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Caliente rail alignment under the Shared-Use Option through Nye County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Commercial trains/shared use operations exhaust	2	2	8	7	40	40	2	1	2	1	< 1	< 1
Proposed railroad operations exhaust	47	46	180	170	490	470	15	15	14	13	1	1
Totals	49	48	188	177	530	510	17	16	16	14	1	1
Off highway (2002)[e]	338		1,788		199		27		25		22	
Highway vehicles (2002)[e]	1,335		13,977		1,050		32		25		28	
All county sources (2002)[e]	2,279		17,071		1,436		3,324		650		237	
Percent increase (projected emission/county emission multiplied by 100)	2.2	2.1	1.1	1	37	36	< 1	< 1	2.5	2.2	< 1	< 1

a. To convert metric tons to tons, multiply by 1.1023; < = less than.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Nye County would be 398 kilometers (247 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Nye County would be 342 kilometers (213 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-52. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Caliente rail alignment under the Shared-Use Option through Esmeralda County, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

Emissions source	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Commercial trains/shared-use operations exhaust	< 1	< 1	1	< 1	5	2	< 1	< 1	< 1	< 1	< 1	< 1
Proposed railroad operations exhaust	1	< 1	2	1	10	5	< 1	< 1	< 1	< 1	< 1	< 1
Totals	1	< 1	3	1	15	7	< 1	< 1	< 1	< 1	< 1	< 1
Off highway (2002)[e]	9		68		26		3		3		3	
Highway vehicles (2002)[e]	131		1,247		107		3		3		3	
All county sources (2002)[e]	240		1,352		149		1,105		194		55	
Percent increase (projected emission/ county emission multiplied by 100)	< 1	< 0.1	< 1	< 0.1	10	5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

a. To convert metric tons to tons, multiply by 1.1023; < = less than.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Esmeralda County would be 44 kilometers (27 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Esmeralda County would be 22 kilometers (14 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Emissions for all air pollutants projected to be released during the construction phase would be greater than during the operations phase. Projected ambient concentrations of all air pollutants would be below the NAAQS, except possibly during quarry operations in South Reveille Valley. Therefore, the projected impacts throughout the region of influence, during both the construction and operations phases, would be small, except in the vicinity of the quarry. Under the Shared-Use Option, there would be an increase in emissions over those of the Proposed Action without shared use, but impacts to air quality would still be small. Table 4-53 summarizes impacts to air quality.

Table 4-53. Summary of potential impacts to air quality – Caliente rail alignment[a,b] (page 1 of 3).

County/rail line segment/facility	Construction impacts	Operations impacts
Lincoln County		
Caliente alternative segment; Eccles alternative segment; common segment 1; Garden Valley alternative segments 1, 2, 3, and 8; and common segment 2	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, and VOCs. PM_{10}, $PM_{2.5}$, and NO_x would each have increases greater than the 2002 county-wide burden. However, these emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 20 percent to the 2002 county-wide burden of all criteria air pollutants and would not lead to a violation of air quality standards.
	Modeling of emissions from construction of the rail line near Caliente showed no air pollutant would exceed 40 percent of the NAAQS for any averaging period.	Modeling of emissions from operation of the rail line near Caliente showed no air pollutant would exceed 40 percent of the NAAQS for any averaging period.
Nye County		
Common segment 1, Garden Valley alternative segments 1, 2, and 3; common segment 2; South Reveille alternative segments 2 and 3; common segment 3; Goldfield alternative segments 1, 3, and 4; common segment 4; Bonnie Claire alternative segments 2 and 3; common segment 5; Oasis Valley alternative segments 1 and 3; and common segment 6	Construction activities would add less than the 2002 county-wide burden of VOCs, CO, and SO_2. $PM_{2.5}$, PM_{10}, and NO_x would each have an increase greater than the 2002 county-wide burden. However, these emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 40 percent to the 2002 county-wide burden of all criteria air pollutants and would not lead to a violation of air quality standards.
Construction and operations support facilities		
Esmeralda County		
Goldfield alternative segments 1 and 4; common segment 4	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, VOCs, PM_{10}, and $PM_{2.5}$. NO_x would have an increase greater than the 2002 county-wide burden. However, emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than 6 percent to the 2002 county-wide burden of all criteria air pollutants and would not lead to a violation of air quality standards.

Table 4-53. Summary of potential impacts to air quality – Caliente rail alignment[a,b] (page 2 of 3).

County/rail line segment/facility	Construction impacts	Operations impacts
Construction and operations support facilities (continued)		
	Modeling of emissions from construction of the rail line near Goldfield showed no air pollutant would exceed 90 percent of the NAAQS for any averaging period.	Modeling of emissions from operation of the rail line near Goldfield showed no air pollutant would exceed 34 percent of the NAAQS for any averaging period.
Lincoln County		
Access roads (including alignment access road)	About 40 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Interchange Yard	Modeling of emissions from construction at the Interchange Yard in Caliente showed no air pollutant would exceed 36 percent of the NAAQS for any averaging period.	Modeling of emissions from operation of the Interchange Yard in Caliente showed no air pollutant would exceed 36 percent of the NAAQS for any averaging period.
Quarries	Using conservative modeling assumptions, no exceedances of the NAAQS would be expected at potential quarry CA-8B, with most values expected to be well below the NAAQS.	Quarries would be reclaimed following rail line construction and would have no emissions during the operations phase.
Other facilities	Construction dust and exhaust emissions would be very small.	Operations would result in very small emissions from other facilities.
Construction camps 1, 2, 3, 4, and 5	Only about 2 percent of the fugitive dust emissions would be due to construction of the construction camps. In no case would construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and would have no emissions during the operations phase.
Wells	Well construction would be responsible for less than 1 percent of the fugitive dust emissions. In no case would construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the completion of construction to serve as the water source for facility operations.
Access roads (including alignment access road)	About 40 percent of fugitive dust emissions would be from the access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Maintenance-of-Way Trackside Facility	Construction of the Maintenance-of-Way Trackside Facility would account for less than 1 percent of fugitive dust emissions. In no case would this be expected to cause an exceedance of any air quality standards.	The Maintenance-of-Way Trackside Facility would be responsible for less than 1 percent of the operations emissions in Nye County.
Rail Equipment Maintenance Yard and Cask Maintenance Facility	Combined, construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility would account for less than 1 percent of fugitive dust emissions. In no case would this be expected to cause an exceedance of any air quality standards.	Combined, the Rail Equipment Maintenance Yard and Cask Maintenance Facility would be responsible for about 84 percent of the operations emissions in Nye County.

Table 4-53. Summary of potential impacts to air quality – Caliente rail alignment[a,b] (page 3 of 3).

County/rail line segment/facility	Construction impacts	Operations impacts
Quarries	Modeling of emissions from potential quarry NN-9B indicates that the 24-hour PM_{10} NAAQS could be exceeded. However, the required Surface Disturbance Permit would greatly reduce PM_{10} emissions, making an exceedance of the NAAQS unlikely.	Quarries would be reclaimed following the construction phase and would have no emissions during the operations phase.
Nevada Railroad Control Center and National Transportation Operations Center	Construction dust and exhaust emissions would be very small.	Operation of these facilities would result in very small emissions.
Construction camps 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12	Only about 2 percent of the fugitive dust emissions would be from construction camps. In no case would this be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and would have no emissions during the operations phase.
Wells	Well construction would be responsible for about 2 percent of fugitive PM_{10} emissions. In no case would this be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the construction phase to serve as the water source for facility operations.
Esmeralda County		
Access roads (including alignment access road)	About 40 percent of fugitive dust emissions would be from the access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Maintenance-of-Way Headquarters Facility	Construction emissions associated with the Maintenance-of-Way Headquarters Facility would account for less than 1 percent of the construction fugitive dust emissions. In no case would the Headquarters Facility construction emissions be expected to cause an exceedance of any air quality standards.	Operation of the Maintenance-of-Way Headquarters Facility would result in very small emissions from the facility.
Construction camp 9	Only about 0.4 percent of the fugitive dust emissions would be due to construction of this construction camp. In no case would the construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and would have no emissions during the operations phase.
Wells	Well construction would be responsible for less than 1 percent of the fugitive PM_{10} emissions. In no case would construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the construction phase to serve as the water source for facility operations.

a. Impacts to air quality under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds; NAAQS = National Ambient Air Quality Standards.

4.2.5 SURFACE-WATER RESOURCES

This section describes potential impacts to surface-water resources (***washes***, playas, ***floodplains***, and ***wetland*** areas) from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.5.1 describes the methodology DOE used to analyze potential impacts; Section 4.2.5.2 describes potential construction impacts; Section 4.2.5.3 describes potential operations impacts; Section 4.2.5.4 describes potential impacts under the Shared-Use Option; and Section 4.2.5.5 summarizes potential impacts to surface-water resources.

4.2.5.1 Impact Assessment Methodology

As described in Section 3.2.5.1, the region of influence for surface-water resources would be limited in most cases to the nominal width of the rail line construction right-of-way. In some cases the region of influence would extend beyond the construction right-of-way. Construction and operations activities along the rail line could impact a larger area in cases where surface-water drainages could carry pollutants (such as petroleum-based lubricants and fuels) and eroded soil downstream of the rail line or in cases where floodwaters backed up on the upstream side of the rail line.

DOE evaluated potential impacts to surface-water resources based on a series of criteria, as listed in Table 4-54. There would be an impact if railroad construction and operations would cause any of the conditions listed in Table 4-54. To avoid or limit adverse impacts to surface-water resources, the Department would comply with applicable laws, regulations, policies, standards, and directives, and implement best management practices (see Chapter 7). Most importantly, careful pre-planning of construction and operations activities would allow the Department to assess and minimize potential impacts before they occurred (see Section 2.1).

The areas where surface-water impacts would be greatest and where DOE would implement direct controls (such as erosion and sedimentation controls) would be within the construction right-of-way. The Department expects that the numbers and types of surface-water features within the construction right-of-way would have a direct relationship to the degree of impacts within this area. To evaluate potential impacts to surface water, the Department identified areas where there are drainage channels, floodplains, springs, and wetlands along the rail alignment (including those it would cross or cover) and identified the activities associated with construction or operations that would have the potential to impact these surface-water resources.

Table 4-54. Impact assessment criteria for surface-water resources (page 1 of 2).

Resource criteria	Basis for assessing adverse impact
Stormwater drainage	Would railroad construction or operations: • Alter stormwater discharges, which could adversely affect drainage patterns, flooding, and/or erosion and sedimentation • Alter ***infiltration*** rates, which could adversely affect (increase or decrease) the volume of surface water that flows downstream • Conflict with applicable stormwater management plans or ordinances
Surface-water quality	Would railroad construction or operations: • Contaminate public water supplies and other surface waters, exceeding water quality criteria or standards established in accordance with the Clean Water Act, state regulations, or permits • Conflict with regional water quality management plans or goals

Table 4-54. Impact assessment standards for surface-water resources (page 2 of 2).

Resource criteria	Basis for assessing adverse impact
Surface-water availability and uses	Would railroad construction or operations: • Alter the capacity of available surface-water resources, such that human health, the environment, or personal property would be adversely affected • Conflict with established water rights or regulations protecting surface-water resources for future beneficial uses
Wetlands and waters of the United States	Would railroad construction or operations: • Cause filling of wetlands or otherwise alter drainage patterns such that wetlands or waters would be adversely affected
Floodplains and floodwaters	Would railroad construction or operations: • Alter floodway or floodplain or otherwise impede or redirect flows such that human health, the environment, or personal property would be adversely affected • Conflict with applicable flood management plans or ordinances
Springs	Would railroad construction or operations: • Reduce or eliminate access to springs such that human health, the environment, or personal property would be adversely affected

4.2.5.2 Construction Impacts

Section 3.2.5 describes surface-water resources along the Caliente rail alignment. Table 4-55 lists the numbers of surface-water features within the nominal width of the rail line construction right-of-way and support facilities. The table includes estimates of the number of drainage channels the Caliente rail alignment alternative segments and common segments would cross. DOE identified drainage channels using the National Hydrological Dataset, a U.S. Geological Survey dataset of hydrologic features. The table also identifies two subsets of the total number of drainage channel crossings. The first is the notable channels described in Section 3.2.5.2.1. The second subset is the washes DOE classified as waters of the United States during field studies in support of this Rail Alignment EIS.

This section also addresses impacts to surface-water quality, and water availability and usage. Springs are also evaluated because they are a significant source of surface water within and near the Caliente rail alignment region of influence.

Floodplains and wetlands are two other important surface-water features the Department evaluated as part of this analysis. Appendix F, Floodplain and Wetlands Assessment provides additional information on wetlands and floodplains the Caliente rail alignment could encounter. Appendix F includes figures showing the locations of these surface-water features and provides more detail on their characteristics.

4.2.5.2.1 Impacts Common to the Entire Rail Alignment

The following sections describe common impacts identified and assessed for activities associated with construction of the proposed railroad along the Caliente rail alignment. DOE would minimize impacts through the engineering design (see Section 2.2) and the implementation of best management practices (see Chapter 7).

4.2.5.2.1.1 Stormwater Drainage. Construction of the proposed railroad could result in both direct and indirect impacts to surface-water resources. Direct impacts would result from the temporary or permanent grading, dredging, rerouting, or filling of ***ephemeral*** or ***intermittent streambeds***. Indirect impacts would include increases in ***nonpoint source pollution*** resulting from runoff from construction areas where surface grades and characteristics had been changed (such as the rail roadbed, facilities, and access roads).

Table 4-55. Summary of drainages the rail line and support facilities would cross – Caliente rail alignment.

Rail line segments/facilities	Total[a]	Notable drainages[b]	Waters of the United States[c]
Caliente alternative segment	15	10	9
Staging Yard (Indian Cove option)	10	7	1 (bridged)
Staging Yard (Upland option)	13	9	1 (bridged)
Potential quarry CA-8B	0	0	3 (siding)
Eccles alternative segment	15	8	11
Interchange Yard	1	0	1
Staging Yard (Eccles-North)	10	7	4
Caliente common segment 1	144	33	17
Garden Valley alternative segment 1	25	13	0
Garden Valley alternative segment 2	19	13	0
Garden Valley alternative segment 3	28	12	0
Garden Valley alternative segment 8	18	10	0
Caliente common segment 2	35	12	0
South Reveille alternative segment 2	9	5	0
South Reveille alternative segment 3	11	6	0
Caliente common segment 3	92	31	0
Maintenance-of-Way Trackside Facility	1	1	0
Goldfield alternative segment 1	25	9	0
Goldfield alternative segment 3	15	6	0
Goldfield alternative segment 4	26	6	0
Maintenance-of-Way Headquarters Facility	1	0	0
Caliente common segment 4	9	1	0
Bonnie Claire alternative segment 2	31	11	0
Bonnie Claire alternative segment 3	23	9	0
Common segment 5	124	84	0
Oasis Valley alternative segment 1	24	15	2 (bridged)
Oasis Valley alternative segment 3	28	11	1 (bridged)
Common segment 6	43	20	14
Rail Equipment Maintenance Yard	1	0	0

a. All drainages identified in National Hydrologic Dataset (DIRS 177714-MO0607NHDFLM06.000).
b. Only includes drainages with stream order equal to or greater than two from the National Hydrologic Dataset (DIRS 177714-MO0607NHDFLM06.000).
c. Source: DIRS 180914-PBS&J 2006, Figures 3A through 3E.

Cut and fill operations during rail line construction would cause the alteration of natural drainage patterns and runoff rates in some areas that could affect downgradient resources. Construction activities that could temporarily block surface drainage channels include moving large amounts of soil and rock to develop the track platform and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and movement of equipment to the construction initiation points. Depending on site conditions, construction could include regrading so that a number of minor drainage channels would collect in a single ***culvert*** or pass under a single bridge, resulting in water flowing from a single location on the downstream side rather than across a broader area. As a result, there would be some localized changes in drainage patterns.

Regrading and rerouting washes through channelization, including the installation of culverts and stabilization of existing stream banks, could increase the flow rate in relation to natural flow conditions. Culverts and improved channels would provide less resistance to flow so that the flow rate of runoff could increase as it passed through such a structure. The speed by which water flows through a drainage structure (a culvert, a bridge, or a stream channel) affects the erosive potential of the flow; therefore, the design of drainage structures must account for the potential for scour and erosion and incorporate outlet protection and velocity-dissipating devices that calm the flow and lessen its erosive potential. Without such protective measures, scour might occur, especially around bridge piers and abutments, where water flowing past a pier or abutment could erode the supporting soil and sediment around these structures. As the speed of flow increased, the chances for the entire streambed and bank to be exposed to scour and erosion would increase.

DOE would incorporate hydraulic modeling into the final design process to ensure that crossings are properly engineered so that they would not contribute to erosion and sediment pollution, and impacts to surface-water resources downstream of the rail line would be greatly minimized. Therefore, impacts associated with surface-water drainage patterns from rail line construction would be small.

DOE would employ standard engineering design practices to size and place culverts to move runoff water from one side of the track to the other. These culverts or other means of runoff control would be put in place as part of subgrade construction to prevent water from backing up. Preliminary rail line design includes various structures to accommodate drainage features the rail line would cross (DIRS 176166-Nevada Rail Partners 2006). These structures include slab bridges with multiple piers spaced at 4-meter (13-foot) intervals; double cell bridges with multiple piers spaced at 10-meter (33-foot) intervals; shaft-supported bridge structures with spans between end shafts of 14 to 24 meters (45 to 80 feet); precast reinforced concrete box culverts with a maximum cross-section size of 3.7 meters by 3.7 meters (12 feet by 12 feet); and corrugated metal pipe culverts of various diameters.

Except in areas where drainage structures would cross a Federal Emergency Management Agency designated 100-year floodplain, hydraulic design would be based on typical Class 1 freight railroad standard design criteria. Floodplain crossings are described in Section 4.2.5.2.1.6. Class 1 freight railroad standard criteria require that the ***50-year flood*** should not come into contact with the top (crown) of the culvert or the lowest point of the bridge, whichever is applicable. For the ***100-year flood***, these criteria require that the floodwaters should not rise above the ***subgrade elevation*** at the structure. To conform to these standards, DOE would use circular culverts where flow rates would be small (less than 4 cubic meters per second [140 cubic feet per second]). For larger flows (up to 28 cubic meters per second [1,000 cubic feet per second]), DOE would use box culverts. The Department would construct bridges where flows were larger and where the rail surface would not be tall enough to accommodate a sufficiently sized culvert, and

50-year flood is a flood that has a 2-percent chance of being equaled or exceeded in any given year.

100-year flood is a flood that has a 1-percent chance of being equaled or exceeded in any given year. A base flood may also be referred to as a 100-year storm and the area inundated during the base flood is sometimes called the 100-year floodplain.

500-year flood is a flood that has a 0.2-percent chance of being equaled or exceeded in any given year.

Ballast is crushed stone used to support the railroad ties and provide drainage.

Subballast is a layer of crushed gravel that is used to separate the ***ballast*** and roadbed for the purpose of load distribution and drainage.

Subgrade elevation of the rail line is the elevation of the top of the ***subballast***.

would install the culverts with ***riprap*** around the exposed ends to protect the fill material from erosion (DIRS 176166-Nevada Rail Partners 2006, p. ii). Bridge abutments and piers would be similarly protected. In some places, training dikes or berms would be required to redirect flow and ensure that the flow would be conveyed through the structure. In places, channel improvements might be necessary for a short distance upstream and downstream of the rail line to intercept and effectively redirect flows through drainage structures.

DOE would analyze crossings on a case-by-case basis and propose culverts whenever feasible. Where there would be very wide and shallow depths of flow during a 100-year flood, or the flow would be divided into multiple natural channels that would cross the rail line, the Department would use a series of multiple culverts, potentially in concert with small bridges to span the main flow channel. In locations where there were very high fill conditions, it would be more economical to use multiple culverts than to construct a bridge (DIRS 176166-Nevada Rail Partners 2006, p ii). Because DOE would design stormwater conveyance systems to safely convey design floods (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts on stormwater conveyance associated with construction of the rail line would be small.

Construction activities that disturbed the land surface, such as grading, excavation, or stockpiling, would have the potential to alter the rate at which water could infiltrate the disturbed areas. Depending on the type of disturbance, the infiltration rate could increase (for example, in areas with loosened soil) or decrease (for example, in areas where construction activities had compacted the soil or involved the installation of impermeable surfaces like asphalt pads, concrete surfaces, or buildings). Most of the land disturbance during the construction phase would result in surfaces with lower infiltration rates; that is, the surfaces would be less permeable than natural soil conditions and would cause an increase in runoff. The change in the amount of runoff that would actually reach the drainage channels would be minor, because construction would affect a small amount of the overall natural drainage area (DIRS 155970-DOE 2002, p. 4-24). Therefore, adverse impacts associated with changes in stormwater infiltration and runoff rates would be small.

DOE would construct two access roads (each up to 7.3 meters [24 feet] wide) along most of the rail line within the rail line construction right-of-way (one on each side of the rail line) to support operations. Additional access roads could be needed to provide access to the construction support facilities, such as construction camps, wells, and quarries. DOE would improve all access roads as necessary in accordance with the parameters for rural roads as defined by the Nevada Department of Transportation and the American Association of State Highway and Transportation Officials (DIRS 180922-Nevada Rail Partners 2007, p. 4-20). The Department would excavate roadside ditches on both sides of the roadway as necessary to direct stormwater to drainage features and washes. Most access roads would likely have gravel surfaces, except for those to wells. Dip sections (depressions in a road that allow stormwater to flow across the road surface) would be used to convey ephemeral flows across the road surfaces (DIRS 176172-Nevada Rail Partners 2006, p. 4-19).

DOE would locate most wells along the two alignment access roads or adjacent to existing roads; however, construction of new access roads to distant wells might be required in four cases (total distance of less than 5.5 kilometers [3.5 miles]). These roads would be needed to reach the well sites and to accommodate temporary pipelines constructed to convey water to the construction right-of-way. DOE would construct temporary pipelines on top of the ground next to an existing road or a new access road (DIRS 176172-Nevada Rail Partners 2006, p. 4-11). The Department would position the temporary pipelines so they would not obstruct or redirect surface runoff or natural drainage channels. Therefore, there would be no adverse impacts to surface-water resources from construction of temporary pipelines.

Water would be required for compaction of fill material to construct the embankment areas of the rail roadbed. Compaction of fill would require approximately 6.8 billion liters (1.8 billion gallons) of water (DIRS 180922-Nevada Rail Partners 2007, p. 4-10). To stay within the plastic limits of the soil, fill would not be completely saturated, and runoff will be intentionally avoided. DOE would use standard erosion-control practices during compaction activities. Water would also be required for dust control along roads used to access the rail alignment during construction activities. Approximately 250 million liters (65 million gallons) of water would be required for dust control over a 3-year period. DOE would use standard construction dust-control measures. Water quantities used for dust suppression in these areas would not be expected to result in runoff.

DOE would minimize construction impacts to stormwater drainage through engineering design (see Section 2.2) and implementation of best management practices (see Chapter 7). A National Pollutant Discharge Elimination System General Construction Permit would be required for construction activities. In accordance with this permit, construction contractors would be required to prepare and submit a Stormwater Pollution Prevention Plan, which would be prepared consistent with state and federal standards for construction activities and would detail the best management practices that would be employed to minimize soil loss and degradation to nearby water resources. Design of the best management practices program would be based on practices listed in the *Best Management Practices Handbook* developed by the Nevada Division of Environmental Protection and the Nevada Division of Conservation Districts (DIRS 176309-NDEP 1994, all) and the *Storm Water Quality Manuals Construction Site Best Management Practices Manual* developed by the Nevada Department of Transportation (DIRS 176307-NDOT 2004, all).

Best management practices are structural and nonstructural controls that would be used to control nonpoint source pollution such as sedimentation and stormwater runoff. Structural controls are those best management practices that need to be constructed (such as detention or retention basins). Nonstructural controls refer to best management practices that typically do not require construction, such as planning, education, revegetation, or other similar measures. Stormwater runoff and sedimentation are typically addressed through the use of temporary and permanent best management practices, including techniques such as grading that would induce positive drainage; silt fences; and revegetation to minimize or prevent soil exposed during construction from becoming sediment to be carried offsite. Best management practices would be implemented, inspected, and maintained to minimize the potential for adverse impacts to downstream water quality. Chapter 7 describes best management practices in more detail.

4.2.5.2.1.2 Surface-Water Quality. Construction activities could adversely impact surface-water quality due to increased sedimentation because rail line construction activities would result in the potential for erosion and sediment during precipitation events. Sediment would generally be contained onsite through the use of best management practices, including erosion- and sedimentation-control measures. Therefore, the potential for off-site impacts to surface water from increased sediment loads would be small.

Water quality impacts are also possible from potential release and spread of contaminants (materials potentially harmful to human health or the environment), which could be released through an accidental spill or discharge. These types of releases could be localized if there was a small spill or widespread if precipitation or intermittent runoff carried contaminants away from the site of the spill. For the areas of the Caliente rail alignment near surface-water bodies, contaminants could be released directly to surface water; however, there are only a few places where there are surface-water bodies along the rail alignment.

Section 4.2.12, Hazardous Materials and Waste, describes construction materials that could be mishandled (spilled), including petroleum products (such fuels and lubricants) and coolants (such as antifreeze). Incidental spills could also include solvents used for cleaning or for degreasing equipment.

The construction camps would include some bulk storage of hazardous materials, and supply trucks would routinely bring new materials and remove used materials and wastes (such as lubricants and coolants) from the construction sites (see Section 4.2.12). These activities would present some potential for incidental spills and releases, the significance of which would depend largely on the nature and volume of the material spilled and its location. A release or spill of pollutants to a stream or river, or stormwater runoff carrying pollutants to such receptors, would have the greatest potential to adversely impact surface-water quality.

The potential for such impacts during the construction phase would be small because the environment along the Caliente rail alignment is arid and there is little flowing water. Also, construction contractors would be required to comply with regulatory requirements for spill-prevention measures, reporting and remediating spills, and properly disposing of or recycling used materials (as described in Chapter 7). Common stormwater pollution control practices mandate that hazardous materials be stored inside facilities or have secondary containment or other protective devices and that spill control and containment equipment be stationed close to hazardous material (for example, fuel) storage.

Sanitary sewage generated at construction camps would be treated onsite or collected and trucked to a wastewater treatment plant. A portable wastewater treatment facility could be installed at each construction camp. As a water conservation measure, the Department would use treated wastewater effluent (***gray water***) produced at the camps for dust suppression and soil compaction. These water conservation measures would help reduce the demands placed on groundwater wells. The portable wastewater treatment plants would be designed and operated so that generated effluent would not adversely impact the quality of surface water with which it comes in contact; therefore, impacts to surface-water quality from wastewater treatment operations during the construction phase would be small. There would be no on-site discharges of industrial wastewater during the construction phase.

The wastewater treatment process would result in the production of biosolids (sludge). DOE would store biosolids on the sites and allow them to dry until the conditions specified in federal regulations (40 CFR Part 503) and state regulations are met. DOE would dispose of biosolids at a licensed facility in accordance with all applicable state and federal laws (DIRS 176172-Nevada Rail Partners 2006, p. 4-6).

4.2.5.2.1.3 Surface-Water Availability and Uses. See Section 4.2.2, Land Use and Ownership, for a discussion of impacts to manmade water systems.

4.2.5.2.1.4 Waters of the United States. Jurisdictional ***waters of the United States*** subject to Section 404 of the Clean Water Act include interstate waters and intrastate waters with a connection to interstate commerce, tributaries to such waters, and wetlands that are adjacent to waters of the United States. The Section 404 permitting program prohibits discharge of dredged or fill material into jurisdictional waters if a practicable alternative exists that would be less damaging to the aquatic environment, or if the Nation's waters would be significantly degraded. In other words, it must be demonstrated that, to the extent practicable, steps have been taken to avoid impacts and that potential impacts on waters of the United States have been minimized and mitigation is provided for any remaining unavoidable impacts (if required). See Chapter 6, Statutory, Regulatory, and Other Applicable Requirements, for further discussion of the Clean Water Act Section 404 permitting requirements.

The U.S. Army Corps of Engineers is responsible for determining whether drainages and wetlands along the rail alignment are regulated under Section 404; therefore, all conclusions in this analysis about the classification of washes and wetlands as waters of the United States are tentative. On June 5, 2007, the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers released interim guidance that addresses the jurisdiction over waters of the United States under the Clean Water Act. Based on this guidance, it is likely that many of the drainages along the rail alignment that DOE currently considers to be waters of the United States might not be considered as such. If DOE selected the Caliente rail alignment for construction of the proposed railroad, the Department would request that the U.S. Army Corps of Engineers determine the limits of jurisdiction under Section 404 along the rail alignment before beginning construction.

Estimates for potential fill area and quantity of fill are provided in this section to support Section 404 permitting requirements (see Table 4-56). These estimates were calculated based on the depth and width of the water body that would be crossed and the type of engineered structure planned for each crossing. For crossings with culverts, DOE assumed that culverts would be extended 12 meters (40 feet) on either side of the cut/fill boundary for the rail roadbed. For bridges over waters of the United States having a width of less than 3 meters (10 feet), DOE assumed that no fill would be placed in the channel. For bridges over wider channels, DOE assumed that there would be one bridge pier every 6 meters (20 feet) and that each pier would cover a surface area of 1.9 square meters (20 square feet). Fill estimates calculated for these crossings depend on channel depths. These fill estimates represent an upper bound estimate, because the drainages currently identified during this analysis as waters of the United States might not be considered waters of the United States under the new U.S. Army Corps of Engineers guidance.

Table 4-56. Summary of waters of the United States – Caliente rail alignment.[a]

Rail line segments/facilities	Crossings[b]	Fill area (square meters)[c]	Fill volume (cubic meters)[d]
Caliente alternative segment	9	9.3	2.8
Staging Yard (Indian Cove option)	1 (bridged)	0	0
Staging Yard (Upland option)	1 (bridged)	0	0
Potential quarry CA-8B	3 (siding)	1,800	120
Eccles alternative segment	11	850	41
Interchange Yard	1	33,000	10,060
Staging Yard (Eccles-North)	4	120	11
Caliente common segment 1	17	560	22
Oasis Valley alternative segment 1	2 (bridged)	0	0
Oasis Valley alternative segment 3	1 (bridged)	0	0
Common segment 6	14	560	37

a. Source: DIRS 180914-PBS&J 2006, Figure 3A through 3E.
b. Any water of the United States within 12 meters (40 feet) of the construction footprint is considered to be crossed.
c. To convert square meters to acres, multiply by 2.4711.
d. To convert cubic meters to cubic feet, multiply by 35.314.

If DOE constructed the railroad along the Caliente rail alignment, there would be no practicable alternative to crossing some ephemeral streams in the Meadow Valley Wash and Amargosa River drainage systems that are waters of the United States. In those areas, there are numerous ephemeral waters of the United States that flow perpendicular to the general direction of the rail line, and the rail line would have to cross them. DOE would construct bridges across many of the ephemeral waters of the United States along the rail line, and very little or no fill in regulated stream channels would be required for those crossings. The Department would place culverts in the smaller ephemeral streams. Because the size of these regulated channels is generally less than 1 to 2 meters (3.3 to 6.6 feet), the area filled per crossing would typically be less than about 100 square meters (0.03 acres). The crossings would be designed so that they would not alter stream flow, and the Department would implement best management practices (see Chapter 7) to minimize sedimentation during and after construction.

4.2.5.2.1.5 Wetlands. Executive Order 11990, *Protection of Wetlands*, requires that federal agencies "…take action to minimize the destruction, loss, or degradation of wetlands…" The Executive Order requires consideration of all wetlands regardless of whether they are regulated under Section 404 of the

Clean Water Act. DOE regulations at 10 CFR Part 1022 direct that impacts to wetlands be avoided wherever possible and minimized to the extent practicable during construction projects. In accordance with Executive Order 11990 and 10 CFR Part 1022, this Rail Alignment EIS examines impacts to all wetlands regardless of whether they are considered jurisdictional under Section 404 of the Clean Water Act.

Under 10 CFR 1022, the Department is required to preserve and enhance the natural and beneficial values of wetlands. The values of wetlands are a function of the importance or worth of the functions that wetlands serve to society. Functions of wetlands include storage of water (floodwater protection), water filtration (wetlands can trap nutrients, sediment, and pollutants), and biological productivity (plant and animal ***habitat***). Impacts to these functions can eliminate or diminish the value of wetlands (DIRS 176797-EPA 2001, p. 1). Temporary or permanent filling or draining of wetlands would result in direct impacts to those resources. Actions in and around wetlands could result in indirect impacts, such as potential degradation of water quality and disruption of water flow.

To meet the requirements of 10 CFR Part 1022, Appendix F, Floodplain and Wetlands Assessment, includes a detailed analysis of wetlands and wetland functions. Specifically, this appendix includes a more detailed presentation of the data sources the Department used to identify wetlands and floodplains along the Caliente rail alignment, a discussion of potential impacts (repeated in this section), and an alternatives analysis. The discussion of impacts in this section and Appendix F is limited to the water storage and filtration functions of wetlands. Section 4.2.7, Biological Resources, addresses impacts to the biological-productivity functions of wetlands.

DOE would minimize filling of wetlands by keeping the rail line footprint to a minimum and incorporating avoidance into rail line engineering and design to the extent practicable. DOE would mitigate loss of wetlands, as required under Section 404 of the Clean Water Act, by enhancing existing wetlands adjacent to or near the rail line that have been degraded by grazing and other impacts, or by creating new wetlands adjacent to or near the rail line. The exact acreage of wetlands to be enhanced or created would be determined in coordination with the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency and would be based in part on the amount of wetlands that would have to be filled to construct the rail line, the function and quality of the wetlands that would be lost, and the likelihood of success of the methods used to enhance or replace wetlands. This section describes impacts to wetlands in the segment-specific sections.

4.2.5.2.1.6 Floodplains and Floodwaters. DOE has prepared a floodplain assessment (see Appendix F) for the area along the Caliente rail alignment in accordance with the requirements of 10 CFR Part 1022. Appendix F includes figures that show the Federal Emergency Management Agency floodplain maps that cover the Caliente rail alignment region of influence. DOE obtained floodplain data from the Agency, which has published Flood Insurance Rate Maps that, depending on the combination of alternative segments, cover between 58 and 62 percent of the Caliente rail alignment. The Agency has not mapped areas that are uninhabited. These floodplain maps depict, as applicable, the lateral boundaries or spread of water that could be expected in drainage channels or around collection basins from a 100-year and a ***500-year flood***.

DOE overlaid a map of the Caliente rail alignment on the available floodplain maps and estimated the crossing distances for each alternative segment and common segment. Table 4-57 lists the crossing distances and the percentage of the area for which floodplain map coverage is available. Areas with little or no floodplain map coverage could contain floodplains not listed in the table. Appendix F discusses floodplains in more detail.

Table 4-57. Floodplains the Caliente rail alignment would cross (page 1 of 3).

Rail line segment	Percent covered by FEMA[b] floodplain maps	Floodplain crossing distance (kilometers)[a] Mapped	Floodplain crossing distance (kilometers)[a] Additional estimated	Floodplain description
Caliente alternative segment	28	2.6	2.6	Starting from the southern end of the alternative segment with the Clover Creek floodplain to its junction with the Meadow Valley Wash floodplain and up the alternative segment approximately 4 kilometers. No FEMA floodplain map available above Caliente city limit. Used shaded relief map to extend floodplain and estimate additional floodplain. Crossing distance for Meadow Valley Wash is based on the width of the floodplains further south where there is floodplain map coverage.
Eccles alternative segment	0	0	1.0	FEMA floodplain map coverage is not available for the Eccles alternative segment. Estimated the crossing distance from the width of the 100-year floodplain along Clover Creek near its confluence with Meadow Valley Wash where there is floodplain map coverage.
Caliente common segment 1	14	0	2.0	Floodplain of Dry Lake Playa estimated using shaded relief maps.
Garden Valley alternative segment 1	0	0	3.9	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 2	0	0	9.5	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 3	0	0	3.9	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 8	0	0	9.5	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Caliente common segment 2	26	0	0	No floodplains identified.
South Reveille alternative segment 2	100	23	0	Reveille Valley braided wash floodplain extending from Railroad Valley around southern tip of Reveille Range.
South Reveille alternative segment 3	100	0	0	No floodplains identified.

Table 4-57. Floodplains the Caliente rail alignment would cross (page 2 of 3).

Rail line segment	Percent covered by FEMA[b] floodplain maps	Floodplain crossing distance (kilometers)[a] Mapped	Additional estimated	Floodplain description
Caliente common segment 3	79	28	0	The floodplain extends from Mud Lake Playa up through Ralston Valley Wash, Saulsbury Wash, Willow Creek (also called Stone Cabin Creek), and a tributary of Willow Creek and a western tributary of Mud Lake Playa. There are no floodplain maps for parts of eastern common segment 3-west; however, the topography in that area suggests that it is not in floodplain.
Goldfield alternative segment 1	58	1.0	0	Floodplains from Mud Lake Playa and Stonewall Flat extending up minor tributaries of Mud Lake Playa and Jackson Wash and China Wash, respectively.
Goldfield alternative segment 3	55	1.0	0	Floodplains from Mud Lake Playa and Stonewall Flat extending up minor tributaries of Mud Lake Playa and Jackson Wash and China Wash, respectively.
Goldfield alternative segment 4	43	1.5	0	Floodplains from Mud Lake Playa, Alkali Lake Playa, and Stonewall Flat extending up minor tributaries of Mud Lake Playa, tributaries of Big Wash, and tributaries of Jackson Wash and China Wash, respectively. There is no floodplain map coverage for Alkali Lake Playa.
Caliente common segment 4	100	1.3	0	Floodplain extends downgradient of Stonewall Flat Playa to the Lida Valley Alkali Flat Playa.
Bonnie Claire alternative segment 2	30	0	0	No floodplains identified.
Bonnie Claire alternative segment 3	78	1.9	0	Floodplains extending up tributaries of the Lida Valley Alkali Flat Playa and up the Stonewall Pass wash from the Bonnie Claire Flat area of Sarcobatus Flat.
Common segment 5	74	0.3	0	Floodplain extending from Sarcobatus Flat up to Tolicha Wash.
Oasis Valley alternative segment 1	100	1.1	0	Floodplain of the Amargosa River within Thirsty Canyon.
Oasis Valley alternative segment 3	100	0.4	0	Floodplain of the Amargosa River within Thirsty Canyon.

Table 4-57. Floodplains the Caliente rail alignment would cross (page 3 of 3).

Rail line segment	Percent covered by FEMA[b] floodplain maps	Floodplain crossing distance (kilometers)[a]		Floodplain description
		Mapped	Additional estimated	
Common segment 6	55	0.1	0	Beatty Wash floodplain extending from Amargosa River Floodplain.
		0.23[c]		Busted Butte Wash draining east side of Yucca Mountain to Fortymile Wash (rail line would cross wash and tributaries).

a. To convert kilometers to miles, multiply by 0.62137.
b. FEMA = Federal Emergency Management Agency.
c. There are no FEMA floodplain maps covering Busted Butte Wash on the eastern slope of Yucca Mountain. Estimates of floodplain crossings in this area are from DIRS 155970-DOE 2002, Figure 3-12 floodplain mapping efforts.

Construction activities would affect floodplains, either through direct alteration of the stream-channel cross section that would affect the flow pattern of the stream, or through indirect changes in the amount of impervious surfaces and additional water volume added to the floodplain. Based on Federal Emergency Management Agency floodplain maps and flood studies completed in the area of the Yucca Mountain Site, the Caliente rail alignment would cross more than 20 floodplains.

Construction impacts associated with these floodplains would be similar to any other identified drainage areas (the alteration of natural drainage patterns and possible changes in erosion and sedimentation rates or locations). Construction in washes or other flood-prone areas could reduce the area through which floodwaters would naturally flow, which could cause water levels to rise on the upstream side of crossings. Sedimentation would be likely to occur on the upstream side of crossings in areas where the flow of water was restricted enough to cause ponding. DOE would manage sedimentation of this type under a regular maintenance program (DIRS 155970-DOE 2002, p. 6-79). Therefore, impacts to floodplains from construction of the rail line that result in restrictions in flow and sedimentation would be small.

Construction within floodplains would cause direct impacts to floodplains. The Caliente rail alignment would be in a region where flash flooding is the primary concern. Although such flooding can be violent and hazardous, it is generally limited in its extent and duration, limiting the potential for impacts associated with the proposed railroad; that is, any damage would be expected to be confined to a small portion of the rail line.

Although DOE would generally design rail line features to accommodate 100-year floods, based on typical Class 1 freight railroad standard design criteria (see Section 4.2.5.2.1.1), the final design process could also consider a range of flood frequencies and include a cost-benefit analysis in the selection of a design frequency in accordance with standard rail line design guidelines and practices (DIRS 106860-AREA 1997, Volume 1, Section 3.3.2.2 c). In areas where drainage structures would cross a Federal Emergency Management Agency-designated 100-year floodplain, DOE would design the bridge to comply with Agency standards and appropriate county regulations. Federal Emergency Management Agency standards require that floodway surcharge (the difference between the 100-year flood elevation and the actual flood surface elevation) not exceed 0.3 meter (1 foot) at any location. These standards are designed to limit the impacts of floodwater to structures built in or adjacent to floodplains (DIRS 176166-Nevada Rail Partners 2006, p. ii). By adhering to these standards, the Department would substantially limit the potential for adverse impacts to the population and resources located adjacent to floodplains.

Bridge constructing usually involves placing a portion of the bridge abutment in the floodplain (called encroachment). For this reason, the abutment can have some impact on the height of floodwaters upstream of the bridge. Excessive encroachment can result in increased scour potential at the abutments, piers, and the stream bottom through the bridge opening due to increases in flow velocities. Based on the conceptual design for the Caliente rail alignment, there could be encroachments up to 30 percent of the floodplain width, which could result in an approximately 0.3 meter (1-foot) increase in water-surface elevation at the upstream side of the bridge where the floodplain is wide and shallow (DIRS 176166-Nevada Rail Partners 2006, p. ii).

DOE would reduce impacts to floodplains and the resources close to the floodplains by adhering to the design standards that limit the degree to which floodwaters would be allowed to rise. The Department would incorporate hydraulic modeling into the engineering design process to ensure that all crossings were designed to limit impacts to nearby populations and resources.

4.2.5.2.1.7 Springs. DOE designed the rail line to avoid springs and other surface-water resources whenever practicable. In the few cases where there would be springs within the construction right-of-way, the Department would incorporate avoidance into final engineering and design of the rail line to the extent practicable. To minimize temporary impacts, springs would be marked prior to construction and avoided where possible. Therefore, impacts to springs from construction activities would be small. Section 4.2.6, Groundwater Resources, addresses impacts to springs from a groundwater-supply perspective.

4.2.5.2.2 Impacts along Alternative Segments and Common Segments

4.2.5.2.2.1 Interface with the Union Pacific Railroad Mainline. DOE would construct the Interchange Yard, the Staging Yard, a Satellite Maintenance-of-Way Facility, train crew facilities, and possibly the Nevada Railroad Control Center and National Transportation Operations Center at the Interface with the Union Pacific Railroad Mainline. DOE is considering two options for siting the Staging Yard along the Caliente alternative segment (Indian Cove and Upland) (see Figure 3-61). Section 4.2.5.2.3 addresses facilities. The starting points for both the Caliente and the Eccles alternative segments would either cross or be close to surface-water features, specifically Clover Creek and Meadow Valley Wash (see Table 4-55). This section describes site-specific impacts related to construction activities along the Caliente alternative segment or the Eccles alternative segment.

Caliente Alternative Segment The Caliente alternative segment would cross playas, washes, and streams, several of which are waters of the United States, as described in Section 3.2.5.3.1.1 and summarized in Table 4-55. In total, this segment would cross nine waters of the United States, including Meadow Valley Wash, Clover Creek, and Bennett Springs Wash, and drainage channels of these waters. Common impacts from surface-water crossings are addressed in Section 4.2.5.2.1.1. Of the nine waters of the United States the Caliente alternative segment would cross, the amount of fill would range from no fill for the smallest drainage to 1.1 cubic meters (40 cubic feet) for the two largest drainages. The total amount of fill for waters of the United States the Caliente alternative segment would cross would be 2.8 cubic meters (100 cubic feet).

DOE proposes to construct the Caliente alternative segment over the abandoned Union Pacific rail roadbed in part to minimize filling wetlands. The total area of wetlands within 30 meters (100 feet) of the rail line (the area delineated by DOE) would be 0.28 square kilometer (68 acres). DOE would minimize impacts to wetlands in this area by reducing the construction footprint to approximately 21 meters (70 feet), which would reduce the area of wetlands to be filled to 0.05 square kilometer (12 acres). Although DOE evaluated the use of vertical retaining walls and other methods to further reduce the construction footprint and the amount of wetlands filled, those methods would be impractical due to cost (DIRS 180916-Nevada Rail Partners 2007, Appendix F). DOE could modify the final design of the rail line to avoid additional wetlands, such as those adjacent to the old rail roadbed along Meadow Valley Wash, by using a slightly narrower construction footprint; however, this would only slightly reduce the area of wetlands that would be filled. Section 4.2.5.2.1.5 addresses common impacts to wetlands that would be crossed by and adjacent to the rail line and mitigation for wetlands.

The Federal Emergency Management Agency has performed detailed studies of Meadow Valley Wash, Antelope Canyon Wash, and Clover Creek Wash within the corporate limits of the City of Caliente and for some portions of Lincoln County, using detailed methods. The Agency has established 100-year floodwater surface elevations and regulatory floodways for these watercourses within the area studied. Encroachment into the floodway is prohibited unless it can be determined that encroachment into the floodway portion of the floodplain would not cause more than a 0.3-meter (1-foot) increase in the water-surface elevations for these watercourses. Table 4-57 lists floodplain information for the Caliente alternative segment. Federal Emergency Management Agency floodplain mapping extends from Caliente to the southern end of a meadow at Indian Cove. The Agency has mapped the southern portion of the meadow as a 100-year floodplain. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

Caliente Hot Springs would be within the construction right-of-way 16 meters (52 feet) from the rail line, but outside of the cut and fill area (7.7 meters [25 feet] outside the toe of slope). The hot spring itself is inside a hotel located in the City of Caliente. Therefore, there would be no impacts to water quality. There could be short-term adverse impacts to this spring in relation to reduced access for use by the public during the construction phase. Section 4.2.5.2.1.7 describes common impacts to springs in the vicinity of the rail line.

Construction camp 1 would be along the Caliente alternative segment, but the camp would not impact surface-water features. There are no waters of the United States or wetlands in the area of construction camp 1.

Eccles Alternative Segment The Eccles alternative segment would cross several surface-water features (see Section 3.2.5.3.1.2). DOE would construct a large bridge at the beginning of the Eccles alternative segment to span Clover Creek. To construct the 300-meter (1,000-foot) bridge, the Department would have to install piers across the confluence of Clover Creek and an unnamed tributary to Clover Creek that flows from the north and joins Clover Creek in the area just to the north of the proposed bridge. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

Table 4-55 lists crossings of waters of the United States. These waters include Clover Creek and four of its tributaries and four tributaries of Meadow Valley Wash (DIRS 180914-PBS&J 2006, Figures 3A and 3B). Of the 11 waters of the United States the Eccles alternative segment would cross, the amount of fill would range from none for the smallest drainage to 26 cubic meters (930 cubic feet) for the largest drainage. The total amount of fill for waters of the United States the Eccles alternative segment would cross would be 41 cubic meters (1,400 cubic feet).

The Eccles alternative segment would cross wetlands associated with Meadow Valley Wash approximately 1.6 kilometers (1 mile) south of its intersection with Caliente common segment 1 (DIRS 180914-PBS&J 2006, Figure 4R). DOE would use a bridge to cross Meadow Valley Wash and its associated wetlands, which is comprised of a 9- to 10-meter (30- to 33-foot)-wide wetland area adjacent to the wash. There would be no permanent fill activities within this wetland; indirect impacts would still be possible, but such impacts, if any, would be minimized because of the best management practices the Department would use to prevent erosion, sedimentation, and incidental spills during construction of the bridge. Section 4.2.5.2.1.5 addresses common impacts to wetlands that would be crossed by and adjacent to the rail line and mitigation for wetlands.

There is no Federal Emergency Management Agency floodplain map coverage for the Eccles alternative segment. Although the Agency has not defined any floodplains in this area, the Eccles alternative segment would impact floodplains associated with Clover Creek and Meadow Valley Wash. Clover Creek and its associated floodplain, which encompasses Dutch Flat, ranges in width from 130 to 400 meters (430 to 1,300 feet) (see Appendix F). In January 2005, flooding in and around Clover Creek, Meadow Valley Wash, and Muddy River washed out and undermined portions of an existing rail line and worked out the rail bank in this area. DOE would minimize potential impacts from flooding through the use of erosion-control practices and hydraulic structural design standards (see Appendix F, Section F.4.4.3.4). Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and located adjacent to the rail line.

There are no springs along the Eccles alternative segment.

There are no construction camps planned along the Eccles alternative segment.

4.2.5.2.2.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would skirt the Coal Valley playa at its west end. The playa is expected to be an area subject to occasional flooding and standing water. Caliente common segment 1 would also cross several notable drainage features (see Section 3.2.5.3.2), including Coyote Wash and White River. Although the rail line would cross both of these features in areas where they are normally dry, bridges or culverts would be necessary to accommodate periods of high precipitation and runoff. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

Before the rail line crossed Bennett Pass on its way to Dry Lake Valley, it would cross waters of the United States in Meadow Valley (DIRS 180914-PBS&J 2006, Figures 3C and 3D). Table 4-55 summarizes crossings of waters of the United States. Caliente common segment 1 would cross 17 drainage channels that qualify as waters of the United States (DIRS 180914-PBS&J 2006, Figure 3C). The amount of fill for crossing these waters of the United States would range from no fill for the smallest drainage to 7.5 cubic meters (260 cubic feet) for the largest drainage. The total amount of fill for waters of the United States that common segment 1 would cross would be 22 cubic meters (790 cubic feet). Construction activities would require work in these channels, including such actions as installing culverts or bridges and filling portions of the channel. In total, the preliminary rail line design includes bridges, culverts, and permanent fill used in these crossings. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

Caliente common segment 1 would pass within 600 meters (2,000 feet) of a small group of three isolated wetlands in the North Pahroc Range pass (between White River Valley to the west and Dry Lake Valley to the east). These isolated, nonjurisdictional wetlands were delineated in the field survey conducted in support of this Rail Alignment EIS (DIRS 180914-PBS&J 2006, Figure 4S). These wetlands, resulting from the development of an unnamed spring north of Black Rock Spring, would be uphill of and outside the rail line construction right-of-way; therefore, there would be no direct or indirect impacts to these wetlands.

There is no Federal Emergency Management Agency floodplain map coverage for most of Caliente common segment 1. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are six springs within the region of influence of Caliente common segment 1, with distances ranging from 620 to 1,400 meters (2,000 to 4,600 feet) from the rail line. All of these springs would fall at least 300 meters (1,000 feet) outside the construction right-of-way; therefore, there should be no impacts to these springs. However, there could be temporary disruptions in access to these springs during the construction phase. Water quality impacts are not expected due to distance, but these springs would still be marked and avoided during rail line construction activities. Some of the springs would be downgradient of construction activities, and flooding and sedimentation resulting from extreme weather events could result in short-term, direct adverse impacts to water quality. Straw bale barriers or silt fences would be placed around downstream springs to reduce the potential for erosion and runoff of sediments toward them. Section 4.2.5.2.1.7 describes common impacts to springs in the vicinity of the rail line.

Construction camps 2 and 3 would be along Caliente common segment 1, as described in Section 3.2.5.3.2. No surface-water features would be affected during construction of construction camp 2. However, there is one drainage channel that would cross the footprint of construction camp 3. The presence and location of this feature would be incorporated into the final design of the construction camp; however, the potential would exist for direct, long-term impacts. The range of potential adverse impacts is unknown without specific information regarding the facilities and their location at the construction camp; however, potential impacts include possible fill of the channel and impacts to water quality from increased sedimentation. The installation of appropriate drainage structures (such as culverts) or bridges would be used to minimize impacts, and DOE would implement erosion-control measures to reduce sediment loading into the drainage channel. Common impacts from surface-water crossings are described in Section 4.2.5.2.1.1. There would be no waters of the United States or wetlands within the footprints of construction camps 2 or 3.

4.2.5.2.2.3 Garden Valley Alternative Segments. There would be potential playa crossings along Garden Valley alternative segments 1, 2, 3, and 8. All four of these alternative segments would cross through the Golden Gate Range, but at two different locations. For the southerly alternative segments (Garden Valley 2 and 8), Water Gap is the surface-water outlet and the northerly alternative segments (Garden Valley 1 and 3) would cross an unnamed wash approximately 7.2 kilometers (4.5 miles) north of Water Gap. A bridge would be used for this crossing, and no use of fill is anticipated. These surface-water features are described in Section 3.2.5.3.3. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

No waters of the United States or wetlands were identified in the Garden Valley area (DIRS 180914-PBS&J 2006, pp. 6-9 and 11-14).

There are two springs in the vicinity of Garden Valley alternative segments 1, 3, and 8. These springs would be outside the construction right-of-way 460 meters (1,500 feet), 1,300 meters (4,300 feet) and 420 meters (1,400 feet) from the rail line, respectively. Common impacts to springs in the vicinity of the rail line are discussed in Section 4.2.5.2.1.7.

Construction camp 4, as described in Section 3.2.5.3.3, would be within the construction right-of-way near the junction of the Garden Valley alternative segments with Caliente common segment 2 and would be crossed by one drainage feature. The camp would not cross any waters of the United States or wetlands. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

4.2.5.2.2.4 Caliente Common Segment 2 (Quinn Canyon Range Area). Caliente common segment 2 would cross Davis Creek and Quinn Canyon Wash and several unnamed washes. These features are described in Section 3.2.5.3.4. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States or wetlands identified along Caliente common segment 2 (DIRS 180914-PBS&J 2006, all).

There are no floodplains identified along common segment 2 in the limited area where there is floodplain map coverage; however, a floodplain is shown for an unnamed wash that would be parallel to the rail line.

Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are two springs along Caliente common segment 2, both significantly outside the rail line construction right-of-way. McCutcheon Spring would be 1,000 meters (3,400 feet) and Upper McCutcheon Spring 1,200 meters (4,000 feet) from the rail line. Common impacts to springs that would be near the rail line are discussed in Section 4.2.5.2.1.7.

Construction camp 5, as described in Section 3.2.5.3.4, would be within the construction right-of-way. The camp would not overlie any surface-water features and would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.2.5 South Reveille Alternative Segments. South Reveille alternative segments 2 and 3 would run adjacent to and cross unnamed washes. These features are described in Section 3.2.5.3.5. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

No wetlands or waters of the United States were identified along these short alternative segments that would be affected by rail line construction (DIRS 180914-PBS&J 2006, all).

South Reveille alternative segment 2 would cross floodplains associated with several tributaries of an unnamed wash, as indicated in Table 4-57. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are no springs identified or construction camps planned along the South Reveille alternative segments.

4.2.5.2.2.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Caliente common segment 3 would cross numerous drainage channels. These features are described in Section 3.2.5.3.6. Common impacts to drainages are addressed in Section 4.2.5.2.1.1. Notably, Caliente common segment 3 would cross Willow Creek and six unnamed washes and skirt along the northern and western boundaries of Mud Lake Playa.

There are no waters of the United States along Caliente common segment 3 (DIRS 180914-PBS&J 2006, all).

The National Wetland Inventory lists Mud Lake Playa as a wetland; however, DOE field studies in support of this Rail alignment EIS confirmed that there are no ***hydric soils***, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-Potomac Hudson Engineering 2007, p. 3). These studies support the determination that Mud Lake Playa is not designated as wetlands.

There is no Federal Emergency Management Agency floodplain map coverage or identified floodplains for Caliente common segment 3. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

Black Spring would be outside but adjacent to the construction right-of-way, 300 meters (1,000 feet) from the rail line. Common impacts to springs that would be near the rail line are discussed in Section 4.2.5.2.1.7.

Construction camps 6, 7, and 8 (see Section 3.2.5.3.6) would be within the construction right-of-way and would not cross any surface-water features, waters of the United States, or wetlands.

4.2.5.2.2.7 Goldfield Alternative Segments. The Goldfield alternative segments would cross numerous drainages. These features are described in Section 3.2.5.3.7. Common impacts to drainages are addressed in Section 4.2.5.2.1.1. Goldfield alternative segment 3 would cross within 1.4 kilometers (0.87 mile) of Mud Lake Playa; therefore, it is possible that construction activities could indirectly impact the water quality of this playa.

There are no wetlands or waters of the United States along any of the Goldfield alternative segments. (DIRS 180914-PBS&J 2006, all).

There are several springs within the regions of influence of all three Goldfield alternative segments. The spring nearest to the rail alignment would be Willow Spring, which would be within 96 meters (320 feet) of the rail alignment. Willow Spring would be inside the construction right-of-way, but outside the cut and fill area; therefore access to the spring for wildlife and the public could be adversely affected. The other springs would be outside the construction right-of-way and long-term impacts would not be expected; however, there could be temporary disruptions to access during the construction phase. Common impacts to springs that would be near the rail line are discussed in Section 4.2.5.2.1.7.

4.2.5.2.2.8 Caliente Common Segment 4 (Stonewall Flat Area). Caliente common segment 4 would skirt two playas, Stonewall Flat Playa to the east and Alkali Flat Playa to the southwest, and cross seven drainage channels. These features are described in Section 3.2.5.3.8. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States along Caliente common segment 4 (DIRS 180914-PBS&J 2006, all).

The National Wetland Inventory lists Stonewall Flat Playa as a wetland; however, DOE field studies in support of this Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-Potomac Hudson Engineering 2007, p. 6). There are no wetlands along Caliente common segment 4. These studies support the determination that Stonewall Flat Playa is not designated as wetlands.

Federal Emergency Management Agency floodplain maps show a floodplain associated with the Stonewall Flat Playa drainage path, as indicated in Table 4-57. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are no springs identified along Caliente common segment 4.

Construction camp 9, as described in Section 3.2.5.3.8, would be within the construction right-of-way and would not cross any surface-water features, waters of the United States, or wetlands.

4.2.5.2.2.9 Bonnie Claire Alternative Segments. Both of the Bonnie Claire alternative segments would cross an unnamed drainage channel that drains the area of Stonewall Mountain. Bonnie Claire alternative segment 3, the southwestern alternative segment, would also cross the Alkali Flat Playa. These features are described in Section 3.2.5.3.9. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States or wetlands identified along the Bonnie Claire alternative segments (DIRS 180914-PBS&J 2006, p. 7 and Table 3).

Floodplain maps of the area show floodplains associated with the unnamed drainage channel that drains the area of Stonewall Mountain and Alkali Flat Playa; however, map coverage of the unnamed wash terminates just downstream (southwest) of Bonnie Claire alternative segment 3. The coverage stops at an old boundary of the Nevada Test and Training Range, but is close enough to the alternative segment that a reasonable estimate of the crossing distance could be made and included in Table 4-57. The area where Bonnie Claire alternative segment 2, the northeastern alternative segment, would cross the unnamed wash is far enough away from the limit of the floodplain map coverage that a crossing distance was difficult to estimate, which is why no value is shown in Table 4-57. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

There are no springs identified or construction camps planned along the Bonnie Claire alternative segments.

4.2.5.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Common segment 5 would cross numerous drainage channels, including Tolicha Wash and several unnamed washes, and would skirt playa areas of Sarcobatus Flat. These features are described in Section 3.2.5.3.10. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States or wetlands identified along common segment 5 (DIRS 180914-PBS&J 2006, all).

Where common segment 5 would cross the floodplain associated with Tolicha Wash, a drainage structure would be required that would not result in more than a 0.3-meter (1-foot) increase in water-surface elevations upstream of the crossing. Playa areas near common segment 5 would be subject to occasional flooding and standing water, but the Federal Emergency Management Agency floodplain maps do not show that 100-year flood levels would reach this rail line segment. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

There are no springs identified along common segment 5.

Construction camp 10, as described in Section 3.2.5.3.10, would be within the construction right-of-way and would overlie two small ephemeral washes and three notable drainages. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.2.11 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would cross several washes and both would cross the Amargosa River, which is an ephemeral stream in this area. The northeastern alternative segment, Oasis Valley 3, would run within approximately 0.24 kilometer (0.15 mile) from Colson Pond. These features are described in Section 3.2.5.3.11. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

DOE field surveys of these areas identified two drainage channels along Oasis Valley alternative segment 1 and one drainage channel along Oasis Valley alternative segment 3 that would qualify as waters of the United States (DIRS 180914-PBS&J2006, Figure 3D). Crossings of waters of the United States are summarized in Table 4-55. However, DOE likely would use bridges for these crossings. Therefore, the total amount of fill for waters of the United States the Oasis Valley alternative segments would cross would be very small. Common impacts to waters of the United States are addressed in Section 4.2.5.2.1.4.

DOE field surveys also identified a small isolated wetland, WT-15 (74 square meters [800 square feet]), that would be just outside the construction right-of-way, approximately 160 meters (530 feet) north of Oasis Valley alternative segment 1 (DIRS 180914-PBS&J 2006, Table 6 and Figure 4T). There would be no direct impacts to this wetland during the construction phase because it would be outside the construction right-of-way and would be fenced or flagged. Indirect impacts such as sedimentation, erosion, and incidental spills would still be possible. Common impacts to wetlands are addressed in Section 4.2.5.2.1.5.

As shown in Table 4-57, both of these alternative segments would cross floodplains associated with Thirsty Canyon. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

There are 25 springs within the region of influence of the Oasis Valley alternative segments, all of which would be outside the construction right-of-way. Oasis Valley alternative segment 3 would run within 200 to 520 meters (640 to 1,700 feet) of two unnamed springs. Oasis Valley alternative segment 1 would run within 480 to 610 meters (1,600 to 2,000 feet) of seven springs. Because the springs would be downstream of the rail line, there would be the potential for impacts from erosion and sedimentation during the construction phase. Common impacts to springs are addressed in Section 4.2.5.2.1.7.

Construction camp 11, as described in Section 3.2.5.3.11, would be within the Oasis Valley 1 construction right-of-way and would overlie one small ***ephemeral wash*** and two notable ***drainages***. The camp would not cross any waters of the United States or wetlands. Common impacts from surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.2.12 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would cross several drainage features, including Beatty Wash, Tates Wash, Windy Wash, Busted Butte Wash (also known as Dune Wash), and unnamed tributaries of the Amargosa River and Drill Hole Wash. These features are described in Section 3.2.5.3.12. Common impacts to drainages are addressed in Section 4.2.5.2.1.1

Common segment 6 would cross 14 channels that qualify as waters of the United States, including two tributaries of the Amargosa River, Beatty Wash, seven tributaries to Beatty Wash, and four tributaries to Fortymile Wash. Of the 14 waters of the United States that common segment 6 would cross, the amount of fill would range from none for the smallest drainage to 9.9 cubic meters (350 cubic feet) for the largest drainage. The total amount of fill for waters of the United States common segment 6 would cross would be 37 cubic meters (1,300 cubic feet).

There are no wetlands along common segment 6 (DIRS 180914-PBS&J 2006, p. 11, Table 4).

Federal Emergency Management Agency floodplain maps provide coverage for the western portion of common segment 6, but the coverage terminates at approximately the point where the rail line would reach the Yucca Mountain Site boundary. In the areas covered by floodplain maps, the only floodplain along common segment 6 is one associated with Beatty Wash. The maps also show a floodplain associated with the unnamed wash from Crater Flat, but it does not extend up the wash as far as where common segment 6 would cross. DOE would build a large (370-meter [1,200-foot]-long) special-condition railroad bridge across Beatty Wash. Although the floodplain maps do not provide coverage for the area of the repository site on the east side of Yucca Mountain, there have been flood studies performed on several washes in that area, as described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Figure 3-12 and pp. 3-38 and 3-39). If the Caliente rail alignment is overlain on the figure of the floodplains in the Yucca Mountain FEIS (see Figure F-15 in Appendix F of this Rail Alignment EIS), it can be seen that common segment 6 would cross short stretches of 100-year floodplains associated with Busted Butte Wash and Drill Hole Wash before it terminated just prior to crossing a floodplain associated with Midway Valley Wash (also known as Sever Wash). Table 4-57 lists the estimated crossing distances for Beatty Wash, Busted Butte Wash, and Drill Hole Wash. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

No springs have been identified along common segment 6.

Construction camp 12, as described in Section 3.2.5.3.12, would be within the common segment 6 construction right-of-way and would overlie one small ephemeral wash. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.3 Impacts from Constructing Facilities

4.2.5.2.3.1 Interchange Yard.

Caliente Alternative Segment Interchange Yard The Interchange Yard on the Caliente alternative segment would be in the City of Caliente, directly across from the former Union Pacific Railroad Caliente Station within the area of the former Union Pacific Railroad yards. Table 4-55 lists drainage crossing information for the Caliente Interchange Yard. Section 4.2.5.2.1.1 addresses impacts to drainages common to the entire Caliente rail alignment.

There would be no waters of the United States or wetlands within the footprint of the Interchange Yard at Caliente.

Federal Emergency Management Agency floodplain maps for this area show that a 240-meter (790-foot) section of the Interchange Yard would sit in a 100-year floodplain and the rest would be within a 500-year floodplain. Floodwaters from Meadow Valley Wash flow through the center of Caliente to the south where they merge with the runoff from three dry washes that flow to the southwest. In the area where the Interchange Yard would intersect the 100-year floodplain, DOE calculated that the floodwater depth would be 0.90 meter (3 feet) during the 100-year storm event (DIRS 176806-FEMA 1985, all). Because the interchange tracks would be in an area already occupied by an existing Union Pacific siding, the yard would not be likely to obstruct the flow of floodwaters to the point that floodwater depths would increase. Section 4.2.5.2.1.6 addresses impacts to floodplains and floodwaters common to the entire Caliente rail alignment.

There would be no springs within the footprint of the Interchange Yard.

Eccles Alternative Segment Interchange Yard The Interchange Yard on the Eccles alternative segment would be immediately adjacent to the Union Pacific Railroad Mainline within the confines of Clover Creek approximately 8 kilometers (5 miles) east of Caliente. Clover Creek is an ***ephemeral creek*** classified as a water of the United States and drains an area of about 970 square kilometers (240,000 acres) east of the site. Drainage through the site is from east to west, toward Meadow Valley Wash and Caliente. Table 4-55 lists drainage crossing information for the Eccles Interchange Yard. Construction of the Interchange Yard at Eccles would require portions of Clover Creek to be filled to elevate the site out of the floodplain. For a length of approximately 1,400 meters (4,600 feet) along the ephemeral creek bed, for the construction of the interchange tracks, the fill would extend approximately 7.6 to 15 meters (25 to 50 feet) into the ephemeral creek bed. For a length of approximately 900 meters (2,900 feet) on the east end and 600 meters (2,000 feet) on the west end of the interchange tracks, for the construction of the interchange siding, the fill would extend approximately 8 meters (25 feet) into the creek. The total area to be filled within the confines of Clover Creek would be approximately 0.033 square kilometer (8.2 acres). Common impacts to drainages are addressed in Section 4.2.5.2.1.1; however, filling a long section of a stream bank has the potential to create greater adverse impacts than simply crossing a stream, because the structure of the stream itself would be modified to a much greater extent than for a bridge crossing or culvert that would have less presence within the steam channel. It is likely that Clover Creek would be disturbed along the entire length of the Interchange Yard, which could result in a permanent alteration of the localized hydraulic conditions. Such alterations to the hydraulic conditions of the stream bed would have the potential to increase flow velocity and result in a higher potential for erosion during flood events.

Field surveys identified three small wetland areas (see Appendix F) associated with Clover Creek within 300 meters (980 feet) of the existing railroad embankment. DOE would not expect direct impacts to these wetlands during the construction phase because they would be outside the construction right-of-way for the Eccles Interchange Yard and would be fenced or flagged. Indirect impacts such as sedimentation, erosion, and incidental spills would still be possible; however, DOE would expect those impacts to be small because of the best management practices the Department would use to prevent construction-related impacts. DOE would use appropriate protection measures (such as lining the fill with riprap) along the entire length of the Interchange Yard to stabilize and protect the structure from floodwaters. Section 4.2.5.2.1.6 addresses impacts to floodplains and floodwaters common to the entire Caliente rail alignment.

No springs have been identified that would be within the boundary of the Eccles Interchange Yard.

4.2.5.2.3.2 Staging Yard.

Caliente Staging Yard There are two options for siting the Staging Yard along the Caliente alternative segment. One would be approximately 1.6 kilometers (1 mile) northeast of Caliente (the Indian Cove option); the other would be 6.4 kilometers (4 miles) northeast of Caliente (the Upland option). At Indian Cove, the Staging Yard would be constructed in a meadow that is a floodplain of Meadow Valley Wash on the east side of U.S. Highway 93, roughly midway between the City of Caliente and Indian Cove.

Construction of the Staging Yard at Indian Cove would require the wetland meadow area to be drained and built up above the level of the floodplain. It might also require an active drainage system and a channel around the site to keep the area dry and in a stable condition. Meadow Valley Wash drainage through the site is from north to south toward the City of Caliente. Drainage of the site would be accomplished by constructing a channel along the eastern edge of the facility. The channel around the site would be approximately 1,680 meters (5,500 feet) long. The Department would determine final channel dimensions during final design of the Staging Yard. It is very likely that a system of drains would have to be constructed under the Staging Yard tracks. Fill could be needed to elevate portions of the site out of the floodplain. These actions would require permits from the U.S. Army Corps of Engineers, and compliance with Section 404 of the Clean Water Act for stormwater runoff control measures.

The Staging Yard at Indian Cove would require filling an area of wetlands and the associated plant and animal habitat (see Section 4.2.7 for a discussion of impacts to biological resources). DOE was unable to delineate wetlands in this area because it is private property; however, much of this meadow is believed to be wetlands. Assuming that the entire meadow is wetlands, the Staging Yard at Indian Cove would require up to 0.19 square kilometer (47 acres) of wetlands to be filled. The filling of up to 0.19 square kilometer of wetlands in Indian Cove for the Staging Yard would have a large impact on the functions of the wet meadow, such as its ability to support wildlife, retain flood flows, and filter water.

The Staging Yard at Upland, also in Meadow Valley, approximately 5 kilometers (3 miles) north of Indian Cove would cross one water of the United States within the Staging Yard area; however, DOE would build a bridge in that location, and no use of fill is anticipated. There are no wetlands in the area of the Staging Yard location at Upland; therefore there would be no impacts (see Section 4.2.5.2.1.1).

Eccles Staging Yard A Staging Yard on the Eccles alternative segment (Eccles-North) would be approximately 13 kilometers (8 miles) north of Eccles about 910 meters (3,000 feet) east of U.S. Highway 93. There are no wetlands or floodplains in this area; however, the southern portion of the Staging Yard would cross one unnamed wash, identified as a water of the United States (DIRS 180914-PBS&J 2006, Figure 3A). This is the only wash that would be within the fenceline of the Eccles-North Staging Yard.

4.2.5.2.3.3 Maintenance-of-Way Facilities. The Maintenance-of-Way Trackside Facility would be on the north side of Caliente common segment 3 approximately 18 kilometers (11 miles) east of its junction with the Goldfield alternative segments. There is one notable drainage in the proposed location for the facility.

DOE could construct the Maintenance-of-Way Headquarters Facility in the Tonopah area. Depending on the location the Department selected, ephemeral washes could be encountered in this area. Impacts on drainage patterns or changing erosion and sedimentation rates or locations associated with construction of the rail line would be small. DOE would minimize any potential impacts from the storage of hazardous materials at the Maintenance-of-Way Headquarters Facility through the implementation of a Spill Prevention, Control, and Countermeasures Plan and best management practices related to the storage, use, and proper disposal of such products. Based on these conditions, impacts to surface-water quality from accidental spills of hazardous substances during rail line construction would be small.

4.2.5.2.3.4 Rail Equipment Maintenance Yard. Because there are no perennial surface waters in the area where the rail line would end at Yucca Mountain, potential impacts to surface-water features from the construction of rail line facilities in that area would be small (similar to the common impacts already described in Section 4.2.5.2.1.1). The Rail Equipment Maintenance Yard would overlie one ephemeral wash, but would not cross any waters of the United States. The Yard construction area would also include the train crew quarters, and could be the location for the Nevada Railroad Control Center and National Transportation Operations Center, and the Cask Maintenance Facility. Construction of the operations support facilities would include stormwater runoff control, as necessary, which would minimize the potential for contaminated runoff to reach any of the washes in the area; therefore, impacts related to construction of the Rail Equipment Maintenance Yard would be small.

4.2.5.2.4 Quarries

Each quarry facility would be comprised of three primary components: an operations plant, the quarry and production area, and possibly a railroad siding. The operations plant would include an office and administration complex, parking areas, services for fueling and maintenance, and sanitary facilities. Portable sanitary systems would be provided onsite; no water supply or ***wastewater treatment*** facilities would be provided at the quarry sites. The quarries would be close enough to construction camps that on-site residential facilities would not be necessary.

Ballast quarry operations would require the use of water, primarily to wash excavated rock during crushing and screening operations. Water usage quantities would vary depending on the specific quarry process selected to wash the rock during these operations. It is estimated that approximately 140,000 liters (38,000 gallons) of water would be needed per operational day at each quarry site (DIRS 180922-Nevada Rail Partners 2007, p. 3-2). Water used during these activities would also be used for dust suppression in quarry operational areas. The wash water would be contained and recirculated through settling ponds. Relatively small quantities of water would also be used for dust suppression during drilling and blasting, truck loading and unloading, ballast stockpile and waste rock pile operations, and along access roads and in the quarry pit to suppress dust from truck and heavy equipment operations. Water used for dust suppression in these areas would not be expected to result in runoff from the quarry operational areas.

Overburden and waste rock removed from quarry areas would be stockpiled and later used for reclamation of the quarry sites. These piles would be stabilized or, if necessary, covered (for example, with mulch, netting, or synthetic stabilizer) to reduce the potential for erosion and runoff of sediments from these areas. Other best management practices that would be implemented include filter berms, straw-bail barriers, silt fences, or revegetation, as necessary. The change in the amount of runoff that would actually reach drainage channels would be minor, because construction would affect a small amount of the overall natural drainage areas.

Three separate programs established by the Clean Water Act are significant when reviewing activities associated with potential quarries. These include the establishment of water quality standards pursuant to Section 303(c) of the Clean Water Act, National Pollutant Discharge Elimination System permit requirements set forth in Section 402 of the Clean Water Act, and dredge and fill permit requirements set forth in Section 404 of the Clean Water Act. General National Pollutant Discharge Elimination System permits would require that best management practices (including inventorying, assessment, prioritization, and identification and implementation of best management practices) be employed to meet water quality standards. It is expected that any discharges associated with quarry operations would be managed with appropriate stormwater control systems that would effectively minimize off-site impacts from stormwater drainage. Thus, impacts to surface-water features associated with quarry operations would be small.

Worth particular mention is potential quarry CA-8B, which would be along the Caliente alternative segment. Although the quarry itself would not intersect any waters of the United States or wetlands, the quarry siding would be within a wetland area (non-delineated). Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the quarry siding.

4.2.5.3 Railroad Operations Impacts

Potential impacts during the operations phase are addressed in relation to the impact assessment standards for surface-water resources identified in Table 4-54, including stormwater drainage and surface-water quality. Section 4.2.5.2.1 addresses surface-water availability, and floodplains and wetlands.

4.2.5.3.1 Operations Impacts Common to the Entire Rail Alignment

Operation of the proposed railroad would result in a small impact to surface waters beyond the permanent drainage alterations from construction. The rail roadbed would be expected to have runoff rates different from those of the natural terrain but, given the small size of the potentially affected areas within the overall drainage system, the impact on overall runoff quantities would be small. Thus, impacts related to stormwater increases would be limited to those localized areas where drainage patterns would be altered to convey storm flows.

Rail line maintenance would require periodic inspections of flood-prone areas (particularly after flood events) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the rail roadbed would be repaired. If the eroded areas had to be repaired often, that would be an indication that flow patterns had been changed and sediment was being moved as the water was cutting out a new channel. Regular inspection and maintenance of the rail line would help ensure that erosion and sedimentation problems were identified and addressed in a timely manner so that they did not contribute to upstream or downstream impacts. Therefore, impacts during the operations phase from sediment buildup and floodwater activity would be small.

The primary sources of potential surface-water contamination during the operations phase would be fuels (diesel and gasoline) and lubricants (oils and greases) required for equipment operation and maintenance. DOE would minimize the potential for contamination by managing spills and implementing best management practices.

4.2.5.3.2 Facility Operations

The primary sources of potential surface-water contamination during operation of facilities would be fuels (diesel and gasoline) and lubricants (oils and greases) required for equipment operation and maintenance. DOE would minimize the potential for contamination by managing spills and leaks implementing best management practices. Activities at the facilities (including quarries) would adhere to a Spill Prevention, Control, and Countermeasures Plan to comply with environmental regulations and would also include a number of best management practices. The plan would describe the actions the Department would take to prevent, control, and remediate spills of fuel or lubricants. It would also describe the reporting requirements that would accompany the identification of a spill (DIRS 155970-DOE 2002, p. 4-23). Therefore, impacts to surface waters from facilities operations would be small.

Sanitary sewage generated at facilities would be contained and removed, sent to treatment facilities, or in some cases, disposed of through on-site septic systems. No industrial wastewater discharges would be expected from the operation of facilities. All wastewater collection and transfer systems would be designed and operated such that untreated wastewater would not be released to the environment; therefore, impacts to surface-water resources from facilities operations would be small.

4.2.5.3.3 Quarry Operations

Quarries would be reclaimed following the construction phase, and would not be used during the operations phase. Therefore, there would be no impacts from quarry operations.

4.2.5.4 Shared-Use Option

Construction impacts to surface-water resources under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. The Shared-Use Option would involve the construction of additional sidings, which would be approximately 300 meters (980 feet) long and would be aligned parallel to the rail line within the construction right-of-way. Construction of these additional sidings would involve the same types of land disturbance as for the Proposed Action without shared use, but with minor additive impacts. As for the Proposed Action without shared use, potential impacts would be the release and spread of contaminants by precipitation or intermittent runoff events or, for portions of the rail line near surface-water bodies, possible release to the surface water; the alteration of natural drainage patterns or runoff rates that could affect downgradient resources; and the need for dredging or filling of perennial or ephemeral streams. However, the adverse impacts to surface-water resources from constructing additional sidings under the Shared-Use Option would add little to potential impacts described for the Proposed Action without shared use, because the same control measures would be in effect. Because construction of these additional sidings would not be a DOE action and there are uncertainties regarding the exact locations of needed commercial-use facilities, specific impacts of the Shared-Use Option to surface-water features were not analyzed.

Operations impacts under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. Use of a completed rail line from Caliente to Yucca Mountain, including additional sidings, would result in small impacts to surface waters beyond the permanent drainage alterations that would result from construction. The rail roadbed would likely have runoff rates different from those of the natural terrain but, given the small size of the potentially affected areas in a single drainage system, the impact from shared-use operations on overall runoff quantities would be small.

Maintenance of the rail line and shared-use sidings would require periodic inspections of flood-prone areas (particularly after floods) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the rail roadbed would be repaired. Therefore, impacts from rail line maintenance related to sedimentation and erosion under the Shared-Use Option would be small.

General freight shipped on the proposed rail line could include mineral products, petroleum, agricultural products, or other commodities shipped or received by private companies. Spills of oil or hazardous substances carried on the rail line as general freight could affect surface-water resources. If a spill occurred, the potential for contamination to enter flowing surface water would present the greatest risk of a large contaminant migration until spills were contained and remediated. If there was no routinely flowing surface water, as is the condition for most areas along the Caliente rail alignment, it is expected that released materials would not travel far or affect critical resources before corrective action could be taken. Compliance with regulatory requirements on reporting and remediating spills would result in a small probability of spills and, with specific regard to rail line operations, the overall risk of a transportation ***accident*** that could result in a release of a hazardous substance is considered to be small, as discussed in Section 4.2.10, Occupational and Public Health and Safety. Therefore, impacts to surface-water resources from potential accidental releases of contaminants from commercial rail shipments during operations under the Shared-Use Option would be small.

4.2.5.5 Summary

4.2.5.5.1 Impacts Common to the Entire Caliente Rail Alignment

Construction and operation of a railroad along the Caliente rail alignment could result in both direct and indirect impacts to surface-water resources (see Table 4-58). Direct impacts would include temporary or permanent grading, dredging, rerouting, or filling of surface-water resources. Indirect impacts would potentially increase or impede surface flow. Also, nonpoint source pollution could result from runoff from areas where surface grades and characteristics were changed (such as the rail roadbed and access roads). Overall, impacts to surface-water resources from railroad construction and operations would be small.

To evaluate potential impacts to surface-water resources, DOE identified areas where there are surface-water resources along the rail alignment (including those that would be crossed, filled, or covered) and identified the activities associated with construction or operations that would have the potential to affect these surface-water resources. Because of their importance in influencing the types and magnitude of potential impacts, Table 4-55 summarizes the numbers of surface-water features the Caliente rail alignment would encounter. The table includes estimates of the total number of surface-water features the rail line, facilities, and quarries would cross. Such features include drainage channels, floodplains, and wetlands. The table also identifies two subsets of the total number of drainage channel crossings. The first is the notable channels described in Section 3.2.5.2.1, and the second includes drainage channels that would be classified as waters of the United States.

In all instances where the alignment would cross or come close to a surface-water feature, that feature could be affected to some degree by railroad construction and operation; however, impacts would be substantially minimized through the engineering design process and the implementation of best management practices prior to, during, and after construction. DOE would incorporate hydraulic modeling into the engineering design process to ensure that crossings were properly engineered so they would not contribute to erosion and sediment pollution. The design of drainage structures would account for scour and erosion and incorporate outlet protection and velocity-dissipating devices that would calm the flow and diminish its erosive potential. Because conveyance systems would be designed to safely convey increased flow during storm events (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts on stormwater drainage conveyance from construction of the rail line would be small. DOE would minimize impacts to surface-water resources through the implementation of engineering design standards (as described above) and best management practices (see Chapter 7). Best management practices would include erosion control measures, such as the use of silt fences and flow-control devices to reduce flow velocities and minimize erosion. Further, the Department would minimize filling of surface-water resources by incorporating avoidance into final engineering and design of the rail line, to the extent practicable. DOE would use a minimum-width rail line footprint whenever possible.

Table 4-58. Summary of impacts to surface-water resources – Caliente rail alignment (page 1 of 2).

Rail line segment/facility (county)	Proposed Action[a]	
	Construction impacts[b,c]	Operations impacts
All alternative segments and common segments (Lincoln, Esmeralda, and Nye Counties)	Potential for increases in nonpoint source pollution, alteration of natural drainage patterns and runoff rates, temporary blockage of surface drainage channels, localized changes in drainage patterns, and increases in the flow rate in relation to natural flow conditions. Potential for release and spread of contaminants through an accidental spill or discharge. Potential impact from erosion and sediment loading and reduction of floodwater area flow.	Potential for fuel spills or release of contaminants. Drainage crossings (culverts and bridges) might cause floodwaters to back up.
Staging Yard and Maintenance-of-Way Facilities (Lincoln, Nye, and Esmeralda Counties)	Potential impact from erosion and sediment loading.	Potential for fuel spills or release of contaminants.
Potential quarries (Nye and Esmeralda Counties)	Potential impact from erosion and sediment loading.	Potential impact from erosion and sediment loading.
Rail Equipment Maintenance Yard; Cask Maintenance Facility; Nevada Railroad Control Center and National Transportation Operations Center (Nye County)	Potential impact from erosion and sediment loading.	Potential for fuel spills during fueling; fuel transfer; or storage tank failure. Drainage crossings (culverts and bridges) might cause floodwaters to back up.
Caliente alternative segment (Lincoln County)	0.05 square kilometer (12 acres) of wetlands would be filled to construct the rail line. Temporary elimination of access to Caliente Hot Springs.	Permanent loss of wetlands. Long-term reduced and potentially eliminated access to Caliente Hot Springs.
Eccles alternative segment (Lincoln County)	Wetland fill would be very small; crossing would be bridged.	No additional surface-water impacts would be anticipated.
Goldfield alternative segment 3 (Nye County)	Reduced temporary access to several springs; temporary or long-term eliminated access to Willow Springs.	Long-term reduced and potentially eliminated access to Willow Springs.
Staging Yard – Indian Cove (Lincoln County)	0.19 square kilometer (47 acres) of wetlands would be filled.	Permanent loss of wetlands.
Interchange Yard at Eccles (Lincoln County)	0.033 square kilometer (8.2 acres) of Clover Creek would be filled.[e]	Permanent loss and rerouting after filling of Clover Creek.
Potential quarry CA-8B (Lincoln County)	0.09 square kilometer (22 acres) of wetlands would be filled to construct the quarry siding.	Permanent loss of wetlands.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. Wetland filling estimates are based on the assumption that the construction right-of-way would be 21 meters (70 feet) wide.
c. Floodplain crossing distance is given as a range. The minimum crossing distance is represented by the length of the rail line crossing Federal Emergency Management Agency mapped floodplains. The maximum value represents the minimum value in addition to the estimated crossing distance over floodplains that have not been mapped.

DOE would avoid surface-water resources by increasing the slope of the rail roadbed or bridging across wetlands and not constructing access roads in wetlands. In areas where the Department could not completely avoid wetlands (such as the areas along the Caliente alternative segment), DOE would reduce the rail line footprint to a minimum of 21 meters (70 feet). Also, the final position of the rail line could be shifted to avoid filling wetlands and other surface-water resources whenever practicable. By incorporating avoidance of these resources into final rail line engineering and design, adverse impacts to wetlands (and the functions of wetlands) and other surface-water resources from rail line construction would be small.

4.2.5.5.2 Alternative Segment-Specific Impacts

The Caliente alternative segment is adjacent to wetlands and some wetland fill would be unavoidable. DOE proposes to construct the Caliente alternative segment over the abandoned Union Pacific rail roadbed in part to minimize filling wetlands. Of the 0.28 square kilometer (68 acres) of wetlands delineated along the alignment, only 0.05 square kilometer (12 acres) would be filled to construct the rail line. DOE could modify the final design of the rail line to avoid additional wetlands, such as those adjacent to the old rail roadbed along Meadow Valley Wash, by using a slightly narrower construction footprint; however, this would only slightly reduce the area of wetlands that would be filled.

Another area where a potentially large quantity of fill could be needed is potential quarry CA-8B, which would be along the Caliente alternative segment. Although the quarry itself would not intersect any waters of the United States or wetlands, the quarry siding would be within a non-delineated wetland area. Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the siding.

Construction of the Staging Yard at Indian Cove would require filling an area of wetlands. The wetland meadow area would be drained and built up above the level of the floodplain. Constructing an active drainage system and a channel around the site to keep the area dry and in a stable condition might also be necessary. The proposed channel around the site would be approximately 1,680 meters (5,500 feet) long.

These actions would require permits from the U.S. Army Corps of Engineers, and compliance with Section 404 of the Clean Water Act for stormwater runoff control measures. Approximately 0.19 square kilometer (47 acres) of wetlands would be filled to construct the Staging Yard at Indian Cove.

The Eccles alternative segment Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of the floodplain. For a length of approximately 1,400 meters (4,600 feet) along the bed of this ephemeral creek, for the construction of the interchange tracks, the fill would extend approximately 7.6 to 15 meters (25 to 50 feet) into the creek bed. For a length of approximately 900 meters (2,900 feet) on the east end and 600 meters (2,000 feet) on the west end of the interchange tracks, for the construction of the interchange siding, the fill would extend approximately 8 meters (25 feet) into the creek. The total area that would be filled within the confines of Clover Creek would be approximately 0.033 square kilometer (8.2 acres).

Construction of Goldfield alternative segment 3 would adversely affect Willow Spring. The spring is within 96 meters [315 feet] of the alternative segment, which would be inside the construction right-of-way, but outside the cut and fill area. Willow Spring would be fenced or flagged during the construction phase; however, there could be long-term adverse impacts to public access to this spring due to its proximity to the rail line.

4.2.6 GROUNDWATER RESOURCES

This section describes potential impacts to groundwater resources from constructing and operating the proposed railroad along the Caliente rail alignment. To analyze potential impacts, DOE considered whether constructing and operating the railroad would result in:

- Possible damage to existing wells as a result of construction work
- Possible declines in groundwater levels or groundwater production rates at existing groundwater production wells
- Possible changes in discharge rates at existing springs
- Possible changes in infiltration rates in disturbed areas
- Possible changes in groundwater quality at wells, springs, or in shallow groundwater
- Potential subsidence of the ground surface

Section 4.2.6.1 and Appendix G describe the methods DOE used to assess potential impacts to existing groundwater resources; Section 4.2.6.2 describes potential construction; Section 4.2.6.3 describes potential impacts of railroad operations; Section 4.2.6.4 describes potential impacts under the Shared-Use Option; and Section 4.2.6.5 summarizes potential impacts to groundwater resources.

Section 3.2.6.1 describes the region of influence for groundwater resources. The section includes a discussion of existing wells and springs that fall within the Caliente rail alignment region of influence that could be affected by new groundwater wells that would furnish water to support construction and operation of the proposed rail line.

4.2.6.1 Impact Assessment Methodology

DOE considered a variety of methods for obtaining water that would be needed to support construction and operation of the proposed rail line and railroad construction and operations support facilities. These methods include, but are not limited to, construction of new water wells; purchasing water from municipalities or other existing water-rights holders; or importing water from other groundwater ***hydrographic areas***. A combination of such methods could reduce potential impacts to groundwater resources. However, the acquisition of all required water from new wells would place the greatest amount of increased water demand on existing groundwater resources. Therefore, to develop a conservative analysis or upper bound estimate of potential impacts to groundwater resources, DOE assumed that it would obtain all water required for construction and operation of the rail line and railroad construction and operations support facilities from newly constructed wells. This Rail Alignment EIS does not analyze the impacts of obtaining water through other methods.

In this Rail Alignment EIS, DOE evaluates the potential impacts associated with the following types and categories of new water wells that would be installed and utilized to obtain water required for construction and operation of the proposed rail line and associated facilities:

- Construction water wells – These temporary wells (DIRS 176189-Converse Consultants 2006, Section 2.1 and Table 2-2) would furnish approximately 90 percent of the total project water demand. Wells in this category include wells that would provide water for earthwork compaction during rail roadbed construction and wells that would supply water for temporary construction camps. Nearly all water obtained from wells to support rail roadbed construction within each hydrographic area would be pumped within a 1-year period within that area. The average groundwater withdrawal (usage) rate for these wells would vary according to location. Water wells at construction camps would have average withdrawal rates of 76 liters (20 gallons) per minute.

- Quarry water wells – These wells would supply water to support start-up and operation of quarry operations, with each quarry being in operation over an estimated period of about 2 years, following an initial startup period. The average withdrawal rate for these wells would be approximately 91 liters (24 gallons) per minute.

- "Permanent" water wells – These wells would supply water to meet water requirements for rail sidings and railroad operations facilities and provide water for fire protection purposes. Average withdrawal rates for these wells would be very low (less than 3.8 liters [1 gallon] to approximately 16 liters (4.2 gallons) per minute). DOE would use these new wells during the 50 years of railroad operations.

DOE would install most of the new water wells adjacent to new access roads that would be constructed on either side of the rail roadbed and within the rail line construction right-of-way. DOE assumes that if it could not obtain adequate volumes of water from any of these new wells because of limited ***aquifer*** productivity (less then the required productivity for that location based on the water demand at the associated construction location) it would obtain the additional water required from other new wells proposed for installation either within the typical maximum 300-meter (1,000-foot)-wide construction right-of-way or from one or more of the proposed new wells situated outside of that right-of-way. In these cases, the water would either be transported by truck or pumped through a temporary above-ground pipeline. Wells installed outside the construction right-of-way would be installed as near as reasonably possible to the right-of-way, based on ***hydrogeologic*** criteria, except for wells installed at the proposed quarry sites, which might or might not be at more remote locations.

DOE considered a number of factors to evaluate potential adverse impacts to groundwater resources. There could be an adverse impact if construction and operation of the rail line and railroad construction and operations support facilities would cause any of the conditions listed in Table 4-59.

Table 4-59. Impact assessment considerations for groundwater resources.

Resource criteria	Basis for assessing adverse impact
Groundwater availability and uses	• Adversely affect an existing aquifer. Adverse effects would include substantial depletion of groundwater supplies on a scale that would affect available capacity of a groundwater source for use by existing water-rights holders within the hydrographic area where groundwater withdrawal would occur or in any downgradient hydrographic area, interfere with groundwater recharge, or reduce discharge rates to existing springs or seeps. • Conflict with established water rights, allotments, or regulations protecting groundwater resources.
Ground subsidence	• Cause subsidence of the ground surface (as a result of groundwater withdrawals).
Groundwater quality	• Contaminate a public water supply aquifer and exceed federal, state, or local water-quality criteria.

To evaluate potential impacts to groundwater resources DOE considered:

- Potential changes to infiltration rates, with consequent changes to percolation rates of surface water to the groundwater system, that could be caused by the same disturbances evaluated in the surface-water impact analysis (also see Section 4.2.5, Surface-Water Resources).

- Potential changes to groundwater quality due to groundwater withdrawals or from accidental spills or releases

- Potential impacts to aquifer users and uses resulting from withdrawal of groundwater from new wells to support water needs for construction and operation of the rail line and railroad construction and operations support facilities. DOE focused the impact analysis on aquifers and the existing groundwater users who withdraw water from the groundwater hydrographic areas that would serve as sources of water for construction and operation of the rail line. DOE compared the amount of water that would be required for construction and operation of the railroad to the availability and existing uses of groundwater in those groundwater hydrographic areas. Existing groundwater resources addressed in these evaluations include existing wells, springs, and groundwater seeps. DOE considered potential impacts resulting from the following actions: (1) pumping from new wells to obtain water needed for rail roadbed construction (including water needed for earthwork, dust control, and construction camps) and (2) pumping from new wells installed to support quarry operations, rail sidings, and other railroad facilities.
- Potential for damage to existing wells from construction activities or potential ground subsidence as a result of the proposed groundwater withdrawals

4.2.6.2 Construction Impacts

4.2.6.2.1 Construction Impacts Common to the Entire Rail Alignment

Impacts to groundwater or the land surface during the construction phase could include: (1) potential changes in infiltration rates in disturbed areas, with consequent changes in percolation rates of surface water to groundwater (addressed in Section 4.2.5, Surface-Water Resources); (2) reduced flow to springs or a reduction in available flow rates to one or more existing wells within the ***radius of influence*** of, or the radius of the ***cone of depression*** surrounding, proposed new wells; (3) possible damage to, or loss of, use of existing wells within the construction right-of-way; (4) degradation of groundwater quality resulting from groundwater withdrawals; or (5) potential ground subsidence.

As described in Section 4.2.5, construction of the rail line and construction and operations support facilities would result in land-surface disturbance such as grading, excavation, or stockpiling that would alter the rate at which water could infiltrate the disturbed areas. Construction activities would disturb and temporarily loosen the ground, which could produce temporarily higher near-surface infiltration rates (see Section 4.2.5). This situation would typically be short lived; the rail roadbed materials and disturbed areas associated with railroad facilities and ballast areas would become compacted and less porous, with most of the land disturbance during railroad and facilities construction likely resulting in surfaces with lower infiltration rates causing an increase in runoff. Even in the short term, localized changes in infiltration would likely cause no large-scale change in the amount of groundwater percolation ***recharge*** because the disturbed areas would be a very small percentage of the overall surface area of a hydrographic area (see Section 4.3.5). Therefore, changes to infiltration rates in the region where construction would take place would be small, and adverse impacts associated with changes in storm-water infiltration rates would be small.

Most recharge to aquifers in the region is derived from precipitation falling in the higher parts of the inter-basin mountain ranges (see, for example, DIRS 103136-Prudic, Harrill, and Burbey 1993, pp. 2, 58, 84, and 88). The climate in the region through which DOE would construct the Caliente rail alignment is generally arid. These factors combine to produce a deficit of shallow groundwater beneath many parts of the rail alignment, such as several valley floors it would cross. Estimated depths to groundwater beneath most of the hydrographic areas the rail line would cross range from approximately 30 to 100 meters (100 to 330 feet) or more below ground, with the shallowest groundwater at 3 to 15 meters (10 to 50 feet) below ground in the Meadow Valley Wash and Oasis Valley areas (DIRS 176600-Converse Consultants 2005, Plates 4-1 through 4-15; DIRS 176189-Converse Consultants 2006, Appendix B). Available hydrogeologic information suggests that shallow groundwater would occur infrequently, and on a localized basis, beneath the Caliente rail alignment.

Other potential impacts include degradation of groundwater quality due to new sources of ***contamination*** that could come into direct contact with, or migrate to, groundwater. Construction-related materials that would be used in this arid environment, that could contaminate groundwater if spilled, include petroleum products (such as fuels and lubricants) and coolants (such as antifreeze) necessary to operate construction equipment. The infrequent occurrence of shallow groundwater beneath the Caliente rail alignment (see Section 3.2.6) indicates that the probability of ***contaminants*** reaching underlying groundwater would be low; therefore, DOE would not expect impacts to groundwater quality resulting from spills of hazardous or nonhazardous materials.

As discussed in Section 4.2.11, Utilities, Energy, and Materials, sanitary wastes from the construction camps would be disposed of in accordance with all applicable regulatory requirements. By complying with regulatory requirements, DOE expects that wastewater-related impacts to groundwater resources in these areas would be minimized.

Railroad construction activities might occur near one or more existing wells. However, based on the available data, DOE does not anticipate that construction activities would disturb any existing wells. In the unlikely event that wells are identified prior to rail roadbed construction that could be disturbed by construction activities, DOE would take steps to minimize impacts to those wells, such as advising well owners of planned activities and discussing with the owners measures needed to protect the well head (the portion of the well above the ground surface) during construction.

An estimated total of approximately 7.5 million cubic meters (6,100 ***acre-feet***) of water could be required to construct the rail line and railroad construction and operations support facilities (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.1). This estimate updates the estimate of 880,000 cubic meters (710 acre-feet) given in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Figure 6-4). DOE would use water for earthwork compaction, control of excavation dust, workforce needs, and ballast production (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.2). As discussed in Chapter 2, Proposed Action and Alternatives, DOE is considering a 4- to 10-year railroad construction schedule.

The typical groundwater pumping scenario for rail roadbed construction wells assumes a 9-month effective pumping period with 3 months of lost production for each construction well because of adverse weather conditions or other factors such as equipment repairs. This provides for a conservative or upper bound estimate of groundwater withdrawal rates that would result in the largest potential impacts (greatest amounts of drawdown) to groundwater resources and existing groundwater users potentially situated within the region of influence of the proposed water wells. If the construction schedule were lengthened (for example, up to 10 years), the same amount or less water would be required to support construction activities in any given year, thereby resulting in the same or reduced groundwater withdrawal rates and the same or reduced impacts to groundwater resources and existing groundwater users. Section 4.2.6.2.2 further describes the approach and methods DOE used to quantitatively evaluate potential site-specific impacts to groundwater resources.

Table 4-60 lists the proposed Caliente rail alignment alternative segments and common segments and summarizes the estimated total construction-related water requirements (demands) within each hydrographic area. The table lists a range of water demand values for hydrographic areas associated with more than one alternative segment or common segment (Coal Valley, Garden Valley, Alkali Spring Valley, Stonewall Flat, and Lida Valley areas). Figure 4-13 depicts the Caliente rail alignment, hydrographic areas the rail line would cross, and the range of estimated total water demands associated with construction within each hydrographic area.

As described in Section 3.2.6, Table 3-35 identifies hydrographic areas considered to be ***designated groundwater basins***, and lists information about total annual committed resources and ***pending annual duty*** amounts in the listed hydrographic areas. Six of the 19 hydrographic areas are designated groundwater hydrographic areas. Comparison of the estimated water demands within each hydrographic area the Caliente rail alignment would cross with information presented in Table 3-35 indicates that water demands in some hydrographic areas could, depending on the alternative segment selected (areas 144 and 145), or would (area 229), exceed the estimated ***perennial yield*** value for that hydrographic area. It should be noted that, for all hydrographic areas crossed, approximately 90 percent of the groundwater withdrawals would be temporary withdrawals, occurring within 1 year or less, rather than long-term withdrawals. For evaluating potential impacts from the proposed groundwater withdrawals, it is also noteworthy that although available groundwater resources in some hydrographic areas might be deemed to be currently "overcommitted" as a whole (hydrographic areas 203, 204,170, 173A, 149, 146, 228, and 229), one or more particular aquifers within a hydrographic area might not be overcommitted. Additionally, all water-rights appropriations might not be in service simultaneously.

Tables 3-35 and 4-60 suggest that the selection of one alternative segment over another would make no notable difference in the amount of water needed to support construction when compared to the annual committed resources and pending annual duty amounts for each hydrographic area, with the following exceptions:

- Goldfield alternative segment 3 would not cross and, therefore, would not require any groundwater withdrawals, within hydrographic area 142 (Alkali Spring Valley). Construction of either Goldfield alternative segment 1 or 4 through hydrographic area 142 would result in groundwater demands representing approximately 5 percent or 19 percent, respectively, of the estimated annual perennial yield and approximately 5 percent or 21 percent, respectively, of the total annual committed resources of the hydrographic area.
- Construction of Goldfield alternative segment 3 within hydrographic area 145 (Stonewall Flat) would result in a groundwater demand representing approximately 460 percent of the estimated annual perennial yield and approximately 38 times the total committed resources of the hydrographic area. Construction of either Goldfield alternative segment 1 or 4 through hydrographic area 145 would result in groundwater demands representing approximately 290 percent or 40 percent, respectively, of the estimated annual perennial yield and approximately 24 times or 36 times, respectively, of the total committed resources of the hydrographic area.

Construction of Goldfield alternative segment 4, Caliente Common Segment 4, and Bonnie Claire alternative segment 4 within hydrographic area 144 (Lida Valley), would result in the highest groundwater demand, approximately 108 percent of the estimated annual perennial yield and approximately 525 percent of the total annual committed resources of the hydrographic area. Construction of Goldfield alternative segment 1, Caliente common segment 4, and Bonnie Claire alternative segment 3 would result in the lowest groundwater demand, approximately 44 percent of the estimated annual perennial yield and approximately 216 percent of the total annual committed resources of the hydrographic area. Construction of Caliente common segment 4 and other combinations of alternative segments within hydrographic area 144 would result in total water demands between the high and low demands associated with the two combinations described above.

Construction of Oasis Valley alternative segment 1 and common segments 5 and 6 within hydrographic area 128 (Oasis Valley) would result in a groundwater demand equaling approximately 41 percent of the estimated annual perennial yield and approximately 31 percent of the total annual committed resources of the hydrographic area.

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 1 of 4)

Hydrographic area[a] number and name	Perennial yield for hydrographic area[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[c,d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of water demand values within hydrographic area (acre-feet)[f]
204 - Clover Valley	1000	3,787/0	Caliente alternative segment	16
			Eccles alternative segment	80
203 – Panca Valley*	9,000	31,367/0	Caliente alternative segment and Caliente common segment 1	454
			Eccles alternative segment and Caliente common segment 1	566
181 – Dry Lake Valley	2,500	57/21,824	Caliente alternative segment 1	468
208 – Pahroc Valley	21,000	30/0	Caliente alternative segment 1	919
207 – White River Valley	37,000	31,819/42,512	Caliente alternative segment 1	81
171 – Coal Valley	6,000	38/33,071	Caliente common segment 1 and Garden Valley alternative 1	79
			Caliente common segment 1 and Garden Valley alternative 2	133
			Caliente common segment 1 and Garden Valley alternative 3	80
			Caliente common segment 1 and Garden Valley alternative 8	113
172 – Garden Valley	6,000	559/12,224	Caliente common segment 1 and Garden Valley alternative 2	274
			Caliente common segment 2 and Garden Valley alternative 2	149
			Caliente common segment 2 and Garden Valley alternative 2	203
			Caliente common segment 8 and Garden Valley alternative 2	146
170 - Penoyer Valley*	4,000	14,461/11,888	Caliente common segment 2	145

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 2 of 4)

Hydrographic area[a] number and name	Perennial yield for hydrographic area[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[c,d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of water demand values within hydrographic area (acre-feet)[f]
173A – Railroad Valley (Southern Part)	2,800	3,867/0	Caliente alternative segment 2, South Reveille alternative segment 2, and Caliente common segment 3	197
			Caliente common segment 2, South Reveille alternative segment 3, and Caliente common segment 3	169
156 – Hot Creek Valley	5,500	4,231/0	Caliente common segment 3	416
149 – Stone Cabin Valley*	2,000	11,532/6,400	Caliente common segment 3	197
141 – Ralston Valley*	6,000	4,330/1	Caliente common segment 3 and Goldfield alternative segment 1	519
			Caliente common segment 3 and Goldfield alternative segment 3	573
			Caliente common segment 3 and Goldfield alternative segment 4	129
142 – Alkali Spring Valley	3,000	2,596/0	Goldfield alternative segment 1	141
			Goldfield alternative segment 4	550
145 – Stonewall Flat	100	12/0	Goldfield alternative segment 1	291
			Goldfield alternative segment 3	458
			Goldfield alternative segment 4	43

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 3 of 4)

Hydrographic area[a] number and name	Perennial yield for hydrographic area[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[c,d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of water demand values within hydrographic area (acre-feet)[f]
144 – Lida Valley	350	72/0	Goldfield alternative segment 4, Caliente common segment 4, and Bonnie Clair alternative segment 2	378
			Goldfield alternative segment 1, Caliente common segment 4, and Bonnie Clair alternative segment 2	245
			Goldfield alternative segment 1, Caliente common segment 4, and Bonnie Clair alternative segment 3	156
			Goldfield alternative segment 3, Caliente common segment 4, and Bonnie Clair alternative segment 2	257
			Goldfield alternative segment 3, Caliente common segment 4, and Bonnie Clair alternative segment 3	168
			Goldfield alternative segment 4, Caliente common segment 4, and Bonnie Clair alternative segment 3	289
146 – Sarcobatus Flat*	3,000	3,591/0	Bonnie Clair alternative segment 2	336
			Bonnie Clair alternative segment 3	449
228 – Oasis Valley*	1,000	1,299/0	Common segment 5, Oasis Valley alternative segment 1, and common segment 6	401
			Common segment 5/Oasis Valley alternative segment 3. common segment 6	574
229 – Crater Flat	220	1,147/82	Caliente common segment 6	256
227A – Fortymile Canyon, Jackass Flats	880[g]	58/5	Caliente common segment 6	572

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 4 of 4)

Hydrographic area[a] number and name	Perennial yield for hydrographic area[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[c,d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of water demand values within hydrographic area (acre-feet)[f]
Total approximate quarry water demand plus miscellaneous water demand				100[h]
Estimated lowest total water demand value (acre-feet) based on possible combinations of rail line segments				Approximately 5,300
Estimated highest total water demand value (acre-feet) based on possible combinations of rail line segments				Approximately 7,400
Current estimate of total water demand (acre-feet) - current best estimate (see text)				Approximately 6,100

a. Source: DIRS 106094-Harrill, Gates, and Thomas et al. 1988, Summary, Figure 3, with the proposed rail alignment map overlay. An asterisk (*) indicates that the State of Nevada considers the hydrographic area a designated groundwater basin (DIRS 177741-State of Nevada 2005, all).

b. Source: DIRS 103406-Nevada Division of Water Planning 1992, Regions 10, 13, and 14, except hydrographic areas 227A, 228, and 229, for which the source is DIRS 147766-Thiel Engineering Consultants 1999, pp. 6 to 12. The perennial yield value shown for area 228 is the lowest value in range of estimated values (1,000 to 2,000 acre-feet per year) presented by Thiel Engineering Consultants 1999.

c. To convert acre-feet to cubic meters, multiply by 1,233.5. To convert acre-feet to gallons, multiply by 3.259×10^5.

d. Data for committed groundwater resources and pending annual duties are current as of the dates described in section 3.2.6. Data for pending groundwater resources include underground duties but do not include duties for streams or springs. All values have been rounded to the nearest acre-foot.

e. Figures 3-75 through 3-82 show the locations of the Caliente rail alignment alternative segments and common segments.

f. Water demand estimates are from DIRS 176189-Converse Consultants 2006, Table 2-3, with reference also to DIRS 180922-Nevada Rail Partners 2007, Tables 4-4 and 4-5.

g. Based on a 1979 Designation Order by the State Engineer; there are no committed resources in area 227A. However, water-rights information from the NDWR indicates there are 58 acre-feet in committed resources for this area. The discrepancy appears to be related to the location of the boundary between areas 227A and 230 (Amargosa Desert) (DIRS 176600-Converse Consultants 2005, page 29 and Table 4-45). The perennial-yield value shown for area 227A is the lowest estimated value presented in *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel Engineering Consultants 1999, p. 8), for the entirety of hydrographic area 227A. The perennial yield estimate for area 277A is broken down into 300 acre-feet for the eastern third of the area and 580 acre-feet for the western two-thirds of the area.

h. Quarry and miscellaneous water demand values apply to all estimated water demand value cases. This total 100 acre-feet of water demand reflects a difference in the water demand calculation methodology used in DIRS 176189-Converse Consultants 2006, Table 2-3 versus DIRS 180922-Nevada Rail Partners 2007, Tables 4-4 and 4-5.

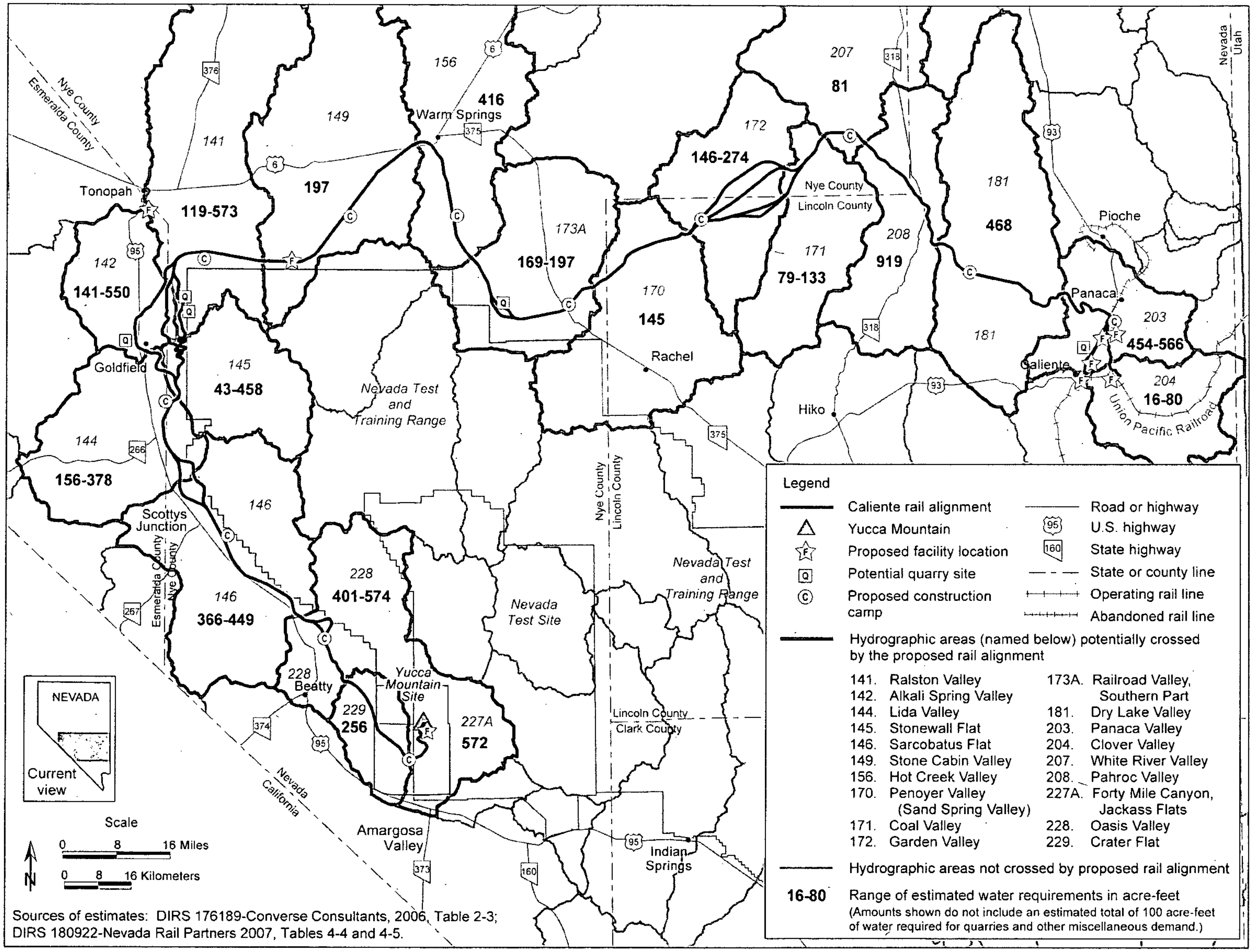


Figure 4-13. Estimated water requirements along the Caliente rail alignment.

Construction of Oasis Valley alternative segment 3 and common segments 5 and 6 through hydrographic area 128 would result in a groundwater demand equaling approximately 57 percent of the estimated annual perennial yield and approximately 44 percent of the total annual committed resources of this hydrographic area.

DOE evaluated potential impacts to existing groundwater resources assuming that it would apply for permits to appropriate water from 150 to 176 new construction water wells, including new quarry water wells, to furnish all the water required to support rail line construction, construction camps, quarry operations, and operation of railroad operations support facilities, including sidings (DIRS 176189-Converse Consultants 2006, Tables 3-2 and 2-3 and Appendix A; DIRS 180922-Nevada Rail Partners 2007, Section 3.1.4). Each construction camp would require approximately one new water well. The actual number of wells required would depend on the specific combination of alternative segments selected and flow rates achieved in installed wells.

New multiple-use water wells could be installed in each hydrographic area along the Caliente rail alignment, with the exception of area 227A. DOE assumed that each of the wells used to support rail roadbed construction would be pumped for a period not to exceed 1 year (for purposes of quantitative analysis, DOE assumed 9 months) (DIRS 176189-Converse Consultants 2006, Section 2.1). These wells would have the highest required water withdrawal rates. DOE could use quarry water wells, which would have lower production rates of approximately 91 liters (24 gallons) per minute, to support startup of quarries and during a quarry operational period of about 2 years. Wells to supply water for construction camps would be temporary and would have average withdrawal rates less than 76 liters (20 gallons) per minute. Wells supplying water for railroad operations support facilities and sidings would have the lowest average withdrawal rates (approximately 16 liters [4.2 gallons] per minute to less than 4 liters [1 gallon] per minute); these would be permanent wells (DIRS 180919-Nevada Rail Partners 2007, Table 3-B; DIRS 176189-Converse Consultants 2006, Section 2.1).

DOE would construct, and would subsequently decommission, all new water wells in accordance with applicable State of Nevada well-construction standards. After DOE completed construction of the rail line, some wells would remain in operation to supply water to railroad operations support facilities located near sidings, rail yards, or elsewhere along the rail line during the operations phase. DOE currently plans that wells not needed for operation of the rail line or for quarries would be abandoned in compliance with State of Nevada regulations, and the well sites and temporary access roads would be reclaimed (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.4) in accordance with applicable requirements.

DOE assumed that proposed new well sites outside the typical maximum 300-meter (1,000-foot)-wide rail alignment construction right-of-way would consist of an approximately 5,800-square-meter (1.4-acre) drilling pad (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.4). Depending on water needs and well yields, DOE would install one or two wells on each drilling pad. Areas identified as potential locations for such well sites would be adjacent to documented existing land disturbances, including existing improved or unimproved roadways. If necessary, DOE would construct temporary access roads to accommodate 0.1- to 0.2-meter (4- to 6-inch)-diameter temporary aboveground pipelines that would transport water from these wells to the area of the construction right-of-way. Impacts that might result from the construction and temporary use of such water transfer pipelines are evaluated in the sections of this Rail Alignment EIS that address applicable resources or media (such as Biological Resources, Cultural Resources, and Land Use and Ownership). After construction of the rail line was complete, some wells would remain in operation to supply water to railroad operations support facilities near sidings, rail yards, or other locations along the rail alignment during the operations phase.

Well water would be piped through the temporary aboveground pipelines to temporary in-ground storage basins (reservoirs), inflatable bladders ("pillow tanks"), or rigid storage tanks within the construction right-of-way to provide storage capacity to meet daily construction needs. For planning purposes, DOE assumed that temporary water-storage reservoirs, if used, would be approximately 30 by 30 meters (100 feet by 100 feet) wide and approximately 3 meters (10 foot) deep, and would be used to store the daily water production from wells. Storage tanks or inflatable bladders, if used, could vary in their storage capacity up to approximately 190,000 liters (50,000 gallons) or more, depending on water demands and water withdrawal rates required for specific locations along the construction right-of-way. Open-storage basins or reservoirs, if used, would be surrounded by a fence to mitigate the potential to attract wildlife (see Section 4.2.7).

In determining the quantity of water that can be appropriated from a specific hydrographic area, requirements contained in the applicable State of Nevada statutes are considered. This authority includes the ability to grant appropriation requests in hydrographic areas that are designated groundwater basins or in cases where such appropriations would cause an exceedance of an area's estimated perennial yield.

DOE evaluated the potential impacts to groundwater resources using two withdrawal scenarios: (1) withdrawal of groundwater from the proposed new water well where each well is assumed to be pumped at its projected base-case average pumping rate (DIRS 176189-Converse Consultants 2006, Appendix A, fourth column); and (2) groundwater withdrawals from a number of wells considered in the first scenario but at an assumed withdrawal rate of up to 852 liters (225 gallons) per minute, or approximately 0.014 cubic meter (0.5 cubic foot) per second. In the second set of (sensitivity analysis) calculations, DOE varied the assumed groundwater pumping rates at higher values to determine how sensitive the radius of influence would be to groundwater withdrawal rates. The sensitivity analysis scenario also helped assess the degree of flexibility available for possibly utilizing some proposed new wells more than, or in lieu of, other proposed wells, based on potential differences in well productivity that might occur between the new wells.

Any groundwater withdrawal would decrease the availability of water within a portion of the aquifer in the region of influence surrounding a groundwater-withdrawal well. However, as described previously, DOE would obtain approximately 90 percent of all the water required for construction of the proposed rail line along the Caliente rail alignment from new temporary groundwater wells. The withdrawal of groundwater from new wells to support railroad construction would not be likely to result in long-term adverse impacts to the groundwater aquifers that are targeted for meeting project water demands because:

- For the proposed new groundwater withdrawals, analysis results (see Section 4.2.6.2.2 and Appendix G) show that short-term direct impacts on groundwater availability in aquifers resulting from proposed groundwater withdrawals where the new wells would be pumped at the projected base-case average required groundwater withdrawal rates would be limited in area (lateral) extent. Analytical results indicate that the maximum calculated lateral extent of the drawdown feature (the radius of influence of the cone of depression) that would be induced at any location within host aquifers from proposed groundwater withdrawals at the base-case production average rates would be approximately 0.8 kilometer (0.5 mile), and in most cases much less at the proposed well locations. With the exception of one location in the Oasis Valley hydrographic area (see Section 4.2.6.2.2.11) and one location in the Panaca Valley hydrographic area (see Section 4.2.6.2.2.1), withdrawals of groundwater from the proposed new water wells at the base-case average withdrawal rates would not be expected to impact existing groundwater users (owners of active pumping wells) or impact discharge rates or groundwater quality at nearby springs. Sections 4.2.6.2.2.1 and 4.2.6.2.2.11 describe one or more mitigation approaches that could be implemented in order to avoid potential impacts at these otherwise affected locations. In addition, Section 4.2.6.2.2.6 describes a possible mitigation approach for the selective use of proposed new wells in the Hot Creek Valley hydrographic area to avoid a potential impact on an existing spring.

- Results of sensitivity analyses (see Sections 4.2.6.2.2 and Appendix G) to evaluate potential impacts to existing wells and springs from a hypothetical increase in the withdrawal rate of groundwater from the proposed new water wells to up to 852 liters (225 gallons) per minute, or approximately 0.014 cubic meter (0.5 cubic foot) per second, indicate that, with the exception of four to possibly five locations in the Panaca Valley hydrographic area (Section 4.2.6.2.2.1), DOE expects no short-term direct impacts to groundwater resources resulting from such higher-rate groundwater withdrawals. Section 4.2.6.2.2.1 describes a possible approach for avoiding potential impacts at these potentially affected locations. In addition, Section 4.2.6.2.2.6 describes a possible approach for the selective use of proposed new wells in the Hot Creek Valley hydrographic area to avoid a potential impact on an existing spring.

- For areas where proposed new water wells would be near the boundary between adjacent hydrographic areas, groundwater withdrawals would not be likely to affect downgradient hydrographic areas because: (1) there are no identified existing well users in downgradient groundwater basins that are within 1.6 kilometers (1 mile) of any of these proposed well water withdrawal locations (see Figures 3-75 through 3-82), or (2) available hydrogeologic information indicates that there is no significant inter-basin groundwater (under)flow in the areas downgradient of the proposed well locations (see Figure 3-73).

- Long-term direct impacts to groundwater resources would not be likely because approximately 90 percent of the total project water demand would be used over a short period to support railroad construction. Most water demands within any given hydrographic area would occur over approximately 9 months under an assumed 4-year railroad construction schedule; therefore, long-term impacts resulting from their use would be small.

- Direct impacts to groundwater would not be likely for the reasons stated above; indirect impacts to groundwater resources in adjacent downgradient hydrographic areas also would not be likely.

New wells proposed to be installed outside the construction right-of-way of some rail alignment segments to support railroad construction or quarries would be either on grazing land or on Walker River Paiute Reservation land, or for one proposed quarry, partly on BLM-administered land and partly on Hawthorne Army Depot property (see Section 4.3.2). Direct or indirect impacts to private-property owners from construction and use of such wells would be expected to be small and capable of being minimized through the use of appropriate planning and mitigation measures, as required (see Section 4.3.2).

Several of the proposed railroad operations support facilities and sidings would overlie hydrographic areas that are designated groundwater basins. Construction-water demand for these facilities would be low compared to the amount of water required for railroad construction. These facilities include the Caliente-Indian Cove, Caliente-Upland, and Eccles-North Staging Yard optional locations for the proposed railroad in hydrographic area 204, the Maintenance-of-Way Trackside Facility northeast of Goldfield, the Maintenance-of-Way Headquarters Facility south of Tonopah in area 141, and proposed sidings in several hydrographic areas. Although the locations for the Staging Yard would not overlie a designated groundwater basin, the committed groundwater resources in area 204 exceed the estimated annual perennial yield. DOE assumed that water demand for constructing these railroad facilities and sidings would be met by installing new wells.

Details on the water requirements activity and groundwater impacts at the railroad operations facilities are provided in the *Facilities–Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, Rev. 03*

(DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). These facilities would require only limited amounts of water, with water required for operations of most facilities estimated to range from approximately 9,500 to 23,000 liters (2,500 to 6,000 gallons) per day at the facilities, which is equivalent to 6.4 to 16 liters (1.7 to 4.2 gallons) per minute. DOE derived operations water requirements from estimated staffing and shift projections, a 190-liter (50-gallon) per day per capita use ratio, estimated shop process needs, and a multiplier of 1.5 to account for miscellaneous water needs (DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). Water needed for meeting emergency water storage capacity requirements (for fire safety) are estimated to range from 380,000 to 830,000 liters (100,000 to 220,000 gallons). The water demand for operation of the Cask Maintenance Facility is estimated at approximately 40,000 liters (10,500 gallons) per day, which is equivalent to approximately 7 gallons per minute (DIRS 104508-CRWMS M&O 1999, Table III-1). Water needs for meeting water storage requirements and facility operations needs at each facility could be readily met using a new low-productivity well. For this reason, the magnitude of short-term or long-term impacts on the host aquifer for the individual facility water wells would be small. For this reason, DOE did not perform quantitative impact analyses for water wells that would support facilities operations.

Water consumption rates during the period of use of construction camps during the peak output year have been estimated at approximately 76 liters (20 gallons) per minute, which is equivalent to approximately 110,000 liters (28,800 gallons) per day (DIRS 176189-Converse Consultants 2006, Table 2-1). Water consumption rates during the period of use of quarries have been estimated at approximately 91 liters (24 gallons) per minute, which is equivalent to 131,000 liters (34,560 gallons) per day (DIRS 176189-Converse Consultants 2006, Table 2-1). New wells proposed for supplying water to support construction camp and quarry operations were considered when performing the quantitative impact analyses. Construction of the Cask Maintenance Facility would require approximately 4,400 cubic meters (approximately 3.6 acre-feet, or 1.176 million gallons) of water, with construction estimated to occur over approximately 2 years (DIRS 104508-CRWMS M&O 1999, Table III-2). The amount of water needed to construct the other railroad facilities (Maintenance-of-Way Facilities and the Rail Equipment Maintenance Yard) would range from approximately 14,000 to 200,000 cubic meters, which is equivalent to 11.5 to 161.1 acre-feet, or 3.75 to 52.5 million gallons (DIRS 180919-Nevada Rail Partners 2007, Table 3-B). No additional water would be required for constructing the rail sidings (DIRS 180919-Nevada Rail Partners 2007, Table 3-B). When compared to the total annual committed groundwater resources listed in Table 3-35, the direct short-term impacts to groundwater resources in the respective hydrographic areas due to water withdrawals associated with construction of railroad facilities and sidings would be small, and long-term direct and indirect impacts on groundwater resources also would be small.

DOE also assessed the potential for the proposed groundwater withdrawals to cause ground subsidence in areas of the proposed withdrawals. Groundwater pumping-induced ground subsidence has been observed at some locations in the western United States, including the Las Vegas Valley of Nevada, the Santa Clara Valley and San Joaquin Valley areas of California, and other selected locations in Texas, New Mexico, and Arizona, and selected other locations overseas. The subsidence that has occurred is primarily related to prolonged groundwater withdrawal at rates that exceed the estimated annual recharge to the affected groundwater system. The estimated annual recharge to the aquifer systems in each of these localities is often less than approximately 50 percent of the total average annual groundwater pumped from these aquifers. In the Las Vegas Valley, groundwater withdrawals between 1955 and 1990 ranged from approximately 49.4 to 108.5 million cubic meters (40,080 to more than 88,000 acre-feet) per year, with the maximum groundwater withdrawal occurring in 1968 (108.9 million cubic meters [88,290 acre-feet]) (DIRS 181390-Bell et al. 2002, p. 156). Estimates of annual recharge rate to the Las Vegas Valley aquifer system range from approximately 30.6 to 72.2 million cubic meters (25,000 to 59,000 acre-feet) per year, indicating that groundwater withdrawal rates in the Las Vegas Valley have typically exceeded, sometimes by a factor of more than two, natural recharge rates over a period of decades (DIRS 181390-Bell et al. 2002, p. 156). Groundwater withdrawals of more than 12.1 billion cubic meters (9.8 million acre-feet) per year in the San Joaquin Valley resulted in withdrawal overdrafts of at least 4.93 billion cubic meters (4 million acre-feet) per year during the 1950s and 1960s (DIRS 181392-USGS, Poland, 1984, p. 264). Annual groundwater pumping rates in each of these areas have exceeded their respective annual groundwater recharge rates between the mid-1940s to 1950s and the 1990s.

Interbedded fine- and coarse-grained sediments underlie each of these areas. Where impermeable caliche horizons occur within alluvial fan deposits or poorly ***permeable*** clay horizons occur within fine-grained basin-fill materials, groundwater is under confined or partially confined conditions, frequently exhibiting artesian flow conditions (for example, Bell et al. 2002, p. 156 [DIRS 181390]). Continued groundwater pumping in excess of the yearly recharge has reduced the artesian pressures in these aquifer systems resulting in an increase in vertical loads, or effective stresses. The increased effective stresses result in the compaction of the underlying sediments and corresponding ground subsidence.

An evaluation of the proposed new groundwater withdrawal wells for the rail alignment indicates that the majority of the wells would be developed in unconsolidated alluvial sediments, with a remaining minority of wells completed in consolidated bedrock aquifers. Subsidence is not expected to be an issue in consolidated bedrock aquifers because as these aquifers are not susceptible to compaction during pumping.

Of the wells developed in unconsolidated alluvial sediments, a relatively small percentage would be developed in confined alluvial sediments. In general, subsidence is not expected to be an issue for pumping unconfined alluvial aquifers, because the major reported cases of land subsidence due to groundwater withdrawals involve pumping from confined aquifers.

Groundwater withdrawals from confined alluvial aquifers, at the withdrawal rates expected for this project, and if they exceed recharge rates, could, in theory, result in some small amount of subsidence within the radius of influence associated with each pumping well. However, no known subsidence effects have been documented for other pre-existing pumping wells situated in these hydrographic areas, many of which are being pumped at rates much higher than the range of pumping rates proposed for this project. Additionally, the area of disturbance within the radius of influence surrounding to each well represents an extremely small percentage of the total area of the host aquifer within each hydrographic area. Finally, the duration of pumping for approximately 90 percent of the proposed total groundwater withdrawals would be on the order of 1 year or less within each hydrographic area the alignment would cross. The pumping rates required, the total volume of groundwater that would be withdrawn from each hydrographic area, and the pumping timeframes involved are much smaller than the pumping rates, water volumes removed, and the prolonged periods of pumping that were involved at locations where ground subsidence has been observed, such as the Las Vegas Valley, Santa Clara Valley, and San Joaquin Valleys. For these reasons, the potential for ground subsidence to occur as a result of constructing and operating a railroad along the Caliente rail alignment would be expected to be low.

4.2.6.2.2 Construction Impacts for Specific Alternative Segments and Common Segments

DOE evaluated potential site-specific impacts to groundwater resources from constructing and operating a rail line along the Caliente rail alignment. This section summarizes the approach and methodologies DOE used to quantitatively evaluate the extent of potential hydrogeologic impacts from withdrawing groundwater to support construction of the rail line and railroad construction and operations support facilities. Appendix G provides a more detailed description of the approach and methodology. Section 3.2.6 summarizes the existing groundwater resources along each of the alternative segments and common segments.

To evaluate potential impacts of proposed groundwater withdrawals from new water wells on existing wells and springs, DOE reviewed proposed well locations, well construction details, estimated groundwater depths, and proposed groundwater withdrawal rates and timeframes (DIRS 176189-Converse Consultants 2006, all; DIRS 176172-Nevada Rail Partners 2006, Section 4.4). Unless noted otherwise, the sources for all spring and well data in this section are as follows:

- DIRS 176600-Converse Consultants 2005, all
- The Nevada Division of Water Resources (NDWR) water-rights database and water-well log database, and other data sets (DIRS 177292-MO0607NDWRWELD.000, all; DIRS 182288-NDWR 2007, all; DIRS 182898-NDWR 2007)
- Data from the U.S. Geological Survey (USGS) National Water Information System (NWIS) database (DIRS 176325-USGS 2006, all and DIRS 177294-MO0607USGSWNVD.000)
- Geographic Information Systems databases on springs and water bodies in Nevada (DIRS 176979-MO0605GISGNISN.000, all; DIRS 177712-MO0607NHDPOINT.000, all; DIRS 177710-MO0607NHDWBDYD.000, all)
- DIRS 177293-MO0607PWMAR06D.000, all

For initial screening purposes, if DOE identified an existing well or a spring within a 1.6-kilometer (1-mile) radius (buffer distance) of a proposed new water well, DOE selected that proposed well location as a candidate for conducting a groundwater hydrogeologic impacts evaluation. When DOE found no spring or existing well within this initial search radius, it identified the nearest spring or existing well within a 2.4-kilometer (1.5-mile) radius (buffer distance) of the proposed new water well, and determined its hydrogeologic and construction characteristics. In addition to the above screening processes, and before completing impacts analyses, for a selected set of new groundwater withdrawal well locations where the well was specifically targeted for installation within a fault zone or an extensive ***fracture*** zone, the locations of existing wells and springs up to 10 kilometers (6 miles) away from each such proposed well were identified. These larger search distances were considered to: (1) allow evaluation of potential simultaneous drawdown effects involving existing individual private wells having higher withdrawal rates that might be located in the general vicinity; and (2) assess the potential for a fault zone or extensive fracture zone present at the proposed new well location to act as a conduit for groundwater flow (possibly resulting in a groundwater drawdown effect over a larger distance).

DOE searched the NDWR water-rights database and well-log databases to confirm the identity, use, water rights status, and appropriated annual duty and diversion rate, if any, associated with each existing well located within these buffer distances. DOE included domestic wells and considered the appropriated annual duty and diversion rate for each well with a water right in hydrogeologic impacts analyses to estimate potential hydrogeologic impacts from groundwater withdrawals at the proposed well location. In some cases, using the available information, DOE could not positively correlate wells listed in the USGS NWIS database to any well listed in the NDWR water-rights database or the NDWR well-log database. For such wells, DOE did not perform quantitative impacts analyses for these wells. For impacts analysis purposes, DOE considered the locations of known domestic wells with respect to the proposed alignment and relative to proposed new well locations. Figures 3-75 to 3-82 show the approximate locations of existing wells, including domestic wells, and springs within the 1.6-kilometer (1-mile) screening level region of influence.

DOE reviewed available geologic and hydrogeologic information to confirm the hydrogeologic characteristics of known and potential aquifers in areas near proposed wells. Where applicable, for the closest existing well having a water right, DOE identified water appropriations information (annual appropriated groundwater duty, well use period, and authorized groundwater diversion rate) and documented the information for subsequent use in analysis.

DOE used the information obtained from the geologic and hydrogeologic data reviews to identify an appropriate analytical method or methods to determine the magnitude of drawdown that would be created in the host aquifer as a result of the proposed groundwater withdrawals, and determine the amount of simultaneous drawdown created, where applicable, due to groundwater production from the nearest existing pumping well. For purposes of analysis, fractured consolidated rock aquifers were treated as homogeneous, ***isotropic*** (identical in all directions), equivalent porous media. For a selected set of new groundwater withdrawal well locations where the well was determined to be in the vicinity of faults or extensive fracture systems or specifically targeted for installation within a major fault zone or an extensive fracture zone (DIRS 176189-Converse Consultants, 2006, Appendix B), additional evaluations of hydrogeologic data and/or additional analyses were performed.

In cases where a proposed well was determined to be located lateral to a mapped fault or fracture zone, the fault or fracture zone was treated as a potential no-flow ***barrier*** if it was located sufficiently close to the proposed new well to be within the region of influence from pumping at that well location. In such cases, the calculations included a specific method (image well method) to simulate the potential effects of the fault or fracture zone on groundwater flow behavior.

Hydraulic tests performed in faulted and fractured consolidated rock aquifers at a few wells in the region of the Nevada Test Site indicate that when a pumping well pumps groundwater from a high-***permeability*** zone associated with a fault, that fault zone might act as a conduit for transmitting hydraulic responses from the pumping well over larger-scale (on the order of kilometers) distances. Results from pump tests conducted at these wells often indicate that very complex hydrogeologic conditions, including heterogeneous hydraulic rock properties, the presence of complex structural systems controlling flow, and other non-isotropic conditions, exist at these test sites. For these reasons, where a proposed new well was identified as targeting a specific fault or fracture system that could act as a high-permeability conduit, DOE identified the locations of existing wells and springs up to 10 kilometers (6 miles) away from each such proposed well. In these cases, DOE reviewed available data on existing wells and springs and locations of known (mapped) faults and fracture zones within the 10 kilometer radius surrounding each new well location and compared these with the locations of the proposed well to estimate the likelihood of a hydraulic connection occurring between the proposed well and existing wells and springs beyond a distance of 2.4 km (1.5 miles) but within the approximately 10-kilometer distance. Additional details regarding the treatment of faults and extensive fracture systems as conduits (or barriers) to flow in the impacts analyses are described in Appendix G.

DOE calculated a region of influence for each well and determined how far from the well the aquifer would be affected by the drawdown. For analysis purposes, DOE assumed that (1) it would obtain all water for railroad construction from new groundwater wells, and (2) groundwater might be pumped at the nearest existing well with a water right simultaneously to groundwater withdrawal at the new well or wells. If existing wells were found to be farther away from the proposed new well than the sum of the radii of influence associated with both wells, DOE concluded that there would be no impacts to the nearest existing well. If the nearest spring was found to be beyond the calculated radius of influence of the proposed new well, DOE concluded that there would be no impacts to the spring.

For each sensitivity analysis completed, DOE assessed the potential impacts to existing wells from imposing a 852 liters (225 gallons) per minute pumping rate at each proposed well, considering the possibility of intersecting cones of depression from the simultaneous pumping of the nearest existing well and the proposed new well. The pumping rate assumed for the nearest well in nearly every case was the average withdrawal rate required to realize the total appropriated annual or seasonal duty value for that well, if that well had a formal appropriated water right, over the authorized period of use. The exceptions included existing wells for which the average pumping rate calculated based on the total appropriated duty value was very low and much smaller than the authorized (short-term) diversion rate for that well.

In those cases, to conservatively bound impact analysis results, DOE used the diversion rate to calculate the well's radius of influence.

Sections 4.2.6.2.2.1 to 4.2.6.2.2.12 describe potential impacts to existing springs or groundwater wells. Table 4-60 lists information about the hydrographic areas the rail line would cross and the estimated volume of water DOE would need to construct each set of Caliente rail alignment alternative and common segments across each hydrographic area.

4.2.6.2.2.1 Interface with Union Pacific Railroad Mainline. Both the Caliente and Eccles alternative segments would overlie hydrographic areas 203 and 204. The Caliente alternative segment would overlie a greater portion of area 203, approximately 16 kilometers (10 miles), than the Eccles alternative segment (approximately 12 kilometers [7.5 miles]). At present, there are no documented pending annual duties for either hydrographic area 203 or 204 (see Table 4-60).

DOE assumed that appropriations for new water wells represent a viable mechanism for obtaining all water required to support railroad construction in these two hydrographic areas. This approach does not predispose the final outcome of decisions regarding the approval or denial of such appropriation applications; however, the analysis assumes that such applications would, in theory, be accepted, and that that there would be groundwater withdrawals at the proposed new wells as designed. This analysis approach provides a conservative estimate of the potential impacts to groundwater resources resulting from groundwater withdrawals within the two hydrographic areas the Caliente or Eccles alternative segments would cross.

Caliente Alternative Segment Figures 3-75 and 3-76 show the approximate locations of proposed new water wells to meet water demands for constructing the Caliente alternative segment. The first step in assessing potential impacts to groundwater resources in this area involved the evaluation of the hydrogeologic impacts resulting from withdrawing (pumping) groundwater from the new water wells, assuming that each well would be pumped at its projected base-case average required groundwater withdrawal rate. Analysis results for the proposed well locations indicate that, with the exception of one proposed new well location (PanV25/PanV26), there would be no impacts to existing wells or springs in the vicinity of this alternative segment as a result of the proposed groundwater withdrawals. DOE anticipates that wells installed at location PanV26 would have to operate at a short-term (9 months) base-case average withdrawal rate of 76 liters (20 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). The nearest existing NDWR-listed water well is approximately 650 meters (2,141 feet) west of location PanV26 (see Figure 3-76). The appropriated seasonal (April to September) duty (980,000 cubic meters [797 acre-feet] per season) for this existing well is equivalent to an average withdrawal rate of 3,800 liters (1,002 gallons) per minute during the period of use of this well. The radius of influence calculated for this existing well varies between an estimated upper- and lower-bound value, depending on assumptions made regarding the saturated thickness of the water-bearing zone in the aquifer within that well. The radius of influence determined for the proposed well at location PanV26 when pumped at the proposed base-case average withdrawal rate is estimated to be approximately 76 meters (250 feet). Given the distance separating the proposed PanV26 well location and the existing irrigation well, the sum of the radii of influence for the proposed well and the existing well indicate the cones of depression generated around these wells could either intercept, or likely not, intercept each other for both the upper bound and lower bound scenarios evaluated for the existing well.

As previously stated, the water-rights permit for the existing well allows it to be pumped annually between April and September. Because of the large appropriated duty of the existing well, it appears that use of proposed well location PanV26 would not be a viable option if such use was during the same 6-month period of use as the existing well. If a new well at location PanV26 were pumped between about October and March, pumping operations at PanV26 would likely not impact irrigation operations at the existing well. Additional field evaluation of the precise location and details about the use of this existing well might provide additional information to support viability of this proposed well location.

DOE performed sensitivity analyses to evaluate potential impacts to existing wells and springs from imposition of groundwater pumping rates up to 852 liters (225 gallons) per minute at proposed new well locations along the Caliente alternative segment. The analysis indicated that, with two (or possibly three), exceptions, there would be no impacts to existing wells or springs in the vicinity of this alternative from groundwater withdrawals at higher pumping rates. The three (possibly four) exceptions are the proposed well location PanV26 previously described and the following proposed well locations:

- For the PanV6 base case scenario, the nearest known existing well is 1,120 meters (3,683 feet) north of proposed location PanV6. Because of the large appropriated duty of this existing well, and its authorized period of use is for the entire year, it appears that a new well at proposed location PanV6 could not operate at the 852 liter (225 gallon) per minute average withdrawal rate, would need to be restricted to an average withdrawal rate of no greater than 470 liters (125 gallons) per minute to not result in an impact at the existing well, if proposed well PanV6 were to be used contemporaneously with the existing well. Alternatively, DOE could use existing wells to obtain the amount of water needed (that is, by purchasing water), use other proposed water-supply wells in the same general area, or install a new well at an alternative location in the same general area at a sufficient distance from existing wells or springs to preclude impacts.

- PanV4 (possible impact) – Figures 3-75 and 3-76 show an existing NDWR well approximately 1.4 kilometers (4,700 feet) northeast, and a USGS NWIS well approximately 1,000 meters (3,500 feet) northwest, of the proposed well location. However, available information suggests these may be the same well even though NDWR and the USGS locations are plotted differently (see Figure 3-76). The reported appropriated annual duty for the NDWR well equates to an average pumping rate of approximately 1,200 liters (300 gallons) per minute when distributed over a 9-month use season. If the NDWR-plotted location of this well is correct, the cone of depression for proposed well location PanV4, if pumped at 852 liters (225 gallons) per minute, and the cone of depression for the NDWR well, if pumped at 1,100 liters (300 gallons) per minute, would not be expected to intersect if the wells were pumped simultaneously. However, if the USGS-plotted location is correct and the NDWR-plotted location is incorrect, and the existing water right is associated with the well at the USGS-plotted location, the cones of depression generated through simultaneous pumping at location PanV4 and the existing well at these same pumping rates would probably intersect.

- PanV5 – For the base-case scenario, the proposed well at PanV5 would be a permanent facility water well, with a base-case withdrawal rate of only 3.8 liters (1 gallon) per minute. No base-case analysis calculation was completed for this well location because of the very small pumping rate required under the base-case scenario. For the sensitivity analysis, the radius of influence determined for the proposed well at PanV5 pumping at 852 liters (225 gallons) per minute is approximately 500 meters (1,600 feet). The nearest known existing well with a water right is a quasi-municipal well approximately 320 meters (1,060 feet) southwest of location PanV5 (see Figure 3-76. Because the authorized period of use of this well is the entire year, it appears that a new well at proposed location PanV5 could not operate at an average withdrawal rate of greater than 230 liters (60 gallons) per minute without resulting in an impact at the existing well, if the wells were to be pumped simultaneously. Further field evaluation of the precise location and details pertaining to use of the existing well might provide additional information to support viability of this proposed well location.

For these locations, DOE could obtain additional data on actual locations and details regarding the use of existing nearby wells and perform additional analyses to determine maximum allowable groundwater withdrawal rates that could be imposed at the proposed well locations. This would preclude possible intersection of drawdown cones from those well locations and from the nearest existing wells, thereby precluding impacts to the existing nearby wells. Alternatively, DOE could use existing wells to obtain the amount of water needed (that is, by purchasing water), use other proposed water-supply wells in the same general area, or install a new well at an alternative location in the same general area at a sufficient distance from existing wells or springs to preclude impacts.

A quarry well, which could also provide water needed to support operation of potential quarry CA-8B, could be installed west of U.S. Highway 93 and approximately 6.9 kilometers (4.3 miles) northeast of Caliente (see location PanV23 on Figure 3-75), and would be approximately 0.32 kilometer (0.2 mile) northwest of an existing USGS NWIS well, and approximately 1.6 kilometer (1 mile) west of an NDWR domestic well.

The average required groundwater withdrawal rate at the new quarry well location would be approximately 91 liters (24 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendixes A and B). Analysis results (see Table 4-61) indicate that the nearest known existing wells and springs in the vicinity of the proposed quarry well would be outside the radius of influence induced by the proposed groundwater withdrawals at each of the wells. Because the quarry well would be situated well outside the typical maximum 300-meter (1,000-foot)-wide rail line construction right-of-way in primarily bedrock-dominated terrain, the groundwater withdrawal rate at this well would not be expected to exceed its projected required average withdrawal rate. Therefore, DOE did not perform sensitivity analyses for this well (or for any other quarry wells) to evaluate whether there would be increased impacts from higher groundwater withdrawal rates.

Table 4-61. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Caliente and Eccles alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
ClV2	> 1.60 (well)	0.38	NA[d]
PanV1	> 1.60 (well)	0.42	0.59
PanV2	> 1.60 (well)	0.33	0.54
PanV3/6	1.12 (well)	0.42	0.65
PanV4	1.44 (well)	0.35	0.72
PanV5	0.32 (well)	NA[d]	0.50
PanV23	1.59 (well)	0.27	NA[d]
PanV24	1.34 (well)	0.33	0.54
PanV25/26	0.65 (well)	0.08	0.28

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.
d. NA = not applicable; no calculation was completed for reasons stated in text.

Eccles Alternative Segment Figures 3-75 and 3-76 show the approximate locations of new wells DOE could install to meet construction water demands along the Eccles alternative segment. Assuming DOE would pump each well at its projected base-case average groundwater production rate, analysis results indicate there would be no impacts to existing wells and springs near this alternative segment.

Results of sensitivity analyses (see Table 4-61) to evaluate potential impacts from withdrawing groundwater from proposed new wells in the rail line construction right-of-way at up to 852 liters (225 gallons) per minute indicate that, with two exceptions, there would be no impacts to existing wells or springs in the vicinity of this alternative segment. The exceptions are proposed new well locations PanV3/6 and PanV26, as previously described for the Caliente alternative segment. As discussed previously, proposed well PanV3/6 would not be viable above 470 liters (125 gallons) per minute if used contemporaneously with the nearest existing well. For these locations, DOE could obtain additional data on actual locations and details regarding the use of existing nearby wells to perform additional analyses to determine maximum allowable groundwater withdrawal rates, if any, that could be imposed at the proposed well locations. This would preclude possible intersection of drawdown cones from those well locations and from the nearest existing wells, thereby precluding impacts to the existing nearby wells. Alternatively, DOE could use existing wells to obtain the amount of water needed (that is, by purchasing water), use other proposed water-supply wells in the same general area, or installed a new well at an alternative location in the same general area at a sufficient distance from existing wells or springs to preclude impacts.

4.2.6.2.2.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would cross hydrographic areas 181, 208, 207, and 171. New wells in these hydrographic areas could be between 60 and 460 meters (200 and 1,500 feet) deep (DIRS 176189-Converse Consultants 2006, Appendix A).

Figures 3-75 through 3-77 show the approximate locations of proposed new wells along common segment 1. These new wells include a series of proposed wells within the Caliente common segment 1 construction right-of-way. These wells might also include wells installed at one or more proposed alternative well locations (DLV5, PahV3, PahV4, and PahV8) north of the common segment 1 construction right-of-way in the Dry Lake Valley hydrographic area or west of the construction right-of-way in the Pahroc Valley hydrographic area (see Section 3.2.6.3.2). These wells could be between 76 and 460 meters (250 and 1,500 feet) deep. The target aquifer for these wells would be alluvial valley-fill aquifers or a regional carbonate-rock aquifer underlying the alluvial valley fill in this area (DIRS 176189-Converse Consultants 2006, Appendixes A and B). Under a 4-year construction schedule, the total required groundwater withdrawal rate from proposed suites of new wells at the various locations to support construction work in this area could range from approximately 76 to 1,000 liters (20 to 270 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). Assuming proposed base-case average groundwater withdrawal rates at each proposed new well location, analysis results indicate that with the exception of proposed well location PanV7/PanV8, there would be no impacts to existing wells or springs near common segment 1 from pumping at the proposed well locations. The nearest existing NDWR well to PanV7/PanV8 is approximately 1,000 meters (3,288 feet) east-southeast of PanV7/PanV8 (see Figure 3-76). There is also an existing USGS NWIS-listed well approximately 880 meters (2,900 feet) southeast of PanV7/PanV8; however, this well could not be correlated to an NDWR well. Therefore, DOE did not analyze the radius of influence for this well. The appropriated annual duty (2.22 million cubic meters [1,797 acre-feet] per year) for the nearest existing NDWR well with a water right equates to an average withdrawal rate of approximately 4,200 liters (1,110 gallons) per minute. Because of the large appropriated duty for this existing well, it appears that use of proposed well location PanV7/PanV8 would not be viable as a ground water withdrawal well location if the nearest existing well with a water right to the northeast of that well is being pumped at the same time as the new well location.

The results of sensitivity analyses (Table 4-62) to evaluate potential impacts from increasing the groundwater withdrawal rate at any new well along this common segment to a maximum value of

852 liters (225 gallons) per minute indicate that there would be no impacts to existing wells or springs in the vicinity from groundwater withdrawals at these higher potential withdrawal rates, with the exception of the previously described proposed new well location PanV7/PanV8.

For nine proposed new well locations associated with Caliente common segment 1, the targeted water zone in each case was initially identified as a possibly water-bearing fault system (DIRS 176189-Converse Consultants 2006, Appendixes A and B and Figures 3-75, 3-76, and 3-77). The proposed well locations (PanV14/PanV16, DLV2, DLV3, DLV4, DLV6, PahV1, PahV2, PahV5, and PahV8) could be installed in hydrographic areas 203, 181 and 208, either within or outside the typical maximum 300-meter (1,000 foot)-wide construction right-of-way of common segment 1 (Figures 3-75, 3-76, and 3-77). There are no known existing wells or springs within approximately 10 kilometers (6 miles) of these proposed well locations that are known to be associated with the same fault or fracture system or potentially related major fault or fracture zones, should these wells be used for obtaining water required at corresponding water-demand stations along the rail alignment.

Table 4-62. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – common segment 1.

Well number	Distance to nearest well or nearest spring (kilometers)[a]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[b] per minute pumping rate (kilometers)
PanV7/8	1.00 (well)	0.32	0.49
PanV9/10/11/12	0.55 (well)	0.37	0.48
PanV13/15	1.11 (spring)	0.35	0.63
DLV3	3.66 (spring)	0.50	0.78
DLV4	1.48 (spring)	0.67	1.20
PahV1/2/3	2.06 (spring)	0.60	0.94
PahV7/8/9	1.17 (proposed well)[c]	0.60[d]	NA[e]

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. The nearest well location assumed for PahV7/8/9 is a hypothetical well location (proposed well application location).
d. This result is based on a calculated minimum transmissivity value required for the aquifer in order to yield the specified pumping rate. The published transmissivity value for this aquifer is significantly higher, which would reduce the calculated radius of influence value accordingly.
e. No sensitivity analysis case required because base-case pumping rate assumed is slightly higher than 852 liters per minute.

As described in Section 3.2.6.2, applications have been filed for a proposed irrigation well that would be within approximately 1.7 kilometers (1.1 miles) of proposed well location DLV3 in Dry Lake Valley, for a proposed municipal well that would be within approximately 1.7 kilometers of proposed well location PahV9 in Pahroc Valley, and for proposed municipal wells that would be approximately 1.5 kilometers (0.9 miles) northeast of the proposed PahV7 well location, and approximately 1 kilometer (0.6 mile) northeast of the proposed PahV8 well location, also in Pahroc Valley. Potential impacts resulting from these proposed new applications are evaluated in Section 5.2.2.6.

4.2.6.2.2.3 Garden Valley Alternative Segments. Figures 3-77 and 3-78 show the approximate locations of new wells DOE could install to meet construction-water demands and locations of existing wells and springs in the vicinity of Garden Valley alternative segments. There are seven existing USGS NWIS wells within 1.6 kilometers (1 mile) of Garden Valley alternative segments 1, 2, 3, and 8. These wells are either dry or have been used as testing or monitoring wells. Other than their possible future use as monitoring wells, these wells have no associated productive (beneficial) use.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results (see Table 4-63) indicate that existing wells and springs near the Garden Valley alternative segments would be outside the radius of influence of the proposed new water wells.

As described in Section 3.2.6.3.3, an application has been filed for a proposed municipal well that would be approximately 1.2 kilometers (0.8 mile) southwest of proposed new application is evaluated in Section 5.2.2.6.

Table 4-63. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Garden Valley alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
GV2	>1.60 (well)	0.27	0.53
GV10	1.23 (well)[d]	0.18	0.45

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.
d. The well location assumed for GV10 is a hypothetical well location (proposed well application location).

4.2.6.2.2.4 Caliente Common Segment 2 (Quinn Canyon Range Area). Figures 3-78 and 3-79 show the approximate locations of existing wells and proposed new wells within the rail line construction right-of-way to meet water demands along common segment 2. Documented pending annual duties for hydrographic area total approximately 3.95 million cubic meters (3,200 acre-feet).

DOE could install up to two new water wells at proposed alternative well location PeV1 in Penoyer Valley (see Figure 3-78), which would be adjacent to a USGS NWIS well south of common segment 2. This well has no beneficial use and is designed to serve as a groundwater monitoring well only. DOE could install up to three additional new water wells at proposed well pair location PeV2/PeV3 in Penoyer Valley (see Section 3.2.6.3.4 and Figure 3-78) to provide water for construction. There are no known existing wells or springs within 1.6 kilometers (1 mile) or within the potential radius of influence of this proposed alternative well location.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results indicate that existing wells and springs near common segment 2 would be outside the radius of influence of the proposed new water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

4.2.6.2.2.5 South Reveille Alternative Segments. The hydrographic area (173A) these alternative segments would cross is not a designated groundwater basin; however, committed groundwater resources exceed the estimated perennial yield. Figure 3-79 shows the approximate location of new water wells DOE would install to meet construction demands for water along these alternative segments. There is one existing NDWR well with a water right approximately 1.77 kilometers (1.1 miles) north northeast of the northern end of South Reveille alternative segment 2 near where it would merge with Caliente common segment 3 (see Figure 3-79). This well provides water for livestock watering.

Assuming proposed base-case average groundwater withdrawal rates at each new well location, analysis results (see Table 4-64) indicate that existing wells and springs near these alternative segments would be outside the radius of influence of proposed new wells. Results of evaluations (Table 4-63) to evaluate the potential for impacts to occur from increasing the groundwater withdrawal rate at any new supply well to a maximum value of 852 liters (225 gallons) per minute indicate that there would be no impacts to existing wells and springs near South Reveille alternative segments from groundwater withdrawals at these higher potential withdrawal rates.

Table 4-64. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – South Reveille alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
RrV6/11	>1.60 (well)	0.19	0.50
RrV8	0.83 (well)	0.13	Not applicable[d]

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.
d. No calculation was completed for reasons stated in text.

4.2.6.2.2.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Figures 3-79 and 3-80 show the approximate locations of the proposed new water wells in hydrographic areas 141, 149, 156, and 173A needed to support construction. Documented pending annual duties for hydrographic areas 141, 149, 156, and 173A total approximately 4.74 million cubic meters (3,840 acre-feet), all of which are assigned to area 149.

Assuming that the total combined, proposed, base-case average groundwater withdrawal rate of 620 liters (165 gallons) per minute might be applied at either HC5 or HC7 new well location, analysis results (see Table 4-65) indicate that, with the exception of Black Spring, existing wells and springs near Caliente common segment 3 would be outside the radius of influence of the new water wells. If it is conservatively assumed that Black Spring and the host aquifer at proposed new well locations HC5 and HC7 are hydraulically interconnected and groundwater underlying HC5 and HC7 is assumed to be under confined conditions, hydrogeologic impact analysis results indicate that if all of the water required for construction was obtained from the HC5, this might impact flow rates to Black Spring. However, analysis indicates that if the groundwater withdrawal rate at HC5 did not exceed 490 liters (129 gallons) per minute, discharge rates at Black Spring would probably not be affected by the groundwater production. The remaining required withdrawal rate of approximately 140 liters (36 gallons per minute) should be assigned to the wells at HC7. There are no known existing wells or springs within the radius of influence of HC7 (see Figure 3-79), if DOE used wells at that location to meet water needs up to the average required production rate of 620 liters (165 gallons) per minute.

Results of sensitivity analyses (see Table 4-65) to evaluate impacts from increasing the groundwater withdrawal rate at proposed well location HC7 to a maximum value of 852 liters (225 gallons) per minute indicate that there would be no impacts to existing wells or springs near Caliente common segment 3, including Black Spring, from this rate of groundwater withdrawal. Alternatively, as for the case just described involving proposed base-case average withdrawal rates, a maximum pumping rate of 490 liters (129 gallons) per minute could be imposed at HC5.

Table 4-65. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – common segment 3.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
HC4	1.11 (well)	0.53	0.88
HC5/7	0.73 (spring)	0.49	0.58
SCV3	>1.60 (well)	0.21	0.57

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.

Caliente common segment 3 would cross an underground pipe conveying water from Black Spring to stock-watering ponds east of the proposed rail line (DIRS 173845-Resource Concepts 2005, Figure 5.31a.1).

4.2.6.2.2.7 Goldfield Alternative Segments. Figure 3-80 shows the approximate location of proposed new wells along Goldfield alternative segments. Groundwater withdrawals within hydrographic areas 145 for Goldfield alternative segments 1 and 3, and within hydrographic area 144 for a Goldfield alternative segment 4, Caliente common segment 4, and Bonnie Claire alternative segment 2 combination of alternatives, would exceed the estimated annual perennial yields for those hydrographic areas. However, approximately 93 to 95 percent of the proposed withdrawals would be to support rail roadbed construction and would be temporary (DIRS 176189-Converse Consultants 2006, Section 2.1 and Table 2-2). DOE could install up to seven new water wells at proposed alternative well locations AsV1/2/3/4/5/8/9 in the Alkali Spring Valley hydrographic area (area 142) approximately 3.5 kilometers (2.2 miles) west of the centerline of Goldfield alternative segment 3 (see Section 3.2.6.3.7 and Figure 3-80). There are no known existing wells or springs within 1.6 kilometers (1 mile) or within the potential radius of influence of these proposed alternative well locations.

DOE could install up to seven new water wells at proposed alternative well locations StF1/2/3/4/5/8/9 in the Stonewall Flat hydrographic area (area 145) approximately 1.9 to 2.3 kilometers (1.2 to 1.4 miles) east of the centerline of Goldfield alternative segment 3 (see Section 3.2.6.3.7 and Figure 3-80). There are no known existing wells or springs within 1.6 kilometers (1 mile) or within the potential radius of influence of these proposed alternative well locations.

DOE could install up to eight new water wells at proposed alternative well locations LV1/2/3/4/9/10/11/12 in the Lida Valley hydrographic area (area 144) approximately 4.7 to 5 kilometers (2.9 to 3.1 miles) west of the centerline of Goldfield alternative segment 3 (see Section 3.2.6.3.7 and Figure 3-80). There are no known existing wells or springs within 1.6 kilometers (1 mile) or within the potential radius of influence of these proposed alternative well locations.

Assuming proposed base-case average groundwater production rates at each new well, analysis results (see Table 4-66) indicate that existing wells and springs near Goldfield alternative segments would be outside the radius of influence of these proposed new water wells. Similarly, results of sensitivity analyses (see Table 4-66) to evaluate the potential impacts of increasing the groundwater withdrawal rate at any new water well to a maximum value of 852 liters (225 gallons) per minute indicate that there would be no impacts to existing wells or springs near Goldfield alternative segments from groundwater withdrawals at these higher potential production rates.

For three proposed new well locations associated with the Goldfield alternative segments, the targeted water zone is a possibly water-bearing fractured ***volcanic rock*** system (DIRS 176189-Converse Consultants 2006, Appendixes A and B and Figure 3-79).

Table 4-66. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Goldfield alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a]	Radius of influence at base-case pumping rate (kilometers)[a]	Radius of influence at 852 liters[b] per minute pumping rate (kilometers)[a]
AsV6	1.04 (spring)	0.18	Not applicable[c]

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. No calculation was completed for reasons stated in text.

The proposed well locations (well locations StF10, LV5/LV13, and LV8/LV19) could be installed in hydrographic areas 144 and 145, within the

300-meter (1,000-foot)-wide construction right-of-way of Goldfield alternative segments 1 and 3 and common segment 4 (Figure 3-80). There are no known existing wells or springs within approximately 10 kilometers (6 miles) of any of these proposed well locations that are known to be associated with the same fault or fracture system as the proposed well locations or potentially related major fault or fracture zones, should these wells be used for obtaining water required at corresponding water-demand stations along the rail alignment.

4.2.6.2.2.8 Caliente Common Segment 4 (Stonewall Flat Area). Figures 3-80 and 3-81 show the approximate locations of proposed new water wells along Caliente common segment 4.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results indicate that existing wells and springs near common segment 4 would be outside the radius of influence of the proposed new water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

4.2.6.2.2.9 Bonnie Claire Alternative Segments. Figure 3-81 shows the approximate locations of proposed new water wells DOE could use to support construction of these alternative segments. Evaluation of proposed new wells and information regarding existing groundwater wells and springs in the area where Bonnie Claire alternative segments would cross indicate, for cases where groundwater pumping is assumed at the projected base-case average required withdrawal rates and where the hypothetical maximum withdrawal rate of 852 liters (225 gallons) per minute is assumed at each location, that known existing wells and springs along Bonnie Claire alternative segments 2 and 3 would be outside the radius of influence of proposed water wells along this portion of the Caliente rail alignment. There are no existing water wells or springs within 1.6 kilometers (1 mile) of Bonnie Claire alternative segments 2 or 3 (see Figure 3-81). For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

4.2.6.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Figures 3-81 and 3-82 show the approximate locations of proposed new wells that DOE could use to support construction of common segment 5.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results (Table 4-67) indicate that existing wells and springs near common segment 5 would be outside the radius of influence of the proposed new water wells. Where the closest existing well or spring to a proposed new well was found to be located more than 2.4 kilometers (1.5 miles) away from that proposed new well location, no quantitative impacts analysis calculations were completed.

4.2.6.2.2.11 Oasis Valley Alternative Segments. A potential concern in this area is that shallow groundwater, if used for meeting ***potable water*** needs at a rail siding, construction camp, or quarry, could have elevated fluoride levels. However, deeper groundwater northeast of Beatty could be of higher quality.

Table 4-67. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – common segment 5.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
SaF4	>1.60 (well)	0.48	0.81
SaF5/9	>1.60 (well)	0.39	0.68
SaF7/11	1.21 (well)	0.36	0.63
OV24/25/26	>1.60 (well)	0.31	0.38

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.

Figure 3-82 shows the approximate locations of proposed new water wells within the Oasis Valley alternative segments 1 and 3 construction rights-of-way. Specific siting and use considerations for new wells that would be installed along this portion of the rail alignment are summarized below. Impacts to existing springs in this area (Section 3.2.6.3.11) would be eliminated by the following strategies.

For Oasis Valley alternative segment 1, up to three proposed new wells at locations OV3 and OV4, and up to two new wells at location OV5, sited within valley-fill alluvial materials, could be used to obtain water needed to support rail line construction. Alternatively, or in combination with these wells, a series of alternate wells approximately 7.2 kilometers (4.5 miles) northwest of proposed well location OV4 (at locations OV24, OV25, and OV26 on Figure 3-82), would also be used to supply water, for the same purpose, to a rail alignment water-demand location in the vicinity of proposed well locations OV3, OV4, and OV5. Locations OV24 through OV26 would be within the proposed rail alignment construction right-of-way, and in valley-fill alluvium. A series of springs on the Upper Oasis Valley Ranch (DIRS 169384-Reiner et al. 2002, Figure 7) are within approximately 1 kilometer (0.6 mile) of proposed well locations OV3, OV4, and OV5. Section 3.2.5, Surface-Water Resources, discusses other springs in this area. Wells at locations OV3, OV4, and OV5 would be between approximately 15 and 30 meters (50 and 100 feet) deep, while wells at locations OV24, OV25, and OV26 would be between approximately 30 and 46 meters (100 and 150 feet) deep (DIRS 176189-Converse Consultants 2006, Appendix B). For a 4-year construction schedule, the total combined withdrawal rate for wells at locations OV3 and OV4, taken together with that for alternative wells at locations OV24 and OV25, would be approximately 410 liters (approximately 110 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). For the same schedule, the total combined withdrawal rate for wells at locations OV5, together with that for alternative wells at location OV26, would be approximately 150 liters (approximately 40 gallons) per minute. The total required water production would be divided between these well locations (Figure 3-82).

For Oasis Valley alternative segment 3, up to two proposed new wells at locations OV13, sited at the same location as OV5 under Oasis Valley alternative segment 1, could be used to obtain water needed to support railroad construction. Alternatively, or in combination with these wells, up to two alternate wells at location OV24, sited at the same location as OV24 under Oasis Valley alternative segment 1 (Figure 3-82), would also be used to supply water to a rail alignment water-demand location in the vicinity of proposed well location OV13. Wells at these locations would have the same depth as the corresponding wells at these locations under Oasis Valley alternative segment 1. For a 4-year construction schedule, the total combined withdrawal rate for wells at location OV13, taken together with that for alternative wells at location OV24, would be approximately 340 liters (approximately 89 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). The total required water production would be divided between these well locations (Figure 3-82).

Analysis results (see Table 4-68) indicate that pumping groundwater from wells at locations OV3, OV4, and OV5, under the Oasis Valley alternative segment 1, and pumping from wells at location OV13, under Oasis Valley alternative segment 3, would need to be limited to a total withdrawal rate of approximately 76 liters (approximately 20 gallons) per minute or less at each location, under each alternative segment, to preclude possible reductions in discharge rates and water quality at the Upper Oasis Valley Ranch springs. The remaining water needed to support construction activities in this portion of the rail alignment would be obtained from proposed alternate well locations OV24, OV25, and/or OV26. For Oasis Valley alternative segment 1, the total combined net production that would be met through the use of wells at alternate well locations would be approximately 340 liters (89 [109 + 40 – 20 – 20 – 20] gallons) per minute. For Oasis Valley alternative segment 3, the total combined net production from wells at location OV24 would be approximately 260 liters (69 [89 – 20] gallons) per minute.

Table 4-68. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Oasis Valley alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[b] per minute pumping rate (kilometers)
OV3/4/5	0.64 (spring)	0.28	Not applicable[c]
OV9	1.5 (spring)	0.18	0.64
OV12/18/19/20/21	0.96 (spring)	0.56	0.61
OV6/8/14/16	1.32 (spring)	0.49	0.64

a. To convert kilometers to miles, multiply by 0.62137.
b. Base-case pumping rate was limited to 76 liters per minute.
c. No calculation was completed for reasons stated in text.

Evaluation of the effects of proposed groundwater withdrawals from proposed wells at locations OV12, OV17, OV18, OV19, and OV20 for Oasis Valley alternative segment 3 indicate that there would be no expected impact to known existing springs or wells in the Oasis Valley area.

Existing UGSG NWIS wells (OVU-Dune Well, OVU-Middle ET Well, OVU-Lower ET Well, and Well ER-OV2) within approximately 0.32 to 0.48 kilometer (0.2 to 0.3 mile) of the proposed new wells at locations OV3, OV4, and OV5 on Oasis Valley alternative segment 1 (see Section 3.2.6.3.11) are shallow groundwater monitoring wells owned and installed by the U.S. Geological Survey. All of these wells have no current or projected beneficial use and are used solely for monitoring purposes. An existing well cluster of UGSGS NWIS wells (ER-OV-01, ER-OV-06a, and ER-OV-6a2) is approximately 1.9 kilometers (1.2 miles) northeast of the proposed new wells at location OV20/OV21 on Oasis Valley alternative segment 3. These are also shallow groundwater monitoring wells owned and installed by the U.S. Geological Survey. These wells have no current or projected beneficial use and are used solely for monitoring purposes.

Alternatively, for Oasis Valley alternative segment 1, up to four proposed new wells could be installed at proposed alternative well locations OV6 and OV8 west of the Amargosa River in the Oasis Valley area (see Section 3.2.6.3.11 and Figure 3-82). Under Oasis Valley alternative segment 3, these alternate well locations are designated OV14 and OV16, but the wells would have the same characteristics and same required withdrawal rates. These alternate wells would support earthwork construction and would be between 30 and 46 meters (100 and 150 feet) deep. The total combined required withdrawal rate for this set of wells would be approximately 510 liters (136 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). Analysis results (see Table 4-68) indicate that pumping groundwater from these wells at the full required base-case withdrawal rates would not be expected to impact discharge rates and/or water quality at a group of springs (identified in records as Ute Springs and Manley Springs) approximately 0.64 kilometer (0.4 mile) to 0.97 kilometer (0.6 mile) east of the OV14 and OV16 locations.

For two proposed new well locations associated with the Oasis Valley alternatives portion of the alignment, the targeted water zone is a possibly water-bearing detachment fault system (DIRS 176189-Converse Consultants 2006, Appendixes A and B and Maps 14a and 14b). A proposed well location (OV7 or OV15, depending on alternative segment) could be installed in the southern portion of hydrographic area 228, within the typical maximum 300-meter (1,000 foot)-wide construction right-of-way of common segment 6 (Figure 3-82). A new well (see Section 3.2.6.3.11 and Figure 3-82) might be installed in the southern part of the Oasis Valley hydrographic area near the area boundary, approximately 0.8 kilometer (0.5 mile) west of common segment 6 (well location OV22 or OV23, depending on alternative segment). The target water source at this location would be a possibly water-bearing detachment fault system (DIRS 176189-Converse Consultants 2006, Appendix B). There are no known existing wells or springs within approximately 10 kilometers (6 miles) of either of these proposed well locations that are known to be associated with the same fault system as either of these proposed well locations or potentially related major fault zones, should these wells be used for obtaining water required at corresponding water-demand stations along the rail alignment.

4.2.6.2.2.12 Common Segment 6 (Yucca Mountain Approach). Figure 3-82 shows the approximate locations of proposed new wells along common segment 6. There are approximately 1.4 million cubic meters (1,147 acre-feet) and approximately 72,000 cubic meters (58 acre-feet) of annual committed groundwater resources in hydrographic areas 229 and 227A, respectively. There are approximately 101,000 cubic meters (82 acre-feet) of documented pending annual duties for area 229 and approximately 6,170 cubic meters (5 acre-feet) of pending annual duties for area 227A. Tables 3-35 and 4-60 indicate that water withdrawal required within hydrographic area 229 for construction of common segment 6 would exceed the estimated annual perennial yield for that hydrographic area. However, except for smaller-magnitude water requirements (on the order of 3.8 liters [1 gallon] per minute) associated with a proposed rail siding (DIRS 176189-Converse Consultants 2006, Table 2-1) and a proposed construction camp (approximately 76 liters [20 gallons] per minute), water requirements for common segment 6 would be required for only 9 months (DIRS 176189-Converse Consultants 2006, Appendix A).

There are 14 existing USGS NWIS wells, no NDWR wells with water rights, no NDWR domestic wells, and no springs within approximately 1.6 kilometers (1 mile) of common segment 6. DOE proposed up to two new water wells at location CF4. These wells would furnish water for earthwork compaction and would be between approximately 370 and 460 meters (1,200 and 1,500 feet) deep. Although there is one USGS NWIS well approximately 1.4 kilometers (0.9 mile) northeast of this location, that well is a groundwater test/monitoring well (NC-EWDP-18P) installed to test subsurface characteristics and monitor groundwater conditions downgradient of the Yucca Mountain repository site. This well has no current or projected beneficial use, and is only for monitoring purposes (DIRS 176600-Converse Consultants 2005, Plate 4-2 and Appendix A; and DIRS 176808-Nye County Nuclear Waste Repository Project Office 2002, all).

As shown in Table 3-35, the perennial yield for the western two-thirds of hydrographic area 227A is approximately 7210,000 cubic meters (580 acre-feet) and committed groundwater resources are very low.

Appropriations for new wells could be pursued in this area to meet construction-water demand for the proposed operations support facilities inside the Yucca Mountain Site boundary.

Water required for railroad construction and operations through area 227A would be acquired as part of the water inventory of approximately 530,000 cubic meters (430 acre-feet) per year proposed for appropriation in area 227A to support construction and operation of a repository at Yucca Mountain. The total estimated water demand for construction of the portion of common segment 6 within area 227A is approximately 710,000 cubic meters (572 acre-feet). Water requirements associated with the construction and operation of proposed rail facilities in area 227A are described in Section 4.2.6.2.1. If the amount of water required to support rail construction and operations exceeds the current amount proposed for appropriation, the schedule for railroad construction or for water acquisition could be modified to reduce peak water demands, or an additional temporary water appropriation for rail construction could be sought (DIRS 176189-Converse Consultants 2006, p. 15).

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results indicate that existing wells and springs near common segment 6 would be outside the radius of influence of the proposed new water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

4.2.6.3 Operations Impacts

Overall, potential impacts to groundwater resources from operating the rail line from Caliente to Yucca Mountain under the Proposed Action would be small.

Rail line operations facilities would need water for daily operation. However, other than relatively limited water quantities required for maintaining fire protection water-tank reserves at rail sidings and meeting relatively low water needs for operations personnel at selected facility locations along the rail line, there would be no continued need for any large-scale production wells once construction of the railroad is completed. Possible changes to recharge characteristics, if any, in the areas of railroad operations and support facilities would be the same as those at the completion of construction of the rail line.

There would be no impacts to groundwater resources from disposal of wastewater (see Section 4.2.11, Utilities, Energy, and Materials).

4.2.6.4 Impacts under the Shared-Use Option

Impacts to groundwater under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. Under the Shared-Use Option, additional commercial rail sidings would be constructed as a third track alongside passing sidings (Figure 2-55). The total length of commercial rail sidings would be relatively small compared to the total length of the rail line. Therefore, under the Shared-Use Option, water needs for construction of the rail line would increase only by approximately 150,000 cubic meters (119 acre-feet).

The commercial sidings would likely be in the Caliente, Panaca/Bennett Pass, Warm Springs Summit, Tonopah, Goldfield, and Beatty/Oasis Valley areas. For purposes of analysis, DOE assumed that the commercial sidings would be in the same hydrographic areas as analyzed for the Proposed Action without shared use. Impacts would be similar to those described for the Proposed Action without shared use; additional impacts to groundwater resources in these areas would be small.

The commercial-only facilities that would be constructed under the Shared-Use Option would likely be close to DOE-owned and -operated rail facilities and would likely overlie the same hydrographic areas identified for the Proposed Action without shared use. Overall, the impacts would be similar to those described for the Proposed Action without shared use and would be small.

Impacts to groundwater under Shared-Use Option operations would be similar to those identified for operations under the Proposed Action without shared use (Section 4.2.6.2). Use of the completed rail line from Caliente to Yucca Mountain, including any additional sidings, would have a small impact on groundwater resources. There would be no continued need for water along the additional sidings, and possible changes to recharge, if any, would be the same as those at the completion of construction.

The commercial-only facilities would require water for daily operation. Water demand to operate these facilities has not been determined, but DOE assumes this demand would be small. Therefore, the additional impacts to groundwater resources would likely be small and overall would be similar to those described for the Proposed Action without shared use.

4.2.6.5 Summary

This section summarizes and characterizes potential impacts to groundwater resources from constructing and operating the proposed railroad along the Caliente rail alignment. The potential for impacts to groundwater resources resulting from physical disturbance of the ground surface during the construction phase would be small. Proposed groundwater withdrawals would locally affect groundwater flow patterns and groundwater availability. Impacts on downgradient groundwater basins (hydrographic areas) due to the proposed groundwater withdrawals would be very small. Impacts on groundwater resources due to groundwater withdrawals at proposed quarry locations and rail facility locations would also be very small. DOE would implement best management practices as part of the Proposed Action to avoid, minimize, or otherwise reduce impacts to groundwater resources. Chapter 7 identifies best management practices and potential mitigation measures.

For the case of groundwater withdrawals from proposed wells to support a 4-year rail construction schedule, analysis results (see Tables 4-61 through 4-68) indicate that, based on anticipated hydrogeologic conditions, existing known productive wells or springs are not expected to fall within the radius of influence of the proposed new wells. The proposed groundwater withdrawal at each new withdrawal well would create a drawdown feature in the portion of the ***saturated zone*** immediately surrounding that well, locally affecting groundwater flow patterns and water availability in the portion of the aquifer immediately surrounding the well. The effects in each case where projected average withdrawal rates are assumed to occur at the proposed well locations would be limited in extent to a maximum horizontal distance of approximately 0.8 kilometers (approximately 0.5 mile) or less in a few instances and generally a much smaller distance. Sensitivity analysis results indicate that the effects in each case where it is assumed that a hypothetical maximum withdrawal rate of 852 liters (225 gallons) per minute might be imposed at each proposed well location would be limited in extent to a maximum horizontal distance of approximately 1.2 kilometers (approximately 0.75 mile) or less.

Analysis results (see Tables 4-61 through 4-68) indicate that certain restrictions or use prohibitions would need to be factored into the final siting and use of some specific proposed new groundwater well locations in some cases (mostly with respect to potential higher well-withdrawal scenarios). Specific locations falling into this category are selected proposed well locations in the Oasis Valley hydrographic area (OV3, OV4, and OV5/OV13), Meadow Valley Wash/Panaca Valley hydrographic area (proposed well locations PanV3/6, PanV5, Pan V7/PanV8, PanV26, and possibly location PanV4), and Hot Creek Valley hydrographic area (proposed well location HC5) in order to preclude potential impacts on existing groundwater resources. The resources that have potential to be affected if such restrictions or use prohibitions were not followed include springs (locations OV3, OV4, OV5/13, and HC5) or existing wells (all other locations).

Wells having the largest withdrawal rates would be expected to be those that are designed for use as supply wells for earthwork compaction; groundwater withdrawals from these wells would occur over a period of less than 1 year (typically over a 9-month pumping period). For a longer rail construction schedule (up to 10 years), groundwater withdrawal rates from new wells would be the same or less than those estimated in this section. For this longer schedule, the magnitude of potential impacts to existing groundwater users from groundwater withdrawals would be equal to or less than that determined for the 4-year railroad construction schedule.

Analysis results indicate that the effects of groundwater withdrawals from the proposed wells at the range of withdrawal rates that could be required for the project would be localized in nature and extent. The impacts caused by the majority of water withdrawals and the wells having the highest production rates (those associated with construction of the rail roadbed) would be short term in duration. Additionally, for those areas where proposed new water wells would be near a boundary between adjacent hydrographic areas, downgradient hydrographic areas would not be likely to be affected by the proposed groundwater withdrawals because (1) there are no identified existing groundwater users associated with the downgradient groundwater basins within 1.6 kilometers (1 mile) of any of these proposed well-water withdrawal locations, and (2) available hydrogeologic information indicates that significant inter-basin groundwater (under)flow is not occurring in the areas downgradient of the proposed well locations.

DOE compared hydrogeologic conditions and required groundwater withdrawal durations and proposed groundwater withdrawal rates for new wells required for the Proposed Action to hydrogeologic conditions and groundwater withdrawal rates and pumping durations that have occurred at certain locations in the western United States where ground subsidence has been observed as a result of prolonged, large-scale groundwater withdrawals. Comparison results indicate that the potential for ground subsidence to occur as a result of proposed groundwater withdrawals in the hydrographic areas the Caliente rail alignment would cross would be small, both during the construction phase and the operations phase.

Section 5.2.1.3.2 provides information about pending applications for proposed large groundwater development projects in the Caliente rail alignment cumulative impacts region of influence.

Table 4-69 summarizes potential impacts to groundwater resources from constructing and operating the proposed railroad along the Caliente rail alignment.

Table 4-69. Summary of potential impacts to groundwater resources - Caliente rail alignment.

Resource	Proposed Action or Shared-Use Option
Groundwater availability and uses	*Construction* - Analysis results indicate that proposed groundwater withdrawals would locally affect groundwater flow patterns and water availability in the portion of the aquifer immediately surrounding each new withdrawal well. The effects in each case where projected average withdrawal rates are assumed to occur at the proposed well locations would be limited in extent to a maximum horizontal distance of approximately 0.8 kilometer (approximately 0.5 mile) or less in a few instances and generally a much smaller distance. Sensitivity analysis results indicate that the effects in each case, where it is assumed that a hypothetical withdrawal rate of 852 liters (225 gallons) per minute might be imposed at each proposed well location, would be limited in extent to a maximum horizontal distance of approximately 1.2 kilometers (approximately 0.75 mile) or less. Proposed groundwater withdrawals at selected proposed well locations in the Panaca Valley (PanV5, PanV26, PanV3/6, PanV7/8, and possibly PanV4), and Oasis Valley hydrographic areas (OV3, OV4, and OV5/13), could, if unmitigated, impact existing groundwater users or existing groundwater resources during the construction phase, if base-case average pumping rates (locations PanV26, OV3, OV4, and OV5/13) or average pumping rates of approximately 852 liters (225 gallons) per minute (all of the listed locations) were assumed to be applied at the new well locations. Hydrogeologic effects resulting from use of the proposed new wells for supporting rail roadbed construction would be temporary in nature. *Construction and Operations* - Physical impacts to existing groundwater resource features such as existing wells or springs resulting from railroad construction and operation would be small. *Operations* - Owing to the very small groundwater withdrawal rates needed to support railroad operations, potential impacts to groundwater resources from operating the railroad from Caliente to Yucca Mountain would be small.
Ground subsidence	*Construction* - The temporary duration of the vast majority (approximately 90 percent) of the total groundwater withdrawals required for railroad construction indicate that the potential for the proposed groundwater withdrawals to cause subsidence of the ground surface is small. *Operations* - Owing to the very small groundwater withdrawal rates needed to support railroad operations, the potential for the groundwater withdrawals needed to support railroad operations to cause subsidence of the ground surface is small.
Groundwater quality	*Construction and Operations* - The impact to groundwater resources of contaminants that might be released by construction equipment during railroad construction or operation would be small because of generally deep groundwater depths beneath most of the alignment. *Construction and Operations* - The impact of proposed groundwater withdrawals on groundwater quality would be small. The proposed withdrawals would not conflict with water quality standards protecting groundwater resources.