PUBLIC UTILITIES COMMISSION OF THE

STATE OF CALIFORNIA

In the Matter of the Application of SOUTHERN CALIFORNIA EDISON COMPANY (U 338-E) for a Permit to Construct Electrical Facilities With Voltages Between 50kV and 200 kV: Ivanpah-Control Project.	Application No. 19-07-xxx (Filed July 17, 2019)

PROPONENT'S ENVIRONMENTAL ASSESSMENT IVANPAH-CONTROL PROJECT

VOLUME 4 (CHAPTER 4, 4.5-4.10)

BETH A. GAYLORD
ROBERT PONTELLE

Attorneys for
SOUTHERN CALIFORNIA EDISON COMPANY

2244 Walnut Grove Avenue
Post Office Box 800
Rosemead, California 91770
Telephone: (626) 302-6025
E-mail: robert.pontelle@sce.com

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4.5 Cultural Resources

This section identifies cultural and paleontological resources along the IC Project Alignment, identifies applicable significance thresholds, assesses the Full-Rebuild Concept's impacts to these resources and their significance, and recommends measures to avoid or substantially reduce any effects found to be potentially significant.

Cultural resources are defined as any object or specific location of past human activity, occupation, or use that is identifiable through historical documentation, inventory, or oral evidence. Cultural resources can be separated into three categories: archaeological, building/structural, and traditional resources. Archaeological resources include prehistoric and historic remains of human activity. Prehistoric resources can be composed of lithic scatters, ceramic scatters, quarries, habitation sites, temporary camps/rock rings, ceremonial sites, and trails. Historic-era resources are typically those that are 50 years or older. Historic archaeological resources can consist of structural remains (e.g., concrete foundations), historic objects (e.g., bottles and cans), features (e.g., refuse deposits or scatters), and sites (e.g., resources that contain one or more of the aforementioned categories). Built environment resources range from historic buildings to canals, historic roads and trails, bridges, ditches, cemeteries, and electrical infrastructure, such as transmission lines, substations, and generating facilities. A traditional cultural resource is a resource associated with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community. They are rooted in a traditional community's history and are important in maintaining the continuing cultural identity of the community. See Section 4.18, Tribal Cultural Resources, for a discussion on cultural resources of potential importance to California Native American tribes.

A paleontological resource is a locality containing vertebrate, invertebrate, or plant fossils (e.g., fossil location, fossil-bearing formation, or a formation with the potential to bear fossils). Paleontology is the study of life from the geologic past that involves the analysis of plant and animal fossils, including those of microscopic size, and their relationships to existing environments and the chronology of the earth's history.

4.5.1 Cultural Resources Environmental Setting

The IC Project area of potential effects (APE) is situated along approximately 358 miles (576 kilometers) of subtransmission line starting southwest of Bishop, California, and extending across Inyo, Kern, and San Bernardino counties. Elevation of the project area ranges from 920 to 4,813 feet (280 to 1,467 meters) above mean sea level (amsl).

4.5.1.1 Physical Setting

The project area spans three geographical regions of California with distinct environmental settings: the eastern Sierra Nevada, southwestern Great Basin/Mojave Desert, and eastern California High Desert region.

4.5.1.1.1 Eastern Sierra Nevada

The Sierra Nevada is characterized by a sharp, steep eastern slope and a gently sloping western side. The bedrock of the mountain ranges is primarily sedimentary rock from the Precambrian to Cenozoic, with some Mesozoic volcanic rock and granitic plutons. The eastern slope of the Sierra Nevada is shadowed by the mountain crest and has low annual precipitation; its foothills generally have warm, dry summers and cool, wet winters. Summer temperatures are generally mild with high temperatures around 29 degrees Celsius (°C; 85 degrees Fahrenheit [°F]). Winters are relatively cold with average highs around 4.4 °C (40°F) and average lows around −3°C (28°F). Annual precipitation averages are less than 41 cm (16 inches; U.S. Climate Data 2017). Vegetation in the area consists mainly of sagebrush scrub, Sierra juniper, lodgepole pine, Jeffrey pine, and a variety of grasses and annual forbs (Barbour et al. 2007:456). Wildlife in the area include deer, coyote, rabbit, and chipmunk. River valleys connect the foothills to high-altitude passes, which provided corridors for movement between the western and eastern slopes and allowed Native Americans to trade goods in the mountain passes.

The landscape of the Sierra Nevada range is a testament to the tectonic and climatic forces that formed it. Pleistocene glaciation was considerable and extended up to 30 km (18.6 miles) down the steep canyons of the eastern escarpment (Millar and Woolfenden 2016:140). Precipitation and runoff filled lakes, such as the large, pluvial Mono and Owens lakes; the latter reached a high stand after 8,000 years before the present (BP; Bacon et al. 2006). Postglacial vegetation included prevalent juniper and subalpine conifers on low slopes and in the southern Owens Valley, at lower treelines than the present day, and winterfat (Krascheninnikovia lanata), rabbitbrush, spiny hopsage (Grayia spinosa), and wolfberry spread into lower-lying basins (Millar and Woolfenden 2016:147).

Owens Lake was a superficial, highly saline lake in a closed basin during the middle and late Holocene (Benson et al., 1997; Li et al., 2000; Smith et al., 1997). Bristlecone pine, pinyon-juniper woodland, and other montane forest species advanced and retreated on the slopes of the eastern Sierras with the changing climate. In the Inyo Mountains, modern vegetation was established at lower elevations by about 2,000 years ago (Jennings and Elliott-Fisk 1993; Koehler and Anderson 1995; Reynolds 1996). Construction of the Owens River–Los Angeles aqueduct led to large-scale diversion of water from the Owens Valley in 1921, and the eventual desiccation of Owens Lake.

4.5.1.1.2 Southwestern Great Basin/Mojave Desert

4.5.1.1.2.1 The Great Basin

The Great Basin, or Basin and Range province, follows the eastern boundary of the state in the extreme northeastern corner adjacent to the Modoc Plateau and east of the Sierra Nevada. Elevations along the province range from 300 to 4,300 m (1,000 to 14,200 feet) above msl. This province covers a vast area of land from the Cascade Range and Sierra Nevada in California to the Rocky Mountains in Colorado. Topography of the Basin and Range is defined by a series of parallel north-south–trending fault-block ranges and intervening basins. The Surprise and Owens valleys in California display typical characteristics of the Basin and Range province. Streams drain into basins and end in saline lakes or sinks with no hydrologic connection to the ocean or other major rivers. The arid climate of the land affected the settlement and subsistence patterns of prehistoric and ethnohistoric as well as historic populations, although prior to 7,500 years ago, lakes and grasslands dominated the landscape and provided a lush environment for hunter-gatherers.

Vegetation communities include scrublands and grasslands with coniferous forests and woodlands at higher elevations and some riparian woodlands and wetlands around lakes and major streams (Miles and Goudey 1998). Typical mammals that occur in these habitat types include mule deer, desert bighorn sheep, desert kit fox, mountain lion, bobcat, coyote, jackrabbits, chipmunks, spotted skunk, spotted bat, ground squirrels, kangaroo rat, and white footed mouse. Historically, pronghorn and mountain sheep were common in this province. More recently, pronghorn have become limited to a few reintroduced herds, and mountain sheep can be found on a few high mountains. Birds include eagles, hawks, owls, northern goshawk, nighthawks, common poorwill, quail, roadrunners, finches, warblers, orioles, sage grouse, sparrows, and gnatcatchers. Reptiles include desert tortoise, chuckwalla, sagebrush lizard, desert horned lizard, western fence lizard, and several species of rattlesnakes.

The paleoenvironment of the Great Basin was similar to that of the Mojave Desert (see below).

4.5.1.1.2.2 Mojave Desert

The Mojave Desert, found in the southwestern Great Basin, is a vast province covering approximately 50,000 square kilometers (19,305 square miles) in the southeastern portion of the state. This arid desert is surrounded by the Sierra Nevada, Transverse Ranges, Peninsular Ranges, and the desolate Yuma and Colorado deserts. Elevations in the Mojave Desert range from 85 meters below msl to 2,400 meters above msl (280 feet below msl to 7,900 feet above msl; Miles and Goudey 1998). Desert playas, or dry lakes, collect runoff after rainstorms and provide evidence of historic lakes that provided water sources for prehistoric people. Small hills occur throughout the Mojave Desert, and prominent ranges are more common to the east near the Colorado River. Intermittent streams occur throughout the desert and carry water following major rain events.

Vegetation communities in the arid Mojave Desert include coniferous woodlands, riparian woodlands, desert scrublands, and occasionally wetlands in moist areas (Miles and Goudey 1998). The Mojave Desert is the only place where Joshua trees are naturally occurring. Typical mammals that occupy these habitat types include desert bighorn sheep, desert kit fox, coyote, spotted skunk, spotted bat, black-tailed jackrabbit, ground squirrels, kangaroo rat, and white footed mouse. Common birds include eagles, hawks, owls, quail, roadrunners, finches, warblers, and orioles. Typical reptiles include desert tortoise, several species of rattlesnakes, and chuckwalla.

The Mojave River, the largest hydrological feature in the Mojave Desert, crosses tectonic basins that were filled, lacustrine environments during the Pleistocene (Enzel et al. 2003). The Mojave River is thought to have flowed to its terminus at the current Silver Lake Playa, forming a delta during the late Quaternary period. At the close of the Pleistocene, temperatures appear to have increased with little concurrent change in the amount of precipitation. This climatic regime resulted in increased runoff due to glacial melting, filling valleys and basins with streams, marshes, and lakes. These pluvial lakes and marshes were surrounded by desert vegetation typical of later time periods, such as white bursage and later the creosote bush (Grayson 1993:199–200), and some low-elevation locales retained juniper and sagebrush habitats.

Climate was still highly variable during the middle Holocene, with multiple oscillations between wetter and drier conditions occurring throughout. In addition, although the lakes and marshes of the early Holocene dried up, streams and springs in the Mojave Desert may have still maintained water flow from nearby ranges at various times and places. The climate of the prehistoric late Holocene was similar to that of today, with cooler and moister conditions than the middle Holocene. As with the middle Holocene, the climate was relatively variable: many lakes rose to their high stands, but lake levels fluctuated, at times dramatically, throughout the period. By the beginning of the late Holocene, most plant communities had taken on their modern distributions.

4.5.1.1.3 Eastern California High Desert

The eastern California high desert region includes part of the Salton Trough, a sediment-filled structural basin that lies within the Basin and Range physiographic province in southern California. The Salton Trough has received a continuous influx of sand, silt, and clay derived from the Colorado River, which created ephemeral lakes in the basin until about 300 years ago (Morton 1977). The area is one of the hottest and driest regions of California, characterized by temperate winters and hot, dry summers; large daily temperature swings; scant precipitation; high evaporation rates; low relative humidity; and abundant sunshine. Summer high temperatures can reach up to 48.8°C (120°F), and annual rainfall is less than 7.6 cm (3 inches; Arizona-Sonora Desert Museum 2010). Most precipitation falls in the winter and spring months with occasional monsoonal thunderstorms (California Department of Water Resources [CDWR] 2009).

Vegetation consists primarily of Sonora–Mojave Creosotebush–White Bursage Desert Scrub. The dominant species is creosote bush, with quail brush co-dominant in some northern areas. Other species present include white bursage, brittlebush, and western honey mesquite. Larger drainageways and washes support small trees and shrubs that may also occur in adjacent areas, such as western honey mesquite, ironwood, and blue palo verde. Shrub species found in minor drainages include catclaw acacia, burrobrush, Anderson thornbush, and desert broom (Turner and Brown 1994). Resident species consist primarily of birds, reptiles, and smaller mammals. Reptile species present include the Colorado fringe-toed lizard, gophersnake, and Mojave rattlesnake. Raptor species include burrowing owl and ferruginous hawk, whereas upland game birds include Gambel's quail and mourning dove. Other small game and furbearer species include the black-tailed jackrabbit, bobcat, coyote, desert cottontail, round-tailed ground squirrel, and white-tailed antelope squirrel (California Department of Fish and Game 2008). The paleoenvironment of the Eastern California High Desert was similar to that of the Mojave Desert (see section 4.5.1.1.2).

4.5.1.2 Prehistoric Background

Although the IC Project Alignment spans three geographic regions (the eastern Sierra Nevada, southwestern Great Basin/Mojave Desert, and eastern California High Desert), the cultural setting of the IC Project Alignment can be described through attributes and chronology relevant to the Great Basin and Mojave Desert cultural area.

4.5.1.2.1 Overview of the Great Basin/Mojave Desert Cultural Area

The prehistory of the Great Basin area is varied and rich, encompassing a period of more than 12,000 years before present (BP). Numerous chronological sequences have been devised to explain cultural changes for areas within the eastern California segment of the Western Great Basin (Basgall and Giambastiani 1995; Basgall and McGuire 1988; Bettinger 1976, 1991; Bettinger and Taylor 1974; Delacorte 1990). Further study is needed to account for a varied and somewhat complicated archaeological record, but differences between these classifications are based primarily on terminology, and there is general agreement on the timing of transitions established through the association of radiocarbon dates and projectile point types (Halford 2008). Following Giambastiani (2004) and consistent with Mojave Desert culture history presented by Sutton et al. (2007), the following sequence uses geologic periods—Late Pleistocene, Early Holocene, Middle Holocene, and Late Holocene—to capture changes in cultural complexes, whereas more local sources (Bettinger and Taylor 1974) are also incorporated where possible. The regional prehistoric cultural chronology is summarized below in Table 4.5-1 and described in more detail below.

Table 4.5-1: Prehistoric Cultural Chronology

Period	Key Characteristics	Date Range
Late Pleistocene	Fluted projectile point technology Focus on hunter-gatherer subsistence strategies	ca. 12,000– 10,000 years BP
Early Holocene	Subsistence strategies become more diverse Heavy stemmed projectile points Broad-ranging subsistence strategies	10,000–7,500 years BP
Middle Holocene/ Little Lake	Diversified tool kit marked by emergence of Pinto complex Exploitation of high- and low-ranked resources Lower population densities	7,500–5,500 years BP
Late Holocene/ Newberry, Haiwee, and Marana	Increased use of bow and arrow Newberry period marked by higher mobility and extensive trade networks Haiwee period marked by increased sedentism and sociopolitical elaboration Marana period indicated by the introduction of pottery, reflecting the intensive exploitation of micro-habitats	3,500 years BP–Contact

4.5.1.2.2 Late Pleistocene (ca. 12,000–10,000 Years BP): Paleoindian or Mohave Period

Most of the earliest evidence for human presence in this region is found further south in the Mojave Desert, Owens Lake, and western Nevada (Giambastiani 2004:32). A firm date for the initial human occupation of the Mojave Desert has not yet been established. Although there have been several controversial claims of Pleistocene-age (pre-Clovis) finds such as the Early Man Site of Calico Hills (Leakey et al. 1968, 1972), most archaeologists remain unconvinced by available data. The growing acceptance of evidence for pre-Clovis occupations elsewhere in the Western Hemisphere, however, suggests the possibility that such evidence may yet be found in this region as well.

The earliest broadly accepted cultural complex in the Mojave Desert is the Clovis complex (Sutton et al. 2007:233). The hallmark artifacts of this complex are large, lanceolate bifaces with distinctive fluting, used to thin and flatten the base for hafting. Other tools associated with the Clovis complex were large side scrapers, blades struck from prepared cores, and a mixture of expedient flaked tools (Justice 2002:73). Paleoindian populations associated with fluted point technology consisted of small, mobile groups who hunted and gathered near permanent sources of water such as pluvial lakes. In the vicinity of the project APE, Basgall (1988) reported one Paleoindian site in west-central Long Valley to the northwest, whereas Hall (1991) reported two sites on the northwestern margin of the Mono Basin. These sites are typically identified by the presence of fluted point base and stemmed points that tend to occur as small surface scatters surface finds (Elston and Budy 1986), which Delacorte et al. (1995) speculate is related to specific taphonomic processes. Where more diverse assemblages are associated with sites in this time period, bifaces and formally shaped unifacial flaked tools are often found (Giambastiani 2004:34). These associations generally support the characterization of early hunter-gatherer populations as highly mobile and small groups ranging over large areas with specialized tool kits (Delacorte et al. 1995; Kelly and Todd 1988), further evidenced by the distance and source variation in tool stone (Basgall 1989). Milling implements are rarely found, which further supports the conclusion that groups of this period were focused on hunting (or at least scavenging). Others have suggested the diverse resource base in the Great Basin would have resulted in greater variability in resource acquisition and adaptive strategies (Fowler and Fowler 1990), although still falling within the general pattern of the mobile hunter-gatherer (Halford 2008:22).

4.5.1.2.3 The Early Holocene (10,000–7,500 Years BP): Mohave Period

The communities living in the western Great Basin witnessed and were profoundly affected by great environmental changes during the gradual Pleistocene–Holocene transition. Temperatures became warmer but remained cooler and moister than today. The Mojave Desert became marked by shallow lakes and marshes that were biologically very productive. These were surrounded by desert vegetation typical of later time periods, most prominently the white bursage and later the creosote bush (Grayson 1993:199–200). Some low-elevation locales retained juniper and sagebrush habitats. By the Early Holocene, warmer temperatures, reduced precipitation, and the eventual dehydration of the pluvial lakes are believed to have led to irregularities in the distribution and abundance of resources (Sutton et al. 2007:237). These climatic changes created the need for a more diversified subsistence strategy; the archaeological pattern associated with this adaptation is known as the Mohave period or Lake Mojave complex, and it is recognized by the heavy, stemmed projectile points of the Great Basin Stemmed series such as Lake Mojave and Silver Lake. Other tools include bifaces, steep-edged unifaces, crescents, the occasional cobble-core tool, and, rarely, ground stone implements (Justice 2002:91). This tool kit represents a generalized adaptation to highly variable terrain. For example, the crescent likely served multiple functions, including use as a spear tip to hunt waterfowl (Justice 2002:116). Work at Fort Irwin in the central Mojave Desert with sites containing stemmed points has shown a significant variety of material sources, bifaces and formed flake tools appear to have increased the range of uses, and ground stone appears regularly (Basgall 1991, 1993; Giambastiani 2004:36).

Although the tool kit for groups of this time period were considered an adaptation to lacustrine subsistence strategies, this conclusion was based on several sites discovered near extinct shorelines (Moratto 2004:93). Many of the lakes were no longer constant sources of water during the Holocene, and recent studies have revealed that the people actually occupied terrain outside the margins of the extinct shorelines (Giambastiani and Berg 2008:14). Sutton et al. (2007:237) have noted that the Lake Mojave assemblages included tools that are "consistent with long-term curation and transport." Moreover, it is not uncommon to find exotic materials, such as stone artifacts and marine shell beads, in Lake Mojave cultural deposits, suggesting that Lake Mojave people were either highly mobile or interacted with groups over long distances.

The changing climate, distribution of occupational sites, and the all-terrain tool kit suggest that the inhabitants of the western Great Basin during the Early Holocene developed a broad-ranging subsistence strategy based on patterns of "intensive environmental monitoring" (Sutton et al. 2007:237): the people monitored the seasons and moved in the direction of known resource patches. This includes a focus on hunting small game and a shift away from large mammals (Basgall 1991).

4.5.1.2.4 The Middle Holocene (7,500–5,500 Years BP): Little Lake Period

The Middle Holocene climate, although more arid than previous and subsequent periods, was still highly variable, with multiple oscillations between wetter and drier conditions occurring throughout. In addition, although the lakes and marshes of the Early Holocene dried up, streams and springs in the Mojave Desert may have still maintained water flow from nearby ranges, at various times and places, providing suitable water sources to sustain human activity, albeit at low densities (Aikens 1978; Basgall 2000; Cleland and Spaulding 1992; Sutton 1996; Warren 1984). Between 7,000 and 5,000 years BP, temperatures appear to have risen and aridity appears to have increased, peaking between around 6,000 years BP. Lowland ephemeral lakes and streams began to dry up, and vegetation communities capable of supporting large game animals became limited to a few isolated contexts. Settlement patterns adapted, shifting to upland settings where sources of water still existed (Sutton 1996). This change in land use also correlated with adjustments in tool assemblage content and diversity, resulting in the emergence of the Pinto complex.

Many interpret these diverse artifact assemblages as a response to the climatic shift to more arid conditions. The presence of both hunting tools and milling equipment appears to represent a move from the strict exploitation of high-ranked food items, such as large animals, to a more diversified subsistence strategy that also includes low-ranked resources such as seeds. Near the end of the Middle Holocene the climate became hotter and drier, marked by a period of expanded diet breadth and generally low population densities between 7,500 and 4,500 years BP (Giambastiani 2004:37–38).

4.5.1.2.5 The Late Holocene (3,500 Years BP–Contact): Newberry, Haiwee, and Marana Periods

The climate of the Late Holocene approximates that of today, with cooler and moister conditions than the Middle Holocene, but not as cool and moist as the Early Holocene. As with the Middle Holocene, the climate was highly variable. Many lakes once again rose to high stands, and plant communities took on their modern distribution; however, these lake levels fluctuated, at times dramatically, throughout the period. At least two major themes are drawn from this period: population expansion and intensification and diversification of indigenous adaptive strategies (Giambastiani 2004:38). Native subsistence organization diversifies to include increased use of lower-ranked plant and animal resources; these changes in subsistence strategies are associated with organizational changes in technology, including innovation and diversification. Late Holocene changes in adaptive strategies are also reflected in temporal and spatial shifts in archaeological patterning, as well as increases in the frequency of archaeological sites

(Giambastiani 2004:38). These changes in subsistence, mobility, and technological organization are correlated with adjustments in artifact or tool assemblage content and diversity, resulting in the emergence of three widely recognized cultural historical periods within the Late Holocene, referred to as the Newberry, Haiwee, and Marana periods (Eerkens and Spurling 2008:112–113; Halford 2008:21).

The Newberry period is characterized by higher mobility, extensive trade networks, the use of longer-term residential base camps with substantial structures, and marked increases in obsidian extraction from major regional obsidian quarries, primarily for the production of bifaces and trade (Eerkens and Spurling 2008:112). Production of bifaces appears to have been related to the use of the bow and arrow, in lieu of the atlatl and dart (Giambastiani 2004:38). Shifts in subsistence and settlement appear to correlate with increased exploitation of desert scrub habitats, with more seasonal use of riparian zones (Halford 2008:23). Other evidence for shifting settlement and mobility organizational strategies include higher curation of lithic tools, such as obsidian bifaces and milling equipment (Halford 2008:23). Later in the Newberry period evidence suggests decreases in mobility, along with marked settlement and sociopolitical reorganization becoming more defined in later temporal phases (i.e., Haiwee and Marana periods).

Archaeological patterning during the Haiwee period (1,350–650 years BP) reflects marked increases in sedentism, sociopolitical elaboration, increased use of the bow and arrow and expedient simple flaked tools, subsistence intensification (particularly of small seeds and nuts) and use of micro-habitats and high-altitude sites, and a noted decrease in the exploitation of obsidian quarries (Eerkens and Spurling 2008:113; Halford 2008:23). These notable adaptive changes may have been influenced by the expansion of Uto-Aztecan speakers throughout the Great Basin (Halford 2008:23). During the Marana period (650 years BP to Historic Contact), apparent decreases in residential mobility appear to correspond with shifting technological patterns. Overall reduction in obsidian source variability correlates with changing technological strategies, including decreases in formal biface and tool production, increases in expedient tool production and use, and tool stone scavenging (Halford 2008:23). The production of projectile points, for example, included using flake-core (as opposed to biface-core) reduction strategies to produce flake blanks. A major technological shift during the Marana period included the introduction of pottery (e.g., Owens Valley brownware), reflecting the intensive exploitation of micro-habitats where the focus was on small seed procurement and processing (Eerkens and Spurling 2008:113; Halford 2008:24). Increased densities of ground stone and elaboration of residential structures is also detected during the Marana period. According to Halford (2008:24), evidence indicates an increase in “trans-Sierran sociopolitical interaction,” reflected in the presence of marine shell ornaments. The archaeological patterns of the Marana period appear to correspond well with the ethnographic pattern of Numic speakers (Halford 2008:24).

4.5.1.3 Ethnographic Background

The IC Project Alignment is located within the traditional territory of five ethnographically distinct Native American groups: the Owens Valley Paiute, Western Shoshone, Kawaiisu, Serrano/Vanyume, and Southern Paiute. A brief discussion of each group is presented below; additional detail is provided in the Tribal Cultural Resources section (Section 4.18) of this document.

4.5.1.3.1 Owens Valley Paiute

Prior to the colonization of the Americas by Europeans, the Owens Valley Paiute lived in a narrow valley along the eastern slope of the southern Sierra Nevada. They established settlements along the Owens River and developed a degree of stability and sedentism unparalleled in the Great Basin in pre-Contact times, due ostensibly to the favorable environment that they occupied. They spoke dialects of Mono, which along with Northern Paiute made up the Western Numic segment of the Numic branch of Uto-Aztecan.

The seasonal food-gathering endeavors of the Owens Valley Paiute depended heavily upon the ripening of wild seed and root crops that provided food year-round. They moved as gatherers in the lowlands in spring and summer in large villages. In years with an ample supply of pine nuts many would venture to the uplands during the winter, occupying log dwellings scattered throughout the highlands east and northeast of the valley, where the piñon and Indian ricegrass seed were cached. Steward (1933) lists some 40 plants harvested in Owens Valley, including five species of roots and bulbs, six species of berries, and pine nuts and acorns, as well as other seed crops. The pine nut, which the Owens Valley Paiute called tiba, was an important subsistence resource to this group. Acorns, a more reliable food resource than pine nuts, were even more important, and the Paiute regularly shared in the trans-Sierran acorn economy (Stewart 1941:374, 427). Within this trade economy, the Owens Valley Paiute traded salt and pine nuts for acorns and acorn flour (Gayton 1948:258–259). Hunting, when possible, was fortuitous, especially for individual hunters. Communal hunting was restricted to the home district or to the territorial boundaries of the band. Teams of hunters hunted in the high Sierra, sometimes crossing the summit into Miwok territory (Muir 1916). Occasionally communal drives for mountain sheep or deer with participation from multiple villages occurred in the Sierra and the White Mountains. Antelope were caught in corrals in open areas east of Owens River. As elsewhere in the Great Basin, the rabbit was the most common game. These were taken individually with bow and arrow or traps, as well as in rabbit drives with nets, usually in connection with a fall festival.

Though pottery was a relatively recent technology to the Owens Valley Paiute (about 200 years later than among the Southern Paiute and Western Shoshone [Steward 1933]), a great variety of shape and utility purposes developed, all modeled on previously existing types of basketry. Most pots had flat bottoms with straight or flaring sides and ranged from small, pan-shaped, low-walled vessels, to medium-sized bowls used as dippers and for keeping food to large cooking vessels with a rim diameter of 20 centimeters (7.9 inches) or more (Liljeblad and Fowler 1986:421). The local pottery type, Owens Valley Brown, was limited to the Sierra piedmont and adjacent regions. Basketry was a much more common and ancient technology among the Owens Valley Paiute. A common and ancient feature was the twined, necked, and small-mouthed water container. The twined conical carrying baskets made by the Owens Valley Paiute occurred in various sizes and tightness (Steward 1933:272). A coarse, open twine, cone-shaped burden basket was used for gathering firewood. A smaller, tightly woven basket with a cloth-covered bottom was used for seed gathering. Winnowing trays were made with tightly woven twill twine, but the parching trays—for use with live coals—were made of open plain twine.

The Owens Valley Paiute used manos and metates to process wild seeds, including pine nuts. In certain localities of the Sierra piedmont, however, the mortar and pestle had replaced the metate as the most important tool for milling due to participation in the California acorn complex, which was associated with the use of bedrock mortars.

Four types of structures were built and used by the Owens Valley Paiute. The most durable building was the communal assembly lodge, or sweat lodge. These were relatively spacious, nearly circular semi-subterranean structures, heated by a fire built immediately inside the low entrance. The building, ownership, and maintenance of the lodge were the responsibility of the village chief, and he sponsored and supervised the erection of such a structure. The second type of structure was a cone-shaped house which ranged from 4.5 to 6 meters (15to 20 feet) in diameter and was built around a central smokehole on a frame of high poles over an excavation about 2 meters (6.5 feet) deep (Steward 1933:264). The roof consisted of mats of tule overlapping like shingles. Such houses were used throughout the year as a men's meeting house (Driver 1937:114). The third structure type used by the Owens Valley Paiute was a dome-shaped thatch or mat-covered dwelling. The framework consisted of bent willow posts brought together at the top. The fourth was a crudely shaped circular wooden structure, a conical pole lodge composed of timber built on a four-pole foundation. This was considered a winter house used primarily in the Sierra highlands and for pine nut gathering at high elevations from late October to the end of winter.

Discovery of gold and silver in the Sierra Nevada and Inyo Mountains brought a flood of prospectors to the region in the 1860s. Open conflicts between the settlers and the Paiute over food scarcity led to military intervention in 1863, forcibly relocating 1,000 Paiute to Fort Tejon in the mountains south of Bakersfield. By the late 1860s, many Paiute returned to Owens Valley and became indispensable to the region's agricultural economy by integrating farm labor with their traditional food gathering techniques (National Park Service 2015). Today, the Owens Valley Paiute are federally recognized as the Big Pine Paiute Tribe, residing on their reservation in Big Pine, California (Big Pine Paiute Tribe of the Owens Valley 2018).

4.5.1.3.2 Western Shoshone (Timbisha and Koso Shoshone)

The IC Project Alignment traverses the western edge of the territory of the Western Shoshone, whose ancestral lands extended from Death Valley across central Nevada, and into northwestern Utah and southern Idaho. These groups were Shoshone speakers, a central Numic language (Thomas et al. 1986). The Western Shoshone lived in small groups composed of an extended or nuclear family. Western Shoshone subsistence was heavily influenced by the seasonal availability of resources, moving from area to area within the valley and mountains as food became available (Steward 1970).

The Western Shoshone of Death Valley, known collectively as the Timbisha, refer to themselves as the Nümü TimbishaTümpisattsi Shoshone Tribe, meaning "people of the red rock face paint" (tim-, "rock"; -pisa, "paint") in reference to a source of red ochre south of Furnace Creek that was used in ceremonies. The Koosotsi, or Koso Shoshone, are a group of Timbisha Shoshone historically associated with the Coso Hot Springs area. Both groups spoke versions of the Panamint language—a western version around Owens Lake, Coso Mountains, and Panamint Valley; another variation that was spoken in Death Valley; and an eastern variation common in Grapevine Canyon, the Funeral Range, and the Beatty, Nevada area. Ancestors of the Timbisha Shoshone Tribe occupied Death Valley for at least 1,000 years. Like other Great Basin groups, the Timbisha Shoshone maintained small bands of related kin who changed residence as the seasons offered various resources (White 2006). In this hostile environment, the people relied on mesquite beans and pine nuts, hunted big game such as bighorn sheep, and procured small game like rabbits and chuckwalla lizards (NPS 2019). They utilized resources in ecological zones at dramatically varied elevations. These native residents of Death Valley modified their environment and encouraged plant growth, as with pruning of mesquite and the use of controlled fires. The dispersed Timbisha people would gather to celebrate their strong tradition of verbal storytelling and their religious traditions, which include dances to influence health and the weather (NPS 2019).

With the establishment of Euro-American ranching and mining operations in the 1850s, indigenous food sources such as pine and mesquite were logged for firewood; as a result, the Timbisha Shoshone were pressed into taking up wage labor jobs (Miller 2008, NPS 2019). In 1866, Congress ratified the Treaty of Ruby Valley, giving the federal government right-of-way access through Shoshone lands. When Death Valley became a national monument in 1933, several Timbisha were dislocated from Grapevine Canyon, Wildrose Canyon, and Furnace Creek. Forty acres of land were set aside for the Timbisha in 1936—this land became the location of the Indian Village of Death Valley.

The Timbisha became a federally recognized tribe in 1983 and in 1990 established a formal reservation after initiating the effort in the 1960s. The passing of the California Desert Protection Act (CDPA) in 1994 established Death Valley as a national park and required a study to be conducted to identify Timbisha aboriginal lands (see Theodoratus et al. 1998). The process to identify traditional Timbisha lands after the signing of CDPA brought tension between tribal members and the National Park Service and Department of the Interior because the federally recognized tribe remained landless in their own territory. Timbisha representatives partnered with the Alliance to Protect Native Rights in National Parks and organized a protest. On Memorial Day 1996, they walked in solidarity from the village entrance at State Route 190 toward the Furnace Creek Visitor Center (Catton 2009:5). This peaceful protest received national news coverage, which led to a restructured dialogue between the parties. A new initiative was drafted and later passed as the Timbisha Shoshone Homeland Act of 2000, establishing 7,753.99 acres of ancestral homelands, including 313.99 acres at Furnace Creek (U.S. Senate Reports No.106-327, 2000). Today there is a tribal government maintained through the election of a council, which upholds a tribal constitution.

4.5.1.3.3 Kawaiisu

The Kawaiisu were mobile hunter-gatherers who primarily resided in a core area in the southern Sierra Nevada and Tehachapi Mountains and made frequent forays into the Mojave Desert to exploit seasonal resources (Zigmond 1986). Linguistically, Kawaiisu has been identified as a part of the Southern Numic branch of the extensive Uto-Aztecan language family, which includes most languages of the Great Basin, extending south from southern Idaho into Mexico and east into Arizona (Mithun 2001:539).

Although there is general agreement about the location of the Kawaiisu core area, the extent of their territory in the Mojave Desert is less clearly understood. Zigmond (1986:399) depicts an area of seasonal use that extends east of the Granite Mountains, in present-day Fort Irwin. Kroeber (1976:602) cites an account of a Kawaiisu group on the upper Mojave River and in the southern Panamint Range. Steward (1970:71, Figure 1) also places the Kawaiisu in the southern Panamint Valley, the Argus Range, the town of Trona, and an undetermined area to the south and west. He notes further that although the Shoshone occupied the northern Panamint Valley, the Kawaiisu and Shoshone were mixed in the southern part of the valley and perhaps near Trona.

Dietary staples for the Kawaiisu included piñon, juniper, yucca, chia, wild rice, sunflower, buckwheat, and screwbean. Zigmond (1981) identifies 233 plant species the Kawaiisu used, of which 112 were used for food and beverages. Deer were a major source of meat when populations were residing in the mountainous core area, supplemented by small game. Hunters exploited antelope and bighorn sheep on the desert floor. Salt was also important in their diet and was collected from Koehn Lake or from Proctor Lake in the Tehachapi Valley when water levels at Koehn Lake were high.

Pottery is rare in sites attributed to the Kawaiisu and was probably primarily acquired through trading. Basket making was an important tradition among the Kawaiisu, who used numerous types of baskets for food collecting, processing, and storing, such as seedbeaters, burden baskets, containers, winnowers, trays, and hoppers (Zigmond 1986:401). Raw lithic material for tool making, such as chert, was likely obtained from areas near Red Rock Canyon, whereas obsidian was acquired through trade with groups from the Coso Volcanic Field (east of the Sierra Nevada). Long-distance exchange with coastal areas is also evident, with the presence of marine shell artifacts in some sites attributed to the Kawaiisu.

During the winter months, the Kawaiisu lived in tomo-kahni, circular, aboveground structures with vertical and transverse poles bound together and covered with brush, bark, and tule mats (Zigmond 1986:401). Other structures included open, flat-roofed shade houses (havakahni) used for summer habitation, sweathouses (tivikahni), circular brush enclosures, and small granaries.

The Kawaiisu practiced a distinctive style of polychromatic (multicolored) rock art that shares many attributes with that of the Chumash (Lee and Hyder 1991). The best-studied Kawaiisu rock art site is Teddy Bear Cave (CA-KER-508), located along the western edge of Sand Canyon, approximately 19 kilometers (12 miles) northeast of Tehachapi. Teddy Bear Cave is one site within Nettle Spring, an archaeological complex that also includes a large habitation area (CA-KER-230) along with numerous other localities. CA-KER-230 is characterized by numerous rock rings, more than 400 bedrock mortars, and rock art. Nearby sites include small camps, additional rock art localities, and a cremation site, all of which are potentially related to the Nettle Spring complex. Teddy Bear Cave is important in the oral history of the Kawaiisu people as the place where their people and the world were created (Sutton 2001).

Today, the Kawaiisu indigenous tribe consists of approximately 250 members living in California's Sierra Nevada foothills. They are not federally recognized. The remaining Kawaiisu speakers are elders who have been working to keep their culture alive with language and cultural revitalization programs. The Kawaiisu Language and Cultural Center was established as a 501(c)3 nonprofit organization in September 2007. The center's mission is to have the Kawaiisu native language spoken in their native communities once again (Kawaiisu Language and Cultural Center 2018).

4.5.1.3.4 Serrano/Vanyume

The Serrano people once occupied the Mountain, North Desert, and East Desert Regions of San Bernardino and Los Angeles counties. The Serrano language is part of the Serran division of a branch of the Takic family of the Uto-Aztecan linguistic stock (Mithun 2001:539, 543). The two Serrano languages, Kitanemuk and Serrano, are closely related. Kitanemuk ethnographic lands were located to the northwest of the Serrano. The Kawaiisu and Chemehuevi, located north and east of the Serrano, respectively, spoke languages that belong to the Numic branch of the Uto-Aztecan family. A relatively small group located within the San Bernardino Mountains and the Sierra Madre originally spoke Serrano (Kroeber 1925:611). The Vanyume, who lived along the Mojave River and associated Mojave Desert areas and are also referred to as the Desert Serrano, spoke either a dialect of Serrano or a closely related language (Mithun 2001:543).

According to the records by Fr. Francisco Garcés, the first European to travel in this region in 1776, the name "Vanyume" is derived from the term for them (Beñeme) used by the Mojave (Coues 1900: Vol. 1:240). Very little is known of the Vanyume-speaking people because the Spanish missionaries greatly disrupted the group between the early 1820s and 1834. By the 1900s, the group was considered extinct (Kroeber 1925:614; Bean and Smith 1978:570). Kroeber (1925:614–615) does make distinction between the Serrano and Vanyume by reporting that the Vanyume were friendly with the Chemehuevi and Mohave to the east, whereas the Serrano maintained animosity with these groups. The area of combined Serrano/Vanyume occupation—the San Bernardino Mountains, the southwestern portions of the Mojave Desert, and the Mojave River area—has become known as the Serrano area.

Most Serrano lived in small villages located near water sources (Bean and Smith 1978:571). Kroeber (1925:617–618) considered the organization of Serrano lineage sets similar to that of political groups. He defined a lineage set as occupying one village, representing at least two moieties, and coordinating its hunting and gathering activities per the religious deliberations and scheduling determined by two leaders (one from each of the moieties), with one leader occupying the ceremonial house and the other possessing the ceremonial bundle. Often, a lineage set had the exclusive power to forge and maintain economic ties to other villages of neighboring Serrano, Cahuilla, Chemehuevi, Gabrielino, and Cupeño. Desert Serrano villages are mentioned in the 1776 account of the Spanish Franciscan missionary Fr. Francisco Garcés and in the records dating to the early 1800s by Fr. Joaquín Nuez. Fr. Garcés mentions villages along the Mojave River near today's cities of Barstow and Daggett (Coues 1900: Vol. 1:241–248). Beattie (1955) suggests the average village population was 70, and that these settlements were generally spaced at 10-mile (16-kilometer) intervals along the river.

The fundamental economy of the Serrano was one of subsistence hunting and collecting plant goods, with occasional fishing (Bean and Smith 1978:571). Serrano territory was a trade nexus between inland tribes and coastal tribes, and trade and exchange were important aspects of the Serrano economy. Those living in the lower-elevation desert floor villages traded foodstuffs with people living in the foothill villages who had access to a different variety of edible resources. In addition to intervillage trade, ritualized communal food procurement events, such as rabbit and deer hunts and piñon, acorn, and mesquite nut-gathering events, integrated the economy and helped distribute resources that were available in different ecozones.

A variety of materials were used for hunting, gathering, and processing food, many of which were also used for shelter, clothing, and ceremonial items. Shell, wood, bone, horn, stone, plant materials, animal skins, and feathers were used for making money, baskets, blankets, mats, nets, and bags. The Serrano made pottery and used it daily to carry and store water or foodstuffs; ceramics were also used as ceremonial objects. They also made awls, sinew-backed bows, arrows, arrow straighteners, throwing sticks (for hunting), traps, fire drills, stone pipes, musical instruments of various types (rattles, rasps, whistles, bull-roarers, and whistles), yucca fiber cordage for snares, nets and carrying bags, and clothing (Bean and Smith 1978:571; Bean and Vane 2002). A strong tradition of basket weaving incorporated the use of juncus sedge, deergrass, and yucca fiber.

Mainly due to the inland territory that the Serrano occupied beyond Cajon Pass, contact between Serrano and Europeans was relatively minimal prior to the early 1800s. As early as 1790, however, the Serrano began to be drawn into mission life (Bean and Vane 2002). More Serrano were relocated to Mission San Gabriel in 1811 after a failed indigenous attack on that mission. In the 1860s, a smallpox epidemic decimated many indigenous southern Californians, including the Serrano (Bean and Vane 2002). Oral history accounts of a massacre in the 1860s at Twentynine Palms may have been part of a larger American military campaign that lasted 32 days (Bean and Vane 2002:10).

Surviving Serrano sought shelter at Morongo with their Cahuilla neighbors; Morongo later became a reservation (Bean and Vane 2002). Other survivors followed the Serrano leader Santos Manuel down from the mountains and toward the valley floors, and eventually settled what later became the San Manuel Band of Mission Indians Reservation. This reservation was established in 1891 (San Manuel Band of Mission Indians 2008). Although ethnographers considered the Vanyume extinct (Kroeber 1925:614; Bean and Smith 1978:570), recent genealogical research combined with mitochondrial DNA (mtDNA) analysis indicates three lineages from the Fort Tejon area were originally from the village of Topipabit downstream from Victorville (California Energy Commission 2008:4.3–11). These lineages are currently part of the San Fernando Band of Mission Indians, located in Newhall. This group, which includes Kitanemuk, Inland Chumash, Tataviam, and Vanyume, has applied for federal recognition.

4.5.1.3.5 Southern Paiute

The Southern Paiute belong to the Southern Numic branch of the Uto-Aztecan linguistic family and include 15 subgroups: Antarianunts, Kaiparaowits, San Juan, Kaibab, Shiwits, Uinkaret, Saint George, Gunlock, Cedar, Beaver, Panaco, Pahranagat, Moapa, Las Vegas (including Pahrump), and Chemehuevi (Kelly and Fowler 1986). Some ethnographers consider the Chemehuevi a separate group from the Southern Paiute, though the differences between them and other Southern Paiute are minimal and are generally attributed to environmental variation (Theodoratus et al. 1998). The traditional territory of the Southern Paiute is vast and the environmental variation of the lands occupied by the Southern Paiute is pronounced, ranging from the Colorado Plateau to the Mojave Desert, and including the Colorado River basin and numerous small mountain ranges (Kelly and Fowler 1986).

Southern Paiute subsistence was centered on gathering and hunting. The environmental differences of the territories of various Southern Paiute groups were reflected in the resources they exploited for subsistence as well as in the procurement strategies they employed (Theodoratus et al. 1998). Fauna used as food sources included small game such as rabbits and tortoises as well as fish and mountain sheep (Kelly and Fowler 1986). The Southern Paiute exploited a variety of flora, including piñon nuts and agave for food; some groups practiced agriculture, raising maize, squash, and winter wheat, among other things (Kelly and Fowler 1986). By the time of European contact, the Southern Paiute had optimal irrigation systems and had been farming for centuries along the Colorado River (Stoffle and Zedeno 2001:234). Southern Paiutes were skilled basket weavers; their handwoven baskets were used to carry a wide variety of resources ranging from seeds and berries, to even carrying water in finely woven baskets sealed with pine pitch (National Park Service 2018). The basic socioeconomic unit of the Southern Paiute was the family household. No centralized political hierarchy has been recorded, though at times households would cooperate during hunting and gathering activities. Immediately after marriage, matrilocal residence was common, though in the longer term most would permanently settle near the husband's relatives (Kelly and Fowler 1986).

Several Southern Paiute tribes with reservations in Arizona, California, Nevada, and Utah are federally recognized. The federally recognized Colorado River Indian Tribes hold reservation land on both sides of the Colorado River (amounting to 270,000 acres) in an area granted in 1865 by the federal government (Colorado River Indian Tribes 2019). Original residents of the reservation included the Chemehuevi and Mohave, but they were later joined by people of relocated Hopi and Navajo tribes. The arduous process of federal recognition for the Chemehuevi, who lost their lands in 1853, ultimately resulted in the establishment of The Chemehuevi Valley Reservation. The first iteration was established in 1907, but the Chemehuevi were relocated to the Parker area and their status revoked (Chemehuevi Indian Tribe 2019). Congress authorized land acquisition in 1935 for the Parker Dam Project, which inundated traditional territory (Chemehuevi Indian Tribe 2019). The tribe achieved recognition in 1970. The current Reservation, in the Parker area, extends about 30 miles along the Colorado River and encompasses more than 30,000 acres of land.

4.5.1.4 Historic Background

Post-Contact history for the state of California is generally divided into three specific periods: the Spanish period (1769–1822), the Mexican period (1822–1848), and the American period (1848–present). These time frames are discussed below, with additional histories about Inyo County, Kern County, San Bernardino County, and military installations intersected by the IC Project Alignment.

4.5.1.4.1 Spanish Period

Some of the first expeditions by Spanish explorers along the southern coast of California occurred between the mid-1500s and the mid-1700s. One explorer, Juan Rodríquez Cabríllo, was searching for the legendary Northwest Passage when he stopped in 1542 in what is known today as the San Diego Bay. Cabríllo explored the shorelines of present Santa Catalina Island and the San Pedro and Santa Monica bays, which were given their names by the next Spanish explorer, Sebastián Vizcaíno. Vizcaíno was a Spanish naval officer who mapped and recorded the coastlines of California and Oregon. Using the surveys conducted by Cabríllo and Vizcaíno, the Spanish crown laid claim to California (Bancroft 1886a:96–99; Gumprecht 1999:35). For the next 200 years, the Spanish did very little inland exploration and colonization in Alta California. The beginning of the Spanish period in California is marked by the overland expedition of Captain Gaspar de Portolá in 1769. Portolá led a group of 64 soldiers, missionaries, Baja California Native Americans, and Mexican civilians to the San Diego area, where they established the Presidio of San Diego, a fortified military outpost and the first Spanish settlement in Alta

California. In addition to the Presidio, Franciscan missionary Fr. Junípero Serra established the Mission San Diego de Alcalá at Presidio Hill, following the directive of the King of Spain that the Franciscan Order would direct religious and colonial matters in the American territories. The Mission San Diego de Alcalá was the first of 21 missions established in Alta California between 1769 and 1823.

Captain Juan Bautista de Anza was the first to establish overland connections between California and Mexico. In 1774, he led a group of 34 padres, soldiers, and others across the Colorado River into the present-day Imperial Valley. Fr. Francisco Garcés charted the route in 1770 and led Anza through present-day Imperial County along the Alamo River drainage (National Park Service 2004). The expedition continued northwest, traveling into present-day Imperial County through the Cahuilla Valley, following the Santa Rosa Mountains and continuing through Coyote Canyon and San Jacinto Valley, eventually ending up in Monterey Bay (Brown 1985). Anza made another expedition along the same route in 1775 with a larger group and continued all the way to San Francisco Bay (Guerrero 2006).

After the expeditions of Anza, several missions were established in the 1770s as far north as San Francisco. The 21 missions were parallel to the California coastline between present-day San Diego and Sonoma, with the coastline positions easy to defend and supply by ships. Similar to earlier Spanish exploration, no missions were placed inland. Only three fortified posts were established in Alta California in addition to the Presidio of San Diego: The Presidio of Monterey was established in 1770, the Presidio of San Francisco in 1776, and the Presidio of Santa Barbara in 1782. Incentives were also provided to bring settlers to pueblos or towns, but just three pueblos were established during the Spanish period, only two of which were successful and remain as California cities (San José and Los Angeles). Several factors kept growth within Alta California to a minimum, including the threat of foreign invasion, political dissatisfaction, and unrest among the indigenous population.

The first documented expedition into the IC Project Alignment area occurred in 1772, when Don Pedro Fages traveled from San Diego to San Luis Obispo via Cajón Pass, the Mojave Desert, Hughes Lake, Antelope Valley, Tejón Pass, Cañada de los Uvas (Grapevine Canyon), and Buena Vista Lake, all in pursuit of Spanish Army deserters (Hoover et al. 1990:126). Fages left the first written record of exploration in the south San Joaquin Valley (California OHP 2013). In 1776, Francisco Garces is reported to have explored the region, including the Cummings and Tehachapi valleys in the Tehachapi Mountains, when traveling from the San Joaquin Valley to the Mojave River near Barstow, naming a large river Río de San Felipe, now known as the Kern River. Historical accounts also indicate that Garces left traces of his visit at Willow Springs (near Rosamond) and on Castle Butte (near California City). After this time, little documentation exists for European explorations or visits to the Mojave Desert and beyond until the 1800s; however, it is certain that such contacts occurred. Native Americans residing in these areas were likely indirectly affected by disruptions in trade caused by the European occupation in the coastal areas.

In 1806, the Spanish visited the Southern San Joaquin Valley again during the expedition of Lieutenant Franscico Ruiz to find fugitive Indians, which was documented by Father Jose Maria de Zalvidea, who renamed the Río de San Felipe to La Porciuncula. Lieutenant Ruiz also named Tejon Pass, Tejon Creek, and Tejon Canyon during this expedition (Bancroft 1886b). Due to its distance from the missions and presidios, the region served as a haven for escaped fugitives, particularly Indians, and its exploration primarily came from expeditions sent after those fugitives, with the Grandos Expedition exploring the valley in 1815 (Bancroft 1886c). In the early 1800s, the Spanish increased their efforts to incorporate Native Americans into the mission system. Native Americans from interior tribes were either brought or came to the San Gabriel and San Fernando missions, established in 1771 and 1797, respectively, which may have exerted influence as far as the upper Mojave River. Although the Spanish were determined to gather all natives into the mission system, there are numerous examples of interior Native American villages not represented in the mission registers. As the Spanish presence in southern California increased, native neophytes attempted to escape missions by running away and seeking refuge with interior tribes, such as in the southern San Joaquin Valley or the Mojave Desert and adjacent mountains. This led to forays into these regions by Spanish soldiers who were attempting to recapture runaway neophytes, and the influx of natives from different tribal territories resulted in tribal intermixing and blurred territorial boundaries.

4.5.1.4.1.1 Old Spanish Trail

The first major non-Native American transportation route through southern California was the Old Spanish Trail (ca. 1829), a trade route stretching between Santa Fe, New Mexico, and the coastal missions in southern California. Both Mexicans and Americans used this route to travel to California in the early 1840s. A segment of the route between Salt Lake City, Utah, and San Bernardino became known as the Mormon Trail for the steady flow of Mormon settlers traveling back and forth. During the Gold Rush, thousands of people traveled the Gila Trail or Southern Overland Trail from Texas to Arizona, then crossed the Colorado River at present-day Yuma into California and proceeded across the Colorado Desert to the San José Valley. The main trail continued from that point northward to Temecula and Los Angeles. Many left the main trail and traveled southward to San Diego, where they then journeyed via ship to San Francisco or took the inland coastal route to Los Angeles, rejoining the main trail to the goldfields. Thousands more traveled the Mojave River Trail, which Captain John C. Frémont named the Old Spanish Trail in 1844. Starting in Santa Fe and continuing through Utah and Arizona, the trail then crossed the Mojave Desert to reach the Mission San Gabriel Arcángel and the Pueblo de Los Ángeles. Northeast of Victorville near today's community of Daggett, a group of Native Americans told Frémont they had lived along the Mojave River and the mountains to the north and traded with other indigenous peoples in the region along the Mojave River Trail. Frémont's is the first account to use the name "Mojave River" (Frémont 1845:260).

4.5.1.4.2 Mexican Period

After more than a decade of intermittent rebellion and warfare, New Spain (Mexico and the California territory) won independence from Spain in 1821. In 1822, the Mexican legislative body in California ended isolationist policies designed to protect the Spanish monopoly on trade and opened California ports to foreign merchants. On July 25, 1826, Governor Jose Maria Echeandía issued a decree beginning the secularization of the California missions (Engstrand and Ward 1995). However, because many Native Americans failed to leave the missions, Echeandía issued a second decree on January 6, 1831, encouraging the Native Americans to leave the missions.

Secularization became official under Governor Jose Figueroa with the Secularization Proclamation of 1834. Secularization of the missions resulted in the subdivision of former mission lands and establishment of ranchos. In keeping with the coastal settlement patterns of the Spanish, these ranchos were centralized in the southwestern section of the county and never extended past the San Gabriel Mountain Range. As the influence of the California missions began to wane from the 1820s through the early 1830s, land grants were initiated in the interior regions, partly to increase the population away from the more settled coastal areas where the Spanish had concentrated their colonization efforts. During the Mexican period, the large ranchos became important economic and social centers, none of which were designated within the IC Project Alignment.

During the 1830s, most Spanish laws and practices continued, whereas economic activity in southern California centered on agriculture and livestock raising for subsistence and localized markets, as well as hide and tallow production for the international market. During the supremacy of the ranchos (1834–1848), landowners largely focused on the cattle industry and devoted large tracts to grazing. Cattle hides became a primary southern California export, providing a commodity to trade for goods from the east and other areas in the United States and Mexico. The number of nonnative inhabitants increased during this period because of the influx of explorers, trappers, and ranchers associated with the land grants. The rising California population contributed to the introduction and rise of diseases foreign to the Native American population, who had no associated immunities.

Early maps of the Mexican territory (e.g., Tanner 1826) include portions of the IC Project area, but activity was primarily limited to travel. Beginning in 1827, fur trapper Jedediah Smith made multiple trips into California on the Mojave Trail and through Cajon Pass, both located to the south of the study area. Subsequent to Smith, Kit Carson and other trappers traveled the route. Around that time, the Mojave Trail became part of the Old Spanish Trial (or Santa Fe Road) between southern California and Santa Fe. By the end of the Mexican period in the late 1840s, travelers from Salt Lake City had also established the Mormon Trail into Southern California via Las Vegas and met up with the Old Spanish Trail (Bean and Rawls 2003:58–71; Hoover et al. 2002: 321–322). In addition to the Mojave River Trail (also Old Spanish Trail; see above), other early routes through the California deserts included the southern Yuma route (Gila Trail, Southern Overland Trail, Butterfield Stage Route), Brown's Wagon Road, the Bradshaw Trail, and Brown and Frink's Road, all located south of the IC Project area.

4.5.1.4.3 American Period

War in 1846 between Mexico and the United States began at the Battle of Chino, a clash between resident Californios and Americans in the San Bernardino area. This battle was a defeat for the Americans and bolstered the Californios' resolve against American rule, emboldening them to continue the offensive in later battles at Dominguez Field and in San Gabriel. However, this early skirmish was not a sign of things to come, and the Americans were ultimately the victors of this two-year war. The Mexican–American War officially ended with the Treaty of Guadalupe Hidalgo in 1848, which resulted in the annexation of California and much of the present-day southwest, ushering California into its American period.

California officially became a state with the Compromise of 1850, which also designated Utah and New Mexico (with present-day Arizona) as U.S. territories. Horticulture and livestock, based primarily on cattle as the currency and staple of the rancho system, continued to dominate the southern California economy through 1850s. The Gold Rush began in 1848, and with the influx of people seeking gold, cattle were no longer desired mainly for their hides but also as a source of meat and other goods. During the 1850s cattle boom, rancho vaqueros drove large herds from southern to northern California to feed that region's burgeoning mining and commercial boom. Cattle were at first driven along major trails or roads such as the Gila Trail or Southern Overland Trail, then transported by trains when available. The cattle boom ended for southern California as neighbor states and territories drove herds to northern California at reduced prices. Operation of the huge ranchos became increasingly difficult, and droughts severely reduced their productivity (Cleland 1941). Although many of the ranchos in the area remained intact after the United States took possession of California, a severe drought in the 1860s resulted in many of the ranchos being sold or otherwise acquired by Americans. Most of these ranchos were subdivided into agricultural parcels or towns, but ranching was to retain its importance through the mid-nineteenth century (Dumke 1944).

During the Gold Rush, thousands of people traveled the Gila Trail or Southern Overland Trail from Texas to Arizona, then crossed the Colorado River at present-day Yuma into California and proceeded across the Colorado Desert to the San José Valley. The main trail continued from that point northward to Temecula and Los Angeles. Many left the main trail and traveled southward to San Diego, where they then journeyed via ship to San Francisco or took the inland coastal route to Los Angeles, rejoining the main trail to the gold fields. Thousands more traveled the Mojave River Trail/Old Spanish Trail.

American politics and the need for a mild-winter route to the west favored a southerly thoroughfare from the eastern United States to California in the 1850s. The U.S. Gadsden Purchase of 1854 secured more land from Mexico for this route, and by 1857, surveys established the current international boundary from New Mexico west to California (Walker and Bufkin 1986). Wagon roads and railroads constructed across California's Colorado and Mojave deserts from the 1840s to the 1870s connected coastal California with the rest of the county. These modes of transport served to carry mail, prospectors, miners, entrepreneurs, merchants, immigrants, laborers, muleteers, settlers, and military personnel, as well as civilian and military supplies, livestock, produce, timber, and minerals produced by desert mines, among other necessities.

Following the Civil War, overland stage services to and from southern California resumed in 1868 with the Holladay and Wells Fargo operations (Nevin 1974; Stein 1994). Railroad surveyors first visited the area in the 1850s, but it was not until 1868, after the Civil War, that congressional approval was given for a railroad charter. The pre–Civil War national initiative for a southern transcontinental railroad route resumed, as the Texas and Pacific (T&P) Railway Company in 1871 conducted transcontinental surveys to pursue the initiative. In 1873, however, the T&P's westerly construction stalled in north-central Texas. The resulting delay was critical, allowing San Francisco investors to extend their own Southern Pacific Railroad (SPRR) through Imperial Valley to the Colorado River in 1877, bridging the river at Yuma into Arizona along the T&P survey in 1878 (Yenne 1985). The Atlantic and Pacific Railroad (later the Atchison, Topeka, and Santa Fe [AT&SF] and currently the Burlington Northern Santa Fe) soon crossed the central part of San Bernardino County, linking the area with San Diego and the eastern states by 1887. The railroad activity led to the establishment of the city of Barstow in 1885, and the town continued to grow with additional rail lines and later the establishment of the interstate highway system in the 1920s and 1930s.

The construction of permanent roadways across the desert trails and wagon roads accompanied the increased use of the automobile at the turn of the twentieth century. The first highways across the Mojave Desert followed the Cajon Pass–Barstow–Needles route established by the Southern California Railway and the AT&SF. Established in 1912, the Ocean-to-Ocean Highway, now known as the National Old Trails Road, stretched from Baltimore, Maryland, to California. Established in 1926, most of U.S. Route 66 largely followed the Ocean-to-Ocean Highway, passing through the desert region south of Needles on its way across the country to Los Angeles. After U.S. Route 66 was decommissioned in 1985, parts of it became Interstate 40 as well as Interstate 15. Other important highways that crossed through the region included the Randsburg/San Bernardino Road, which was added to the state system of secondary highways in 1933 and designated State Route 145. The highway was designated U.S. Route 395 (US-395) two years later (Johnson 2005).

4.5.1.4.4 Regional and Local Histories

4.5.1.4.4.1 Inyo County and Owens Valley

Barricaded from the coastal settlements and missions of the Spanish by the Sierra Nevada, Inyo County remained unexplored throughout the Spanish period and most of the Mexican period. Though Peter Skeene Ogden, a Canadian fur trapper, is believed to be the first non–Native American to travel through Owens Valley (Cline 1963:8), the first recorded exploration of the area did not occur until 1833. Joseph Walker entered the Owens Valley on his return from the Bonneville trapping expedition along the path of what was to become the Walker Pass–Owens Valley Route (Bateman 1995). Walker later used this same route to guide the first American settlers, the Chiles group, into California to their eventual settlement in Gilroy in 1843. John C. Frémont would be the next to enter the region, along with Walker and Kit Carson, on his way to support the American forces fighting in the Mexican–American War in San Francisco and San José.

Euro-Americans did not begin to settle in the region in large numbers until the Gold Rush, though many of these early settlers were not miners but farmers and ranchers following the new markets created by miners; the town of Bishop is named after Samuel Bishop, the first person to raise cattle and sheep in the area (Eastern California Museum 2014). This sudden influx of Euro-American colonists took advantage of the existing indigenous water systems, which, along with their livestock, severely damaged the natural environment that the indigenous Paiute subsisted upon. This sparked conflict between the settlers and the Native Americans, known as the Owens Valley Indian War, resulting in the establishment of Fort Independence in 1862 (Macko 1986).

Settlement of the area was primarily due to the discovery and development of rich mineral resources, particularly silver. The early strikes were focused on silver in Owens and Panamint valleys in the late 1850s and early 1860s, which resulted in the establishment of the Potosi Mining District near Lone Pine (Chalfant 1933). In 1860, Dr. Darwin French discovered the Coso ledges, which began to draw in more miners, but the Owens Valley Indian War severely limited the amount of settlement (Bateman 1995). Most of the strikes and mines were small and of little significance, but in 1865 Pablo Flores struck a rich mine that he named Cerro Gordo, which resulted in the organization of the Lone Pine Mining District. This area was very productive, and by 1868 the Union Mine at Cerro Gordo was the most productive silver mine in the United States (Norwood et al. 1980). It was around this time in 1866 that Inyo County was formally designated out of what had been proposed as Coso County—a subdivision of Mono and Tulare counties—and later expanded in the early 1870s to include segments of Mono, Kern, and San Bernardino counties (Chalfant 1933).

Silver, lead, and zinc were the early metals mined in the area, but beginning in the early twentieth century, tungsten mining developed as an important industry. First discovered in 1913 in the Tungsten Hills west of the town of Bishop, tungsten mining took off with the construction of two mills in Round Valley in 1916. This industry remained economically important until the price of tungsten collapsed following World War I. At the end of the Great Depression into World War II, prices rebounded, and tungsten mining remained important in the area around Bishop until the end of the twentieth century, when mining effectively ceased (Meridian 2014).

In addition to gold and silver, salt was mined in the Saline Valley east of Independence. Salt mining began in 1864, but transportation costs kept the enterprise from growing into a major operation (Norwood et al. 1980). The Saline Valley Salt Company constructed the Saline Valley Salt Tram between 1911 and 1913 to transport salt over the Inyo Mountains to Owens Valley, where it was then shipped via railroad (Ver Planck 1957). It was the steepest tram in the United States, rising from 1,100 feet in the Saline Valley to 8,500 feet at the crest of the Inyo Mountains, and then dropping to 3,600 feet in Owens Valley. The tram is listed on the National Register of Historic Places (NRHP; No. 74000514; Conrad 1973). Salt mining by various companies continued on and off until 1930, when the Sierra Salt Company closed (Ver Planck 1957).

Mining in the Death Valley–Furnace Creek area was slow to develop due to transportation difficulties. The Telescope Mining District, organized in 1860, was located just west of Death Valley on a spur of the Panamint Range. Worked only marginally in the beginning, by the late 1860s a substantial mining district had developed (Greene 1981). Mormon immigrants traveling west discovered gold in 1854 and 1856 in the Amargosa River area (Norwood et al. 1980). Silver was found in the Panamint Range in 1858, and the area was worked with limited success in the 1860s. Beginning in the 1880s a revival of gold mining in the Panamint Mountains occurred, centered in the Tuber Canyon area (Greene 1981). The towns of Ballarat and Garlock developed as a result of the mining industry in the Panamints.

The discovery of borax in Death Valley in 1881 led to the development of this previously sparsely populated portion of Inyo County. One of the most successful mining operations in the area during the late 1800s was the Harmony Borax Works. In 1881, William T. Coleman formed the Greenland Salt and Borax Mining Company, which began operating the Harmony Borax works north of Furnace Creek in 1882 (Caltrans 2008; Greene 1981). The operation mined borate that formed on the surface of the salt flats, called "cottonballs."

Coleman also ran another borate mining operation, the Amargosa Borax Works, near Resting Springs. The Amargosa Borax Works operated during the summer months when work in the valley was suspended because of extreme heat (Greene 1981). It was from the Amargosa Works that the famous 20-mule teams hauled the borate to the Daggett railhead, a 330-mile round trip (Zentner 2012). In 1883 a richer type of borate, occurring underground, was discovered south of Furnace Creek and subsequently southwest of Death Valley Junction. In 1890 Francis M. Smith acquired the borate mines in Death and Amargosa valleys, Furnace Creek, and Borate, consolidating them all under the Pacific Coast Borax Company (Caltrans 2008). Smith closed all the works except the Borate works, which could be worked most profitably (Greene 1981). Borate became the main producer of borax and boric acid in the United States between 1890 and 1907.

Numerous small railroads were constructed into Inyo County for the express purpose of servicing mining operations. The Carson and Colorado Railroad, incorporated in 1880, ran from Mound House, Nevada, to Keeler, California, below the Cerro Gordo Mines on the eastern side of Owens Valley. Much of the route paralleled US-395. The Southern Pacific Company bought the line in 1900, renamed it the Nevada and California Railway in 1905, and in 1912 was renamed again the Southern Pacific. Portions of the railway lines closed in the 1930s and 1940s. The final portion from Laws to Keeler was abandoned in 1960, and the rails were removed in 1961 (Turner 1965).

The Tonopah & Tidewater Railroad, constructed between 1905 and 1907, was a 170-mile rail line that ran from Ludlow, California, to Beatty, Nevada. The line went through Death Valley Junction, where borax from the borax mines in Death Valley was loaded onto railcars for shipment. Both cargo and passenger trains operated on the line. The Pacific Coast Borax Company began shutting down operations in Death Valley in 1928, dealing a substantial blow to the revenue of the railroad. The line continued to run reduced operations for several years afterward, but finally closed down in June 1940 (Jennings and Wyant 1976).

A trail likely ran through Owens Valley into Mono County to the north since prehistoric times, but in the Historic period it became commonly used by prospectors passing through the area to the California gold fields and Comstock Lode. This trail became a road by at least the 1860s when ranchers began driving cattle into the high Sierra Nevada to supply the mining boomtown of Aurora. This road, eventually called El Camino Sierra, ultimately ran from Los Angeles in the south to Lake Tahoe in the north. Initially used to move materials to and from mines and mining communities, by the early twentieth century, El Camino Sierra was marketed as a scenic route for people in the newly available automobile. By 1931, the paving of El Camino Sierra was complete. Today, much of this route in Inyo County is occupied by US-395 (Di Pol 2013).

Though mining was the major industry of the county, farming and ranching kept it stable. Those industries required water, and at the beginning of the twentieth century, the city of Los Angeles was experiencing a severe water shortage. William Mulholland, president of the Los Angeles Water Department, identified the Owens River as a source that could be tapped to supply the city with its much-needed water (Norwood et al. 1980). The diversion of water to Los Angeles did not immediately affect agriculture in the Owens Valley, though tensions were high between farmers and Los Angelenos. A drought in 1921–1922 signaled the end of farming in the area by the mid-1930s, though the L.A. Aqueduct was the true cause (Chalfant 1933; Norwood et al. 1980).

4.5.1.4.4.2 Bishop

Bishop is the only incorporated city in Inyo County with a land area of 1.75 square miles. Samuel Bishop came to the area on a cattle drive in 1861 and stayed to build two small cabins and start San Francis Ranch near the site of the present town. Ranching remained an important economic interest in the area for many years, providing beef to nearby mining towns (Bateman 1995). Adjacent to the city are several developed unincorporated areas. The Bishop Paiute Indian Reservation is 8.74 square miles in size and is 2.6 km (1.6 miles) west of the city of Bishop.

4.5.1.4.4.3 Los Angeles Aqueduct

The Los Angeles Aqueduct spans Inyo, Kern, and Los Angeles counties. Plans to bring water to Los Angeles from the Owens River began as early as 1890. Fred Eaton, the former mayor of Los Angeles and a prominent landowner in Owens Valley, recognized the potential of capturing the water supply of the eastern Sierra Nevada for the rapidly expanding metropolis of Los Angeles, which by the late nineteenth century had outgrown its primary water source, the Los Angeles River (Underwood 2000). This developed into a full-blown water crisis by 1904, allowing Eaton to convince William Mulholland, the chief engineer and superintendent of the Los Angeles City Water Company, that the Owens River was the best source for Los Angeles' future needs. As Eaton secured the necessary land and water rights, Mulholland examined the feasibility and costs of the project. With their results, the two were able to first win the support of the Board of Water Commissioners and then the Los Angeles voters, who on September 7, 1905, approved a $1,500,000 bond measure to fund the project (Department of Public Service of the City of Los Angeles 1916).

Construction began in 1907 and was divided into several divisions, with division headquarters in various locations along the route of the aqueduct. Each was under the direction of a division engineer and included attendant office staff, surveyors, machinists, medical personnel, and laborers. Mojave functioned as the construction headquarters for the project, with supplies, equipment, and thousands of workers funneled through the small community on their way from Los Angeles to the Owens Valley.

To construct the Los Angeles Aqueduct, numerous temporary camps were constructed along the proposed system; these consisted of mess halls, bunkhouses, barns, shops, and homes for workers and their families (Underwood 2000). Alabama Gates was the location of one such work camp occupied between April 1912 and February 1913 (Van Bueren 2002). At this site, aqueduct gates were constructed to control and divert water for the Los Angeles Aqueduct. It was also the site of a number of rebellious acts by Owens Valley citizens, including the bombing of the gate on May 21, 1924, releasing 100 million gallons into Owens Lake. Just a few months later, starting on November 16, more than 700 farmers occupied the gate and drained the entire flow of the aqueduct into Owens Lake for four straight days in one of greatest acts of non-violent civil disobedience in California history (Costello and Marvin 1992).

At the northern end of San Francisquito Canyon was Elizabeth Tunnel, the longest tunnel of the aqueduct system, an engineering feat measuring 26,870 feet long, 10 to 12 feet in diameter, with a capacity of 27,000,000 gallons an hour. Completed on February 28, 1911, it was the site of intense competition between the two crews excavating it, led by W. C. Aston at the south and John Gray at the north. During its construction the southern crew broke the record for longest hard rock tunnel distance a total of three times, with the last record 604 feet in a single month (Guinn 1915).

When it was completed in 1913, the aqueduct was the third largest engineering achievement of its time, exceeded only by New York City's water system and the Panama Canal (Underwood 2000). Its development resulted in new innovations such as huge steam and electric shovels, which were used to excavate ditches, tunnels, dams, and reservoirs. Construction also required massive quantities of local resources, including limestone and clay provided by a plant developed specifically for the project northwest of Mojave at Monolith.

The aqueduct system was expanded in the 1930s by tapping the waters of the Mono Basin. The original system continues to be used today, although portions of the original aqueduct were reinforced in 1960 (Underwood 2000). As Los Angeles continued to grow in the decades following World War II, the increasing demand for water resulted in the development for a second aqueduct. Constructed between 1967 and 1972, this second aqueduct obtained water from the Haiwee Reservoir in the Owens Valley.

4.5.1.4.4.4 Cartago

As farmers and miners redirected the tributaries feeding Owens Lake, the area began to be used for soda processing. Dikes are still present, encircling the historic soda evaporators. The Cottonwood Charcoal Kilns, built to make charcoal for the Cerro Gordo smelters, are remnants of the area's connection to mining. The historic town of Cartago, which gives the protected area its name, served as the shipping port for the Cerro Gordo Mines.

4.5.1.4.4.5 Fort Independence

Originally Camp Independence, Fort Independence was established in 1862 and served as a U.S. Army post until 1877, though it was briefly abandoned in 1864. It was an important site during the Owens Valley Indian War (1861–1865), which was the reason for its construction. It also served as a Civil War army post (Key 1979). The land was transferred to the Interior Department in 1884, where it was neglected for decades. It is now the Fort Independence Indian Reservation, which was created in 1915 and expanded in 1916 and 2000. It is the home of the Fort Independence Indian Community of Paiute Indians.

4.5.1.4.4.6 Manzanar

In February 1942, President Franklin D. Roosevelt signed Executive Order 9066, which authorized the Secretary of War to establish Military Areas and to remove from those areas anyone, particularly those of Japanese descent, who they determined to be a threat to the war effort. This gave the U.S. Army the authority to forcibly relocate between 110,000 and 120,000 Japanese Americans to 10 internment camps away from the Pacific Coast. 1942, the U.S. Army leased 6,200 acres at Manzanar from the City of Los Angeles to establish the first of such internment camps for the purpose of holding Japanese Americans during World War II. This included approximately two-thirds who were American citizens by birth; the rest had been living in the United States for decades but were denied citizenship by law. During its use, Manzanar held a total of 11,070 Japanese Americans, from a high of 10,046 in September 1942 (Thompson 1984). The prisoner population dwindled to 6,000 by 1944, with the last several hundred internees released in November 1945, three months after the war ended. For many of them, they spent three-and-a-half years imprisoned within the fences of Manzanar. The camp consisted of one-story barracks with common bathrooms, showers, laundries, and mess halls, and it is the best-preserved internment camp from the era (Thompson 1984). The Manzanar Relocation Center is listed on the National Register of Historic Places (NRHP) (no. 76000484) and is designated a National Historic Landmark (no. 850) and a National Historic Site (no. 432).

4.5.1.4.4.7 Kern County

John C. Frémont led an expedition into Kern County in 1843 and 1844 under the commission of the U.S. government to explore and map the western territories (Brewer 2001). He brought an artist named Edward

Meyer Kern from Philadelphia to act as the topographer for the expedition. While crossing a river, Kern narrowly escaped drowning, and Frémont named the river after his colleague (Gudde 1998:192; Hoover et al. 2002:124). Frémont was responsible for naming several landmarks, as well as the county itself during this expedition. He returned again in 1845 and 1846, this time with a larger force including several famous frontiersmen such as Kit Carson and Joseph Walker, and eventually joined the American forces fighting in San Francisco and San Jose during the Mexican–American War.

The construction of the Southern Pacific Railway across Antelope Valley began in the mid-1800s and was completed in 1876. After 1875, the use of the railroad system and the closing of mines forced the main stage lines in Kern County to come to an end, although small lines continued to transport passengers up until 1912 (Burmeister 1977). This period was followed by an influx of people during the southern California land boom of the late 1880s when immigrants settled in the Antelope Valley and Mojave Desert areas in search for more affordable land near water. Between the 1880s and 1920s, climatic conditions in the region varied dramatically between wet and dry years. Only settlements with enough water supplies for human consumption and irrigation survived; the others failed. However, by the 1930s, there were more than 80 towns in the Antelope Valley, most of them located along the railroads.

Gold was discovered on the upper Kern River in 1853, bringing miners and settlers to the area. The importance of gold mining operations ended around 1942 due to the War Production Board issuance of Limitation Order L-208, which classified gold mines nonessential for the World War II effort (Taşkıran et al. 1997).

Kern County was established in 1866 with portions of Los Angeles and Tulare counties set aside to form the new county. It is California's third largest county, and the county seat was established at Havilah in 1866. Asbury Harpending, who made a fortune in gold mining along the Kern River, built a toll road from Bakersfield to Havilah. The county seat was moved from Havilah to Bakersfield in 1874 (Gudde 1998:161; Hoover et al. 2002:132).

Agricultural production has also been and continues to be identified with Kern County. The county was the destination of many of the Dust Bowl refugees chronicled by John Steinbeck in his Pulitzer Prize–winning novel The Grapes of Wrath. His account chronicles the people from Oklahoma and Arkansas who were displaced by the severe dust storms of the 1930s and migrated to California for employment. These people came to be known as "Oakies" and "Arkies," the terms usually applied as a pejorative. Many of them settled in Kern County to work the agricultural fields in the southern Central Valley.

4.5.1.4.4.8 Indian Wells Valley

In the late 1870s, the silver mines at Cerro Gordo and Panamint City brought scores of miners to Indian Wells Valley and transport of ore and minerals from the Indian Wells Valley became problematic. R. C. Jacobs went to Los Angeles to convince the city to construct a road from the Bullion Trail in Indian Wells across the Argus and Slate ranges, and in 1874, Chinese laborers blasted a road bed on the Slate Range crossing to connect Indian Wells with Panamint City. China Lake, a dry lake bed in the area, was named due to the Chinese laborers who temporarily resided in the Indian Wells Valley. The Indian Wells Valley was given its name in 1920 by the U.S. Geographical Board, consolidating the areas of Salt Wells, Brown Valley, and Inyokern Valley.

4.5.1.4.4.9 San Bernardino County

San Bernardino County was organized from parts of Los Angeles and San Diego counties in April 1853, and the city of San Bernardino became the county seat in 1854. The Treaty of Guadalupe Hidalgo ushered San Bernardino County into its American period. Horticulture and livestock, based primarily on cattle as the currency and staple of the Mexican rancho system, continued to dominate the economy through the first decade of the Gold Rush, which began in 1848. Since World War II, several areas in the Mojave have experienced a boom in urban growth. Much of this expansion has centered on Barstow, Victorville, Hesperia, and Apple Valley in the west, and near Twentynine Palms and Yucca Valley further to the east. Along with an increased number of year-round occupants and weekend inhabitants, there is an ever-growing number of visitors to natural areas such as Joshua Tree National Park, which was established as a National Monument in 1936. Off-road vehicle users, rock hounds, and relic hunters have significantly stepped up their activities in the area. Accessibility to the region was made easier by the establishment of the interstate freeway system.

4.5.1.4.4.10 Barstow

The city of Barstow is in the Mojave Desert, equidistant from Los Angeles and Las Vegas. The discovery of silver, and later borax, within the Barstow area in the 1800s and the building of several rail lines prompted an influx of settlers to the region. Ore was easily transported from the mines to various mills using the considerable transportation options available in Barstow at the time (Robinson 1989). As mining operations waned in the early twentieth century, Barstow's role as a transportation hub took off. Additional rail lines were laid through the city, with Barstow serving as a transfer point for people traveling to and from the west coast. The construction of Routes 66 and 91 and later the interstate system, which all run through Barstow, ensured the city's growth and future existence (Walker 1986). The city saw rapid population growth from the 1950s through the 1970s (from 6,135 in 1950 to 17,442 in 1970); however, the population growth of Barstow slowed significantly, increasing by approximately 5,000 people over the next 40 years. Known historic-era properties within Barstow are Barstow High School, located at Country Road and 2nd and the NRHP-listed Casa del Desierto/Harvey House, located adjacent to the AT&SF railroad lines on the northern end of the city. Barstow officially annexed Nebo Center in 2001. At the time of the 2010 U.S. Census, Barstow's population was 22,639.

4.5.1.4.4.11 Daggett

Daggett is an unincorporated area of San Bernardino County, located 19.3 kilometers (12 miles) east of Barstow in the Mojave Desert. Settled in the 1860s as Calico Junction, in 1883 the town's name was changed to Daggett to avoid confusion with the town of Calico, located a few miles to the north (Garrett 1992). The new name bestowed on the town was in honor of John Daggett, then Lieutenant Governor of California. Mining has played an important role in Daggett's history since its founding. Silver, and to a lesser extent gold, was found in the desert area in the late 1800s. Rail lines were laid to help move ore from the mines to the mills and beyond. By the turn of the century, borax mining had become the most important industry in Daggett, employing more than 200 men and supporting the burgeoning town's three stores, three saloons, two restaurants, lumber yard, and hotel (Robinson 1989; Thompson and Thompson 1995). When mining operations declined early in the twentieth century, the population of Daggett plateaued. Daggett experienced a small renaissance in the 1980s and 1990s, supported by a new industry: solar and experimental energy sources. The first commercial solar power plants in the world, SEGS I and SEGS II, were built in Daggett in the 1980s. SEGS II was moved from Daggett in 2009. In 2011 the population of Daggett was recorded as approximately 1,200 residents.

4.5.1.4.4.12 Yermo

Yermo, California, is an unincorporated community located in the Mojave Desert in San Bernardino County, 21 kilometers (13 miles) northwest of Barstow. The gold and silver mining boom of the 1800s introduced settlers to the land. The silver mining operations, located several miles north of Yermo in the Calico Mountains, supported Yermo's economy until the mid-1890s, when silver lost its value and mining operations in the area ceased. The railroad industry had been steadily growing in the area since the 1880s, with new tracks being laid through Yermo at a rapid pace. Yermo eventually became a rail hub for the AT&SF Railway (later purchased by Union Pacific, which operates the Yermo Yard today). In the mid-twentieth century, Yermo experienced an economic renaissance: the establishment of the “Calico Ghost Towns” by businessman Walter Knott in 1952 brought tourism to Yermo. The town’s chamber of commerce marketed Yermo as the “Gateway to the Calicos,” serving as the main point of entry to the mountains, the historic ghost town of Calico, and to recreational activities in the Mojave Desert. Business sprang up all around Yermo and today military operations and tourism are Yermo’s largest industries. The most recent U.S. Census Bureau data list the population of Yermo at 1,092.

4.5.1.4.5 Mojave National Preserve

Created by the Desert Protection Act in 1994, the Mojave National Preserve comprises 1,600,000 acres of land and is the third largest unit of the National Park System within the contiguous United States. Previously the East Mojave National Scenic Area, it now contains the Providence Mountains State Recreation Area and the Mitchell Caverns Natural Preserve. Before the creation of the Preserve, the area was subject to intensive mining and ranching. In the 1880s, ranchers moved to the area now encompassed by the Mojave National Preserve to raise cattle. Five men—George S. Briggs, T. L. Blackburn, Daniel Murphy, Frank Monaghan and George Nay—formed a partnership and in 1894 incorporated the Rock Springs Land & Cattle Company. The company, later also known as the “88” after its cattle brand, was sold in 1904 to Earle J. Greening and John Ewing Jenison, who continued to grow the enterprise. At its peak, the Rock Springs Land & Cattle Company was said to have encompassed 1 million acres. Between 1928 and 1931 the company was split to form three smaller ranches: the California portion of the ranch became the Kessler Springs Ranch of about 300,000 acres and the OX Ranch of about 400,000 acres; the Nevada portion became the Walking Box Ranch. The ranches changed hands several times throughout the twentieth century, and by 1986 the two California ranches were again owned by one family, the Oversons. The 1994 Desert Protection Act established the Mojave National Preserve and encouraged the cessation of ranching operations for environmental reasons. The Overson family and their livestock left the area in 2001 after private donors provided the funds to purchase their holdings and end the region’s long history of cattle ranching (Livingston 2002).

4.5.1.4.6 Military Installations

Military bases were established in the California desert prior to U.S. entry into World War II, but the military took control of much of the California desert at the onset of the war. Whereas General Patton’s Desert Training Program (see Bischoff 2000; Howard 1985) was concentrated in the eastern Mojave (south of the IC Project area), several military bases were established in the western Mojave that are in or near the IC Project area. What would become Edwards Air Force Base (EAFB) was originally established in the early 1930s as the Muroc Lake Bombing and Gunnery Range, located near the remote settlement of Muroc in rural Kern County. The IC Project area intersects a small portion of EAFB near Kramer Junction, in the northeastern corner of the base. In 1940, a large tract of land northeast of Barstow was set aside for Fort Irwin, outside but near the southern segment of the IC Project area. Near Twentynine Palms, a glider training base was set up in 1941. Both of these sites were also used as armored division training areas. Army air bases were created near Daggett and Victorville. The Marine Corps took over supply depots at Nebo and Yermo after World War II, which are now administered as the Marine Corps Logistics Base (MCLB) Barstow (Norris and Carrico 1978). The IC Project area bisects the portion of the MCLB referred to as the Rifle Range and is situated outside the western and southern boundaries of the Yermo Annex. The Naval Air Weapons Station (NAWS) China Lake was established as Naval Ordnance Test Station Inyokern in 1943 as a research, development, acquisition, testing, and evaluation (RDAT&E) facility, and intersects portions of Inyo, Kern, and San Bernardino counties. The IC Project area is along the southwestern NAWS China Lake boundary, north of the community of Inyokern. Brief histories of the three military installations directly intersected by the IC Project area are described below.

4.5.1.4.6.1 Naval Air Weapons Station China Lake

The history of the military presence at NAWS China Lake can be broken down into three periods: Old Military, World War II era, and Cold War era. The Old Military period relates to the initial Euro-American exploration of the West, generally in the 1840s and 1850s, before mining, freighting, and settlement. Early military explorations in the area included Frémont's third expedition in 1845 down Owens Valley and over Walker Pass, and Lt. Bendire's expedition in the 1850s. Expeditions such as these left few discernable archaeological sites in the area because their camps were used for a very short duration.

Aside from exploration, the history of the Old Military period is concerned with conflicts among settlers, miners, and American Indians. The period of Army–Native American conflict (known as the "Indian Wars") coincided generally with the Civil War, from 1862 to 1865. In 1866 The Mining and Scientific Press reported the town of Coso as abandoned because of conflicts with Native Americans. The conflict was reportedly settled when miners at Darwin agreed to provide local Native Americans with jobs at the smelter in return for use of the spring. The reoccupation of Coso by Mexican miners in 1868 indicates that the conflict was resolved by then. Up until 2007 it was believed that stone buildings located near Coso Village and by a spring were the remnants of a military fort associated with the events of this period. Enhanced recordation of this building and associated structures suggest that this building was used not as a fort, but as an early mill for the Coso Mining District (ASM 2008).

In response to American involvement in World War II, the California Institute of Technology (CalTech) in Pasadena assembled a group of scientists who had expertise in rocket development. Under the direction of Dr. Charles Lauritsen, this group had a particular expertise in propellants and fuses. In 1943, the Navy was given the priority of developing a usable aircraft-fired rocket. Before the end of the year, the Navy had committed substantial financial resources to CalTech to advance rocket research, development, testing, and evaluation. Pasadena was a poor location in which to undertake this work due to logistical, safety, and security concerns. In mid-1943, Dr. Lauritsen and Navy Commander Jack Renard recommended that a new test range for Navy rockets be sited at Inyokern. Captain Sherman E. Burroughs, tasked with expediting the rocket program, endorsed these recommendations. In November 1943, the Bureau of Ordnance authorized the permanent establishment of the Naval Ordnance Test Station (NOTS) at Inyokern. Shortly thereafter Burroughs served as the first commander of NOTS Inyokern (Christman 1971; Esser and Treviño 2014).

The original NOTS Inyokern was located in Inyokern, but was moved to China Lake after construction of Armitage Airfield. The previous NOTS Inyokern became what is today the Inyokern Airport. As the original military and civilian directors of NOTS Inyokern, Burroughs and Lauritsen guided installation design, construction, and operation. Four characteristics distinguish NOTS from other World War II installations: 1) it was designed as a permanent facility, 2) it employed a very high percentage of civilian employees, 3) its personnel were a mixture of highly educated civilians and military career men of some rank, and 4) it was consciously designed to foster close communication and cooperation between these two groups. NOTS Inyokern, as originally created, included much of the area referred to today as the North Range. With the need for increasing ranges and test areas for rockets, warheads, fuses, and facilities for pilot training, Mojave B Range (established as a Marine Corps aerial gunnery range in 1943) was added in 1947, and the Randsburg Wash Test Range was added in 1950.

The installation's postwar mission remained largely the same as it had been during the war: to provide RDAT&E leading to the development of improved aircraft rockets for use by U.S. Navy pilots. An abbreviated list of some weapons advanced at NOTS Inyokern attests to the important military role of this facility. During the final years of World War II, the much-touted Holy Moses (a 5-inch high-velocity aircraft rocket) and Tiny Tim (an 11.75-inch air-launched rocket) rocket systems were developed and perfected largely at NOTS Inyokern. After the war, NOTS was tasked with developing a small-caliber, folding-fin rocket for air-to-air use. This effort resulted in two products: Mighty Mouse (released to the Fleet [RTF] in 1952) and Zuni (RTF in 1960).

Equally significant is NAWS China Lake's role in testing and developing production methods for rocket propellants, specifically ballistite, the principal solid rocket propellant used in the 1940s and 1950s. This program took place at the China Lake Pilot Plant facility (now known as the China Lake Propulsion Laboratory). Atomic bomb–related activities also took place at NAWS China Lake, at the rapidly built Salt Wells Pilot Plant (now known as the SWPL). At this facility, development of an explosive lens and testing of the design for atomic bomb casing and fins occurred. The Salt Wells Project spanned from 1945 to 1954.

In the postwar years, China Lake developed a large number of new technologies. The B-4 High Speed Test Track, for example, was a crucial testing facility between 1944 and 1954 (largely for jet aircraft components and missile systems) and is considered an important historic structure at NAWS China Lake. This is also the case for the Supersonic Naval Ordnance Research Track (SNORT), which was developed in 1953 and is still in use today (Mikesell and Larson 1999b).

During this interval, China Lake also continued to excel in developing air-to-air guided missiles. It was here that the world's first infrared homing air-to-air guided missile, the Sidewinder, was devised (RTF 1956). Underwater weapons development also advanced at NOTS, in particular the Mk-32, an acoustic homing torpedo (RTF 1951), and Weapon A, a 13.75-inch antisubmarine rocket (RTF 1951). NAWS China Lake maintained an annex at San Clemente Island, off the southern California coast. This facility hosted the testing and development of the submarine-based ballistic missile program, Polaris, which was intended to counter the Soviet's nuclear arsenals and delivery system.

The Vietnam War renewed Navy interest in conventional weapons, and NAWS China Lake was at the forefront in developing new technologies and customizing hardware to solve urgent problems. A "weapon-a-week" atmosphere developed at China Lake, and the more notable achievements included improvements to the Sidewinder; production of new weapons such as Shrike, Walleye, and fuel-air explosives; the development of night attack and variable thrust technologies; and testing/development of laser and optical guidance systems. Advancements in free-fall bombs were also being made at NAWS China Lake, most notably the cluster bomb "eye" series. Computer-driven weapons systems became increasingly important beginning in the 1970s, and NAWS China Lake played an integral role in developing and testing weapons software for the Navy, Air Force, and Marine Corps.

Throughout the 1960s, NAWS China Lake advanced work on developing precision-guided munitions, which are weapons guided by pilots after they are dropped. The Walleye, a glide bomb with a stabilized TV camera on its nose, was developed almost entirely at NAWS China Lake (RTF 1967). This weapon revolutionized air warfare tactics, and the precision targeting capabilities of Walleye altered conventional military bombing strategies. The nation's first antiradar guided missile, the air-to-ground Shrike missile (RTF early 1960s), is another major NAWS China Lake accomplishment. RDT&E for thrust vector-control (TVC) technology also took place here, with application in the vertical-launch missile systems for Antisubmarine Rocket (ASROC), Harpoon, and Sparrow missiles. Building on Sidewinder technology, forward-looking infrared (FLIR) systems were also advanced at NAWS China Lake. The static monitor testing facility at Skytop was built for the Fleet Ballistic Missile (FBM) project and also recommended eligible for listing to the NRHP. These systems were used extensively during the Vietnam War, as they allow nighttime detection and identification of heat-emanating targets.

In 1967, NOTS Inyokern was renamed the Naval Weapons Center (NWC) China Lake. Through the 1970s and 1980s NWC China Lake continued its excellent work in the RDAT&E field, adding more successful weaponry to the Navy's arsenal and making improvements to previously developed weapons, such as Sidewinder. On January 22, 1992, NWC China Lake was officially placed as a tenant activity under the Naval Air Weapons Station (an operational division of the Naval Air Systems Command [NAVAIR] headquartered in Patuxent River, Maryland) and became the Naval Air Warfare Center Weapons Division (NAWCWD). In 1993 the station assumed its current designation as the NAWS China Lake.

4.5.1.4.6.2 Edwards Air Force Base

For several reasons, the area around Muroc gained increasing attention during the 1920s. Its proximity to Los Angeles provided an ideal filming location for the blossoming movie industry, and the hard, flat surfaces of Rosamond and Rogers dry lakes quickly became a favorite of automobile racing enthusiasts (Earle et al. 1998:65–70). For the same reasons, civilian aircraft manufacturers such as Northrop and Lockheed also began using the area for flight tests by the end of the decade (Earle et al. 1998:72).

The Army Air Corps first expressed interest in the dry lakebeds in 1928 as it looked to establish two bombing and gunnery ranges on the west coast (Earle et al 1998:72). Progress stalled, however, until 1931, when Lieutenant Colonel Henry "Hap" Arnold was assigned to command March Field in Riverside, California. Arnold favored Rogers Dry Lake's proximity to March Airfield, its remoteness, and, above all, its hard, flat surface, which he believed to be the finest landing field conceivable (Komporlides et al. 1997:2–5). Following the approval of the Secretary of War, Arnold began development of the Muroc Lake Bombing and Gunnery Range in 1933. Alternately named Camp 1, it was located on the eastern side of Rogers Dry Lake and within two years, consisted of a cantonment that included a mess hall and barracks (Komporidles et al. 1997:2–7). The complexity and size of the range continued to grow and by the end of the decade, it encompassed an area of more than 150,000 acres (Earle et al. 1998:76)

The eastern side of the lake proved adequate for the first decade of operation, but in 1940 the Muroc Bombing and Gunnery Range was moved to the western side of Rogers Dry Lake. Military decision makers believed this location was advantageous for its proximity to the existing infrastructure at Muroc and also believed it was a better landing field because of the prevailing northwestern winds (Earle 1998:76). Construction continued at what is now known as South Base when the U.S. Army Corps of Engineers developed a water system, roads, runways, range targets, and ordnance buildings (Cotterman et al. 1997:2-10–2-11).

Japan's attack at Pearl Harbor on December 7, 1941, and the U.S. entrance into World War II profoundly affected the development of the Muroc installation. The facility became a major hub of reconnaissance and bomber groups following the arrival of the 6th Reconnaissance Squadron and the 41st and 30th Bombardment Groups, and by 1942, nearly 90 percent of all Pacific Coast patrols were flying out of the airfield (Cotterman et al. 1997:2-11). Eventually made independent of March Field in mid-1942, it was briefly renamed the Muroc Army Air Base (AAB) before being redesignated the Muroc Army Air Field (AAF) in late 1943.

As the United States became involved in World War II, the primary mission of Muroc AAF focused on flight crew training, particularly for B-17 and B-24 bombers and P-38 fighters. Between 1942 and 1945, several thousand pilots, bombardiers, and aerial gunners received training at Muroc, where they practiced strafing, identification, and skip bombing (Komporlides et al. 1997:2-12). The permanent population of the base grew exponentially during this period, from 150 enlisted men in mid-1941 to 6,300 by the end of 1942 (Earle et al. 1998:76).

To support both the mission and the growing population, construction activity accelerated greatly along the western side of Rogers Dry Lake (renamed in 1946). Technical facilities built at South Base included a year-round concrete runway, radio buildings, hangars and support buildings, and a large control tower that provided a commanding overview of the installation (Cotterman et al. 1997:2-11; Earle et al. 1998:76). Further development of the base also involved the construction of administrative buildings, barracks, officer's quarters, mess halls, and recreational facilities.

However, development in California's high desert carried with it a complex set of issues. To fill the base's urgent needs, buildings were rapidly constructed, often at the expense of quality. In accordance with other military buildings built during World War II, many were constructed of wood and tar paper using standardized architectural plans, whereas others were prefabricated structures that were simply installed where needed (Cotterman et al. 1997:2-14–2-15; JRP 2006:30). Limited building materials were another concern, leading base planners to experiment with various construction methods. Two examples included revetments for sheltering aircraft constructed of rammed earth and the construction of a new commander's residence using adobe bricks.

On the northern side of Rogers Dry Lake, the Army Air Forces Materiel Command at Wright Field in Dayton, Ohio, established an additional and distinct installation in mid-1942. Now known as North Base, the facility was named the Muroc Flight Test Base and was built to house and test Bell's XP-59A Airacomet, a secret jet airplane project believed to be vital to the war effort (Hudlow et al. 1995:22). Initial development of the new test installation was intended to be temporary, and limited facilities included a hangar (Building 4305) and barracks. The success of the XP-59A program brought additional test programs at the test installation and construction of a permanent runway, control tower (Building 4500), and additional hangars, and other support buildings and structures were soon built (Hudlow et al. 1995:22). Development of the base also included a heavily guarded security perimeter with barbed wire fences and guard shacks.

Just prior to the end of World War II, the base would become home to another testing facility. Scientists and engineers from the Guggenheim Aeronautical Laboratory/California Institute of Technology (GALCIT) in Pasadena began development of an installation to continue their work on jet-assisted takeoff (JATO), a solid- or liquid-propellant motor engine mounted on a plane to assist with takeoff (Hudlow 1995:13). The GALCIT group was drawn to Rogers Dry Lake like many others for its isolated location and began constructing its new facility 0.75 mile north of the Muroc Flight Test Base in April 1945. Later renamed the Jet Propulsion Laboratory (JPL), the group conducted JATO tests under a U.S. Navy contract, as well as research on missiles for the Army Air Forces; and although there was some interchange with the Muroc Flight Test Base, security restrictions and competition limited any extensive exchange of ideas with other facilities on the base (Komporlides et al. 1997:2-13).

The transfer of Edwards AFB from Air Material Command (AMC) to Air Research Development Command (ARDC) in 1951 emphasized the need to develop the Main Base. Development of the newly re-sited Main Base began immediately and centered on a 300-foot wide by 15,000-foot long, 500,000-pound concrete runway located just north of South Base, which would be the longest and strongest in the world when completed (Weitze 2003:81). By situating it in a southwest/northeast orientation, the new runway took advantage of its natural surroundings and provided unobstructed approaches for more than 30 miles in either direction (J. Gordon Turnbull, Inc. 1950:24–26). Moreover, this location required minimal grading and offered test pilots emergency landing areas on Rogers Dry Lake and Rosamond Dry Lake a short distance to the southwest. A secondary, parallel runway for proven aircraft was located immediately to the north, reducing taxiing distances and reserving the main runway for the testing of unproven aircraft (J. Gordon Turnbull, Inc. 1950:24–26).

The increased capabilities of Edwards AFB were reflected in the growing workload of the base, which had doubled since the implementation of the Master Plan (U.S. Air Force 1959:7). As a result of its expanding operations, the Air Force Flight Test Center's (AFFTC's) mission was redefined on May 4, 1955, "…to accomplish functional (as distinct from engineering) flight tests of complete, manned aircraft weapons systems, including components and allied equipment; to conduct engineering evaluation flight test of aircraft and power plants; to accomplish static firing tests of guided missile power plants; to accomplish research and development related to such tests; to plan for, control, and operate ERETS, the 6511th Test Group (Parachute) facilities, the USAF Experimental Flight Test Pilot School, Center Track Testing Facilities, and other special test activities; to provide facilities and special services for contractors and for other governmental agencies in support of the ARDC Mission" (U.S. Air Force [USAF] 1959:7–8). Tests of experimental and prototype aircraft during this period included the F-100 fighter series; the C-130, C-133, and C-140 transport aircraft; adaptations of the B-52 and RB (reconnaissance bomber-66); and the U-2 (Weitze 2003:87).

As Edwards AFB entered into the 1980s, flight testing had become an increasingly complex and costly process, which required facilities capable of collecting and processing data efficiently. In addition, the ever-increasing sophistication of new weapons systems meant that the AFFTC constantly needed to expand and enhance its technical facilities and equipment (USAF 1981:62). As a result, a number of improvement and modernization efforts were begun by the start of the decade to accommodate the next generation of aircraft. The Ridley Mission Control Complex opened on June 12, 1980, and provided the AFFTC with a modern facility that integrated the Center's mission control and range control functions (USAF 1981:63). Other facilities constructed during the 1980s included the Integration Facility for Avionic Systems Test, the Modeling and Simulation Facility, and the Benefield Anechoic Facility, which was the largest anechoic chamber in the world when constructed (USAF 1989:105). All part of the Avionics Test and Integration Complex, these facilities allowed the testing and integration of software-intensive systems on the ground before ever being taken to the air.

Flight testing and large rocket motor data gathering continued at Edwards AFB through the end of the Cold War in 1991. A large number of fighter, reconnaissance, support, and research aircraft continued to be tested at Edwards AFB, including the Grumman X-29, the AFTI/F-111, the F-15 STOL/MTD, the McDonnell Douglas C-17 Globemaster III, and the Northrop B-2 Spirit. In addition, a new weapons system developed in association with the B-2 was the Short-Range Attack Missile (SRAM), a nuclear cruise missile (Weitze 2003:94). Although flight and weapons RDT&E evolved significantly since the AFFTC's founding, the unique combination of natural, technical, and human resources at Edwards AFB would ensure the base's role as one of the world's preeminent testing installations.

4.5.1.4.6.3 Marine Corps Logistics Base (MCLB) Barstow

With the onset of World War II in 1939, the United States increased military funding and began to develop and expand new and existing facilities. To meet this demand, the Navy's Bureau of Yards and Docks developed a set of standardized plans that provided for the efficient construction of temporary facilities, bases, and buildings. This type of construction is commonly referred to as "World War II temporary" and was used because of wartime shortages of time, manpower, and materials.

As the military's personnel and facilities rapidly expanded, so did a demand for additional supplies and logistical support. In 1940, the Navy only had two continental naval supply depots and two small Marine Corps depots, which procured, stored, and delivered materials to individual installations. As a result, the Navy began a campaign to develop a number of new depots in remote inland locations with standardized plans and new palletizing and forklift storage systems.

Barstow was chosen as the site of a new depot because of its proximity to existing roads and highways, and a dry climate that allowed for outdoor storage. Congress authorized construction of the new depot on May 8, 1942, and contacted James T. Holmes and D. Lee Narver's Los Angeles engineering firm to design and construct the new supply depot. Prior to construction, naval engineers addressed concerns over flooding from the Mojave River by constructing a series of culverts. Other preliminary considerations included the development of wells and provision of electricity through lines run along highway and railroad rights-of-way.

Holmes and Narver began working on plans in June 1942, with construction beginning in September of the same year. In late 1942, the Navy made the decision to transfer the supply depot to the Marine Corps. The new supply depot was officially activated on January 4, 1943, and would continue to develop into the following months. Throughout the rest of World War II, MCLB Barstow supported the war effort by providing supply and warehouse functions.

After World War II, MCLB Barstow grew in size and expanded the scope of its operations. Equipment damaged during the war was repaired, and new equipment was added. In 1946, MCLB Barstow was re-designated as the Marine Corps Storage and Repair Depot (MCSRD) in response to the installation's new function. By April 1946, the Navy was looking to expand MCSRD by acquiring a nearby World War II Army post known as the U.S. Army Quartermaster Depot at Yermo. After successful negotiations in July 1946, the USMC officially moved into the Yermo facility.

During the early postwar period, new residential units and storage facilities were added to the base. A 1947 housing project constructed 100 family apartments for both civilian and military personnel, 44 apartments for officers and enlisted personnel, 20 dormitory units for women, and 30 dormitory units for men. As the population of installation personnel grew, the number of Morale, Welfare, and Recreation (MWR) facilities, medical facilities, and civilian-operated businesses increased. Along with this growth came the addition and upgrade of storage and repair facilities.

In March 1948, the installation's official designation was changed to Marine Corps Depot of Supplies, Barstow. The installation was now composed of two separate areas: the original location, known as the Nebo Area, and the newly acquired Yermo Annex. In response to a labor shortage on base, the USMC pushed for the recruitment of Navajo Indians to fill the labor gap. In March 1949, the installation was re-designated Barstow Annex, Marine Corps Depot of Supplies, San Francisco. By this time, the base had grown to accommodate more than 1,200 personnel. In response, Commanding Officer Colonel Chester R. Allen looked to the Wherry Housing program under Title VIII of the National Housing Act for a solution to the housing shortage.

Throughout the Korean Conflict (1950–1953), the installation performed the same supply function as it did during World War II, with the addition of the new Yermo repair facility. During the conflict, the installation was able to expand its capabilities, upgrading existing systems and adding new storage and housing projects. The base now served the USMC in the western United States and overseas forces, provided storage for the California National Guard 140th Heavy Tank Battalion, and conducted automotive maintenance for the Army at Camp Irwin.

In the mid-1950s, the San Francisco depot was phased out and its functions transferred to Barstow. From 1958 on, MCLB Barstow was responsible for all USMC logistics west of the Mississippi River, as well as the Pacific and Far East. These new responsibilities led to further expansion of the base with the acquisition of the Rifle Range along Highway 66. During this time, MCLB Barstow constructed a repair facility building at Yermo (Building 573), which became the largest single-story workspace ever constructed for the USMC, covering 10 acres and equipped with several cranes to repair and service equipment. This new repair facility elevated the installation's level of support during the Vietnam War, continuing to expand throughout the 1960s and 1970s.

In November 1978, the installation was given its current name, MCLB Barstow. MCLB Barstow would go on to have an active support role following Iraq's invasion of Kuwait in 1990, providing Marines stationed in Saudi Arabia with thousands of tons of supplies. Between 2004 and 2005, MCLB Barstow was faced with the possibility of a base closure or substantial reduction after Congress called for base closures across the United States. Despite this congressional action, MCLB Barstow managed to remain open and is currently one of the Barstow region's largest employers.

4.5.2 Cultural Resources Methods

4.5.2.1 Archaeological Methods

4.5.2.1.1 Records Search Methods for Archaeological Sites

SCE consultant SWCA Environmental Consultants (SWCA) reviewed resource records and previous studies located within 0.8 kilometer (0.5 mile) of the IC Project Alignment. This information was obtained from multiple sources. SWCA conducted a records search within SCE's internal ArcGIS Online (AGOL) system, which contains results from the Southern San Joaquin Valley Information Center (SSJVIC) of the California Historical Resources Information System (CHRIS), located at California State University, Bakersfield, and the Eastern Information Center (EIC) of the CHRIS, located at the University of California Riverside. In June 2018, Material Culture Consulting, Inc. (MCC) conducted a records search at the SSJVIC and the EIC; records from San Bernardino County, which were not on file within the SCE AGOL system, were obtained from the South Central Coastal Information Center (SCCIC), located at California State University, Fullerton.

4.5.2.1.2 Native American Coordination

The Native American Heritage Commission (NAHC) maintains two databases to assist cultural resources specialists in identifying cultural resources of concern to California Native Americans. On December 7, 2018, SWCA contacted the NAHC to obtain information about known cultural and tribal cultural resources and request a list of Native American tribal representatives who may have a cultural affiliation with the IC Project area. The NAHC responded on December 28, 2018, stating that the Sacred Lands File (SLF) database includes previously identified sacred sites in the vicinity of the IC Project Alignment. In consideration of these culturally significant sacred sites, the NAHC suggested contacting two Native American tribes for more information. The NAHC also forwarded a list of 12 Native American groups or individuals that are culturally affiliated with the IC Project area. The results of the NAHC SLF search would be provided to the CPUC and BLM for use in their respective Native American consultation efforts.

4.5.2.1.3 Survey

An intensive pedestrian survey of the project APE for cultural resources would be conducted following the methodology described in the project Work Plan (Martinez and Wesson 2018), a draft of which was submitted to the Bureau of Land Management (BLM) for review in late November 2018. The direct area of potential effect (APE) for the IC Project is defined as construction areas for the Full-Rebuild Concept. This is a 22.8-m (75-foot) buffer along the existing IC Project Alignment, which includes a total of a 45.7-m (150-foot)-wide swath for 576 km (358 miles). The direct APE further includes a 15.2-m (50-foot) buffer around ancillary areas needed during construction, for staging, equipment laydown, materials storage, vehicle parking, etc., as well as a 7.6-m (25-foot) buffer on all access roads needed for construction. The combined area of the direct APE is 8,309.8 acres, all of which would be subjected to intensive pedestrian survey for cultural resources.

SWCA would conduct a Class III pedestrian survey as defined by the California BLM Guidelines for a Cultural Resources Inventory (BLM 2009). The survey would be conducted using equally spaced parallel transects approximately 15 m in width, except when necessitated by hazardous topography, excessively dense vegetation, or other physical barriers. Transect spacing may be reduced to facilitate the recordation of features and boundaries within sites with dense vegetation (or other ground cover that limits visibility). A global positioning system (GPS) receiver with submeter accuracy and topographic maps would be used to locate previously recorded sites and APE boundaries, and to maintain transit accuracy. Field data would be recorded on a global positioning system (GPS) receiver with submeter accuracy and on digital forms using Samsung tablets with Android operating systems, with standard field forms available in case of equipment failure.

SWCA would collect all data necessary on new and previously recorded resources to complete the appropriate State of California Department of Parks and Recreation (DPR) Series 523 forms. Resources that were initially recorded or updated in the last 10 years that exhibit no discrepancy when compared with existing records would not be updated. SWCA would not survey areas of the APE where a previous survey was conducted in the last 10 years if the survey meets modern standards of adequacy.

4.5.2.1.4 National Register of Historic Places Eligibility Criteria

SWCA would make recommendations on NRHP/California Register of Historical Resources (CRHR) eligibility based on surface manifestations of features and visible artifact assemblages. Resources would be evaluated for their integrity and be recommended eligible or not eligible; alternatively, resources would remain unevaluated where eligibility recommendations cannot be made for sites with only survey-level data.

4.5.2.2 Built Environment Methods

For the purposes of differentiating the scope of Class III cultural resources work between the Class III Report and the Historic Built Environment Report (HBER), the historic-era built environment is defined to include any building, structure, built object, or property improvement; manmade road or circulation route; and manmade park, open space, or other scenic location which could be regarded as a designed cultural landscape. This definition includes but is not limited to single- and multifamily dwellings, commercial buildings, warehouses and other industrial and utilitarian structures, powerhouses and substations, electrical transmission lines, roads and highways, water conveyance channels and holding features, walls, railroad tracks/lines with associated infrastructure, onsite or offsite advertising signage, and agricultural or homestead properties with intact or remnant buildings, structures, and animal husbandry and containment structures.

4.5.2.2.1 Records Search Methods for the Built Environment

In July 2018 Urbana completed a desktop survey of the direct APE using Google Earth aerial views, historic aerial imagery, and other available data layers. A desktop survey database/spreadsheet was compiled listing all built environment improvements observed within the direct APE. These observed improvements were preliminarily researched to assign approximate year-built dates. Each built environment improvement was categorized as more than 45 years of age (historic-era) or less than 45 years of age (contemporary-period) to inform properties and would be photographed as part of field survey efforts. Sources used to obtain year-built dates include County Assessor data, GIS road ownership data, historic USGS topographic maps, and U.S. Department of Agriculture (USDA) aerial photography.

4.5.2.2.2 Survey

The historic built environment survey would divide the survey into two segments and photograph and observe each historic-era or potentially historic-era improvement to obtain representative views and to understand construction features and level of integrity. Urbana would document historic roads on the appropriate DPR Series 523 forms. Documentation for any archaeological resources associated with the roads would be provided by SWCA so that Urbana can augment their documentation for each road to include any associated archaeological resources. Associated archaeological resources would be considered features of a linear resource comprising both the road and associated features and reported in the HBER. Field survey photos would be processed for use in California DPR Series 523 forms and within the HBER. All newly recorded historic-era properties within the direct APE shall be documented, at a minimum, on DPR 523 A (Primary Record), B (Building, Structure, Object Record), L (Continuation Sheet, as needed), and J (Map Sheet) series forms.

4.5.2.2.3 National Register of Historic Places Eligibility Criteria

Each property shall be evaluated under the eligibility criteria of the NRHP, CRHR, and local registers. A CRHR status code shall be assigned to each property to indicate significance findings and eligibility conclusions. Contextual and property-specific research shall inform Urbana’s eligibility findings, with the historical narrative and contexts included in the HBER. Improvements that were previously recorded prior to 2014 shall be updated or re-evaluated as needed on the appropriate DPR forms.

4.5.3 Cultural Resources Results

4.5.3.1 Records Search

SWCA reviewed records search results from the SSJVIC, EIC, SCCIC, and SCE’s AGOL system, including resources and records within a 0.5-mile buffer around the direct APE. A total of 715 cultural resource studies have been previously conducted within 0.5-mile of the APE. Of these, 376 studies intersect the direct APE. These studies include intensive and reconnaissance surveys as well as archaeological monitoring. Approximately 878 acres or 10.6 percent of the direct APE has been subject to survey in the past 10 years. A total of 63 intensive surveys totaling 441 acres or 5.3 percent of the APE have been conducted within the direct APE during the last 10 years. Non-intensive studies previously conducted within the direct APE include one reconnaissance survey of 116.47 acres, two monitoring projects totaling 2.31 acres, and two studies categorized as “unknown” totaling 0.34 acre. The data set includes 22 surveys with no value provided for survey type; together, these cover a total of 306.66 acres within the direct APE.

The records searches also identified a total of 2,508 previously recorded cultural resources within 0.5 mile of the direct APE. Of these, 582 previously recorded cultural resources are located within or partially intersect the direct APE. Of the 582 previously recorded cultural resources present within the direct APE 237 are historic, 186 are prehistoric, and 159 are multicomponent resources. The temporal affiliation of six cultural resources is unknown. Historic districts within the direct APE include the Rand Mining District, Stringer Mining District, and Crestview Subdivision. The Little Lake Prehistoric District that intersects with the APE has been recommended eligible for listing in the NRHP. The multicomponent Last Chance Canyon Archaeological District is rich with archaeological sites such as gold mining campsites, aboriginal villages, house ring complexes, and petroglyphs. Within the direct APE, two cultural resources are listed on in the NRHP: the Last Chance Canyon Archaeological District (NRHP no. 72000225) and the Manzanar War Relocation Center, National Historic Site (NRHP no. 76000484). The Manzanar War Relocation Center is a California State Historical Landmark (CRHR no. 850).

4.5.3.2 Native American Consultation

California Public Resources Code (PRC) Section 5097.91 established the Native American Heritage Commission (NAHC), the duties of which include taking inventory of places of religious or social significance to Native Americans and identifying known graves and cemeteries of Native Americans on private lands. PRC Section 5097.98 specifies a protocol to follow when the NAHC is notified of a discovery of Native American human remains from a county coroner.

SWCA contacted the NAHC on December 7, 2018, with a request for a search of its Sacred Lands File (SLF) within the IC Project area. A search of the SLF was completed for the project with positive results. Initial tribal outreach letters were sent by the CPUC to 39 tribal contacts on December 14, 2018, with a fact sheet summarizing the Full-Rebuild Concept. Follow-up email messages were sent on December 16 and 24, 2018.

See Section 4.18, Tribal Cultural Resources, for a discussion on cultural resources of potential importance to California Native American tribes.

4.5.3.3 Survey

Information regarding the Class III intensive pedestrian survey of the project APE and the findings of the survey would be made available following completion of the survey and agency approval of the associated technical report.

4.5.4 Cultural Resources Regulatory Setting

Federal, state, and local regulations were reviewed for applicability to the IC Project.

4.5.4.1 Federal

A federal undertaking is a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; those requiring a federal permit, license, or approval; and those subject to state or local regulation administered pursuant to a delegation or approval by a federal agency (36 Code of Federal Regulations [CFR] 800.16[y]). Actions and undertakings may take place either on or off federally controlled property and include new and continuing projects, activities, or programs and any of their elements not previously considered under the National Environmental Policy Act (NEPA) and Section 106 of the NHPA. If the project requires federal water permitting or is located on federal lands, it is subject to compliance with NEPA and Section 106 of the NHPA. In addition to the federal regulations described in the following subsections, federal authorizations would also be required because portions of the IC Project area are under the jurisdiction of the Department of the Interior's BLM, the Department of Defense (DoD), or the National Park Service.

4.5.4.1.1 National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires the federal government to carry out its plans and programs in such a way as to "preserve important historic, cultural, and natural aspects of our national heritage" (42 United States Code [USC] Section 4331[b][4]). The intent of the statute is to require that agencies obtain sufficient information regarding historic and cultural properties (including consulting, for example, appropriate members of the public; local, state and other federal government agencies; and Native American tribes, organizations, and individuals) to make a determination of the historical and cultural significance of affected historic or cultural properties and to take into account whether irreversible adverse impacts to such resources can or should be avoided, minimized, or mitigated.

4.5.4.1.2 National Historic Preservation Act

Enacted in 1966 and amended most recently in 2014, the National Historic Preservation Act (NHPA; 54 USC 300101 et seq.) instituted a multifaceted program, administered by the Secretary of the Interior, to encourage sound preservation policies of the nation's cultural resources at the federal, state, and local levels. The NHPA authorized the expansion and maintenance of the NRHP, established the position of State Historic Preservation Officer (SHPO), and provided for the designation of State Review Boards. The NHPA also set up a mechanism to certify local governments to carry out the goals of the NHPA, assisted Native American tribes in preserving their cultural heritage, and created the Advisory Council on Historic Preservation (ACHP).

4.5.4.1.2.1 Section 106

Section 106 of the NHPA requires federal agencies to consult with the ACHP to take into account the effects of their undertakings on historic properties. The Section 106 process involves identification of significant historic resources within an "area of potential effects [APE]; determination if the undertaking will cause an adverse effect on historic resources; and resolution of those adverse effects through execution of a Memorandum of Agreement." Title 36 of the Code of Federal Regulations (CFR) part 800 defines how federal agencies meet these responsibilities. 36 CFR 800.5(a) describes the process for evaluating a project's adverse effects on cultural resources. An adverse effect is found when a federal undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register of Historic Places (NRHP) in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Examples of adverse effects are provided in 36 CFR 800(a)(2) and include, but are not limited to:

- Physical destruction of or damage to all or part of the property;
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines;
- Removal of the property from its historic location;
- Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features;
- Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
- Transfer, lease, or sale of property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

4.5.4.1.3 National Register of Historic Places

The National Register of Historic Places (NRHP) was established by the NHPA of 1966 as "an authoritative guide to be used by federal, state, and local governments, private groups and citizens to identify the Nation's cultural resources and to indicate what properties should be considered for protection from destruction or impairment" (36 CFR part 60.2). The NRHP recognizes properties that are significant at the national, state, and local levels. To be eligible for listing in the NRHP, a resource must be significant in American history, architecture, archaeology, engineering, or culture. Districts, sites, buildings, structures, and objects of potential significance must also possess integrity of location, design, setting, materials, workmanship, feeling, and association.

A property is eligible for the NRHP if it is significant under one or more of the following criteria:

- Criterion A: It is associated with events that have made a significant contribution to the broad patterns of our history.
- Criterion B: It is associated with the lives of persons who are significant in our past.
- Criterion C: It embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D: It has yielded, or may be likely to yield, information important in prehistory or history. Ordinarily cemeteries, birthplaces, or graves of historic figures; properties owned by religious institutions or used for religious purposes; structures that have been moved from their original locations; reconstructed historic buildings; and properties that are primarily commemorative in nature are not considered eligible for the NRHP unless they satisfy certain conditions. In general, a resource must be 50 years of age to be considered for the NRHP unless it satisfies a standard of exceptional importance.

In addition to meeting the significance criteria, a property must retain historic integrity, which is defined in the National Register Bulletin 15 as the "ability of a property to convey its significance" (National Park Service 1990). To assess integrity, the National Park Service recognizes seven aspects or qualities that, considered together, define historic integrity. To retain integrity, a property must possess several, if not all, of these seven qualities, which are defined in the following manner in National Register Bulletin 15:

- Location: the place where the historic property was constructed or the place where the historic event occurred
- Design: the combination of elements that create the form, plan, space, structure, and style of a property
- Setting: the physical environment of a historic property
- Materials: the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property
- Workmanship: the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory
- Feeling: a property's expression of the aesthetic or historic sense of a particular period of time; and/or
- Association: The direct link between an important historic event or person and a historic property

A cultural resource that meets the definition provided, meets at least one of the criteria listed above, and meets at least several qualities of historic integrity is considered eligible for listing in the NRHP and is referred to as a "historic property."

4.5.4.1.4 Archaeological Resources Protection Act

The Archaeological Resources Protection Act (ARPA) of 1979 provides for the protection of archaeological resources more than 100 years old and that occur on federally owned or controlled lands. The statute makes it unlawful to excavate and remove items of archaeological interest from federal lands without a permit, and it defines the process for obtaining such a permit from the responsible federal agency. This process includes a 30-day notification to interested persons, including Native American tribes, by the agency to receive comments regarding the intended issuing of a permit. The law establishes a process for prosecuting persons who illegally remove archaeological materials from lands subject to ARPA. The law also provides for curation of archaeological artifacts, ecofacts, notes, records, photographs, and other items associated with collections made on federal lands. Standards for curation are provided for in regulations at 36 CFR 79.

4.5.4.1.5 Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act (NAGPRA) provides a process for museums and federal agencies to return certain Native American "cultural items" (i.e., human remains, funerary objects, sacred objects, and objects of cultural patrimony) to lineal descendants, culturally affiliated Native American tribes (i.e., tribes recognized by the Secretary of the Interior), and Native Hawaiian organizations, if the legitimate cultural affiliation of the cultural items can be determined according to the law. Museums, as defined under the statute, are required to inventory cultural items in their possession and determine which items can be repatriated to the appropriate party. Cultural items intentionally or unintentionally excavated and removed from federal lands may be subject to NAGPRA.

Under the NAGPRA regulations (43 CFR 10.3 and 10.5), a federal agency must prepare, approve, and sign a Plan of Action (POA) if the agency intends to excavate or remove, or leave in place NAGPRA cultural items when these cultural items are exposed or are found already exposed, and does not wish for activity in the area of the exposed cultural items to halt.

4.5.4.2 State

4.5.4.2.1 California Public Utilities Commission (CPUC) General Order 131-D

Pursuant to CPUC General Order (GO) 131-D, the California Public Utilities Commission (CPUC) has sole and exclusive jurisdiction over the siting and design of electric power line projects, distribution lines, substations, or electric facilities constructed by public utilities in the state of California. Under CEQA, the CPUC is the lead agency for such IC Project elements within the state of California. SCE is required to comply with GO 131-D and is seeking a Permit to Construct (PTC) from the CPUC for the IC Project; therefore, compliance with CEQA and other state environmental statutes involving cultural resources is required. The CPUC is tasked with compliance of all provisions in CEQA and the CEQA Guidelines that concern cultural resources as explained below.

4.5.4.2.2 California Environmental Quality Act

The California Environmental Quality Act (CEQA) Statute and Guidelines direct lead agencies to determine whether cultural resources are "historically significant" resources. CEQA requires that potential project impacts to cultural resources be assessed, and requires mitigation if significant (or "unique") cultural resources would be affected (Section 21083.2 [a-1] and CEQA Guidelines Appendix G). Generally, a cultural resource is considered "historically significant" if the resource is 45 years old or older; possesses integrity of location, design, setting, materials, workmanship, feeling, and association; and meets the requirements for listing on the CRHR under any one of the following criteria:

1) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
2) Is associated with the lives of persons important in our past;
3) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or,
4) Has yielded, or may be likely to yield, information important in prehistory or history (Title 14 California Code of Regulations [CCR] Section 15064.5).

The statutes and guidelines specify how cultural resources are to be managed in the context of projects, such as the IC Project. Briefly, archival and field surveys must be conducted, and identified cultural resources must be inventoried and evaluated in prescribed ways. Prehistoric and historical archaeological resources as well as historic built environment resources deemed "historically significant" must be considered in project planning and development. Resources eligible for listing on the CRHR are referred to as "historical resources."

If a Lead Agency determines that an archaeological site is a historical resource, the provisions of PRC Section 21084.1 and CEQA Guidelines Section 15064.5 would apply. If an archaeological site does not meet the CEQA Guidelines criteria for a historical resource, the site is to be treated in accordance with the provisions of PRC Section 21083 regarding unique archaeological resources. The CEQA Guidelines note that if a resource is neither a unique archaeological resource nor a historical resource, the effects of a project on that resource shall not be considered a significant effect on the environment (CEQA Guidelines Section 15064[c][4]).

CEQA Guidelines Section 15064.5(e), Assembly Bill 2641, Public Resources Code Sections 15064.5(e) and 15064.5(d), and Health and Safety Code Section 7050.5

If human remains of any kind are found during construction activities on non-federal or reservation land, these codes require that ground-disturbing project activities be stopped in the immediate vicinity of the discovery and that the county coroner be called in to assess the remains. The coroner will examine the remains and determine the next appropriate action based on his or her findings. If the county coroner determines that the remains to be of Native American origin, the coroner must contact the NAHC within 24 hours. The NAHC will then identify a most likely descendant (MLD) to be consulted regarding treatment and/or reburial of the remains.

4.5.4.2.3 California State Assembly Bill 52

California State Assembly Bill 52 (AB 52) of 2014 amended PRC Section 5097.94 and added PRC Sections 21073, 21074, 21080.3.1, 21080.3.2, 21082.3, 21083.09, 21084.2, and 21084.3.

AB 52 formalizes the lead agency/tribal consultation process, requiring the lead agency to initiate consultation with California Native American groups that are traditionally and culturally affiliated with the project, including tribes that may not be federally recognized. Lead agencies are required to begin consultation prior to the release of a negative declaration, mitigated negative declaration, or environmental impact report.

Section 4 of AB 52 adds Sections 21074(a) and 21074(b) to the PRC, which address tribal cultural resources and cultural landscapes. Section 21074(a) defines tribal cultural resources as one of the following:

1. Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either of the following:
    a. Included or determined to be eligible for inclusion in the CRHR
    b. Included in a local register of historical resources as defined in subdivision (k) of Section 5020.1
2. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Section 5024.1. In applying the criteria set forth in subdivision (c) of Section 5024.1 for the purposes of this paragraph, the lead agency shall consider the significance of the resource to a California Native American tribe.

Section 1 (a)(9) of AB 52 establishes that "a substantial adverse change to a tribal cultural resource has a significant effect on the environment." Effects on tribal cultural resources should be considered under

CEQA. Section 6 of AB 52 adds Section 21080.3.2 to the PRC, which states that parties may propose mitigation measures "capable of avoiding or substantially lessening potential significant impacts to a tribal cultural resource or alternatives that would avoid significant impacts to a tribal cultural resource." Further, if a California Native American tribe requests consultation regarding project alternatives, mitigation measures, or significant effects to tribal cultural resources, the consultation shall include those topics (PRC Section 21080.3.2[a]). The environmental document and the mitigation monitoring and reporting program (where applicable) shall include any mitigation measures that are adopted (PRC Section 21082.3[a]).

4.5.4.2.4 California Register of Historical Resources

Created in 1992 and implemented in 1998, the California Register of Historical Resources (CRHR) is "an authoritative guide in California to be used by state and local agencies, private groups, and citizens to identify the state's historical resources and to indicate what properties are to be protected, to the extent prudent and feasible, from substantial adverse change" (PRC Sections 21083.2 and 21084.1). Certain properties, including those listed in or formally determined eligible for listing in the NRHP and California Historical Landmarks numbered 770 and higher, are automatically included in the CRHR. Other properties recognized under the California Points of Historical Interest program, identified as significant in historical resources surveys, or designated by local landmarks programs, may be nominated for inclusion in the CRHR. According to PRC Section 5024.1(c), a resource, either an individual property or a contributor to a historic district, may be listed in the CRHR if the State Historical Resources Commission determines that it meets one or more of the following criteria, which are modeled on NRHP criteria:

- Criterion 1: It is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.
- Criterion 2: It is associated with the lives of persons important in our past.
- Criterion 3: It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values.
- Criterion 4: It has yielded, or may be likely to yield, information important in history or prehistory.

Resources nominated to the CRHR must retain enough of their historic character or appearance to convey the reasons for their significance. Resources whose historic integrity does not meet NRHP criteria may still be eligible for listing in the CRHR.

4.5.4.2.5 Treatment of Human Remains

The disposition of burials falls first under the general prohibition on disturbing or removing human remains under California Health and Safety Code (CHSC) Section 7050.5. More specifically, remains suspected to be Native American are treated under CEQA at CCR Section 15064.5; PRC Section 5097.98 illustrates the process to be followed in the event that remains are discovered. If human remains are discovered during construction, no further disturbance to the site shall occur, and the County Coroner must be notified (CCR 15064.5 and PRC 5097.98).

All work reported here was conducted in conformance with the stipulations of SWCA's U.S. DOI BLM Cultural Resources Use Permit (CRUP) Authorization CA-17-23. All work was also conducted in conformance with SCE's Environmental, Health and Safety Handbook for Contractors (2016).

4.5.4.3 Local

The California Public Utilities Commission (CPUC) has sole and exclusive state jurisdiction over the siting and design of the IC Project. Pursuant to CPUC General Order 131-D (GO 131-D), Section XIV.B, "Local jurisdictions acting pursuant to local authority are preempted from regulating electric power line projects, distribution lines, substations, or electric facilities constructed by public utilities subject to the CPUC's jurisdiction. However, in locating such projects, the public utilities shall consult with local agencies regarding land use matters." Consequently, public utilities are directed to consider local regulations and consult with local agencies, but the counties' and cities' regulations are not applicable as the counties and cities do not have jurisdiction over the IC Project. Accordingly, the following discussion of local land use regulations is provided for informational purposes only.

General plans and municipal codes were reviewed for relevant local policies pertaining to cultural resources in the vicinity of the IC Project. General plans reviewed included preservation programs for Inyo, Kern, and San Bernardino counties; the Daggett Community Plan; and the City of Barstow Historic Preservation Program. Relevant goals, policies, and objectives are discussed in the following subsections.

4.5.4.3.1 Inyo County Historic Preservation Program

There are several preservation ordinances that apply under the Inyo County Code (ICC). Pursuant to Section 9.52.030, no publicly or privately sponsored project or action shall be expressly permitted by the county planning commission, hereinafter, the County Commission, or any other county agency where the County Commission finds that any archaeological, paleontological, and historical features, or Native California Indian burial sites may be disturbed in any way by the project or action. Further, there is a stipulation that no plan shall be sufficient, and no plan shall be approved by the County Commission unless the plan, in addition to proposed preservation, protection, or relocation measures, shall propose reasonable alternatives to the proposed project or action that do not require significant disturbance of the features or sites.

Chapter 9.52 of the ICC covers the disturbance of archaeological, paleontological, and historical features. Pursuant to ICC Chapter 9.52, the excavation or exploration for archaeological, educational, or artifact collection purposes of any Native California Indian burial site is prohibited. In addition, when archaeological or historical evidence indicates that a site was set aside for a Native California Indian burial site, all plans for a project that may cause disturbance must be submitted to the Big Pine Paiute Tribe of the Owens Valley, the Bishop Paiute, the Death Valley Timbisha Shoshone Tribe, the Fort Independence Indian Community of Paiute Indians, the Lone Pine Paiute–Shoshone Tribe, the Owens Valley-Paiute-Shoshone Band, or other representatives for review and comment.

The ICC covers Native California Indian burial sites. If one such site is discovered in the course of a project development, the person responsible for the project must notify the County Commission and interested California Native Indians in the county. The County Commission will weigh the archaeological, paleontological, or historical value of the burial site against the economic detriment to the project; based on the outcome, either the project or the burial site may be relocated.

4.5.4.3.2 Kern County Historic Preservation Program

Policies and implementation measures for cultural resources are contained within the Land Use Element of the Kern County General Plan, within Section 1.10.3 "Archaeological, Paleontological, Cultural, and Historical Preservation."

Kern County Policy: The County will promote the preservation of cultural and historic resources that provide ties with the past and constitute a heritage value to residents and visitors.

4.5.4.3.3 San Bernardino County Historic Preservation Program

The County of San Bernardino regulates the identification, protection, and appropriate treatment of historical resources and historic properties through the General Plan Cultural Resources Element, Cultural Resources Preservation Overlay, and San Bernardino County Development Code.

Goals and policies for cultural resources, including historic buildings and properties, are included within the Conservation Element of the San Bernardino County General Plan.

Established under Development Code Section 82.01.020 and Section 82.01.030, the Cultural Resources Preservation Overlay (CRPO) provides for the identification and preservation of important archaeological and historical resources as many are regarded as unique and non-renewable, and their preservation provides a greater knowledge of County history and identity for the benefit of future generations. The CRPO may be applied to areas where archaeological and historic sites that warrant preservation are known to be present, or are likely, to be present.

Currently, the CRPO map only covers the Oak Hills, Phelan, and Pinon Hills area of San Bernardino County. An overlay does not exist for the proposed IC Project area.

4.5.4.3.4 Daggett Community Plan

The Daggett Community Plan (DCP) is a specific plan intended to guide the future character and independent identity of the unincorporated community of Daggett. Emphasizing the importance on local history, the values statement of the DCP cites its first value as “Community Pride and History. The community takes pride in its people and its heritage. Daggett values its heritage and works to remember, preserve and document its historical roots as it looks to the future.”

4.5.4.3.5 City of Barstow Historic Preservation Program

The City of Barstow maintains goals, policies, and implementation strategies relating to the protection and enhancement of historical and cultural resources within the Resources Conservation and Open Space Element of the General Plan, and also outlines procedures for the review of discretionary and non-discretionary projects within the Resources Conservation and Open Space Element of the General Plan. The City also provides a cultural resources sensitivity map to inform project applicants of the potential for the occurrence of historical and cultural resources within the City’s jurisdiction. The sensitivity map defines areas that have been the subject of cultural evaluations, as well as areas requiring additional study should they be significantly impacted by future development.

4.5.5 Cultural Resources Significance Criteria

CEQA, its Guidelines, and other provisions of the PRC call for the protection and preservation of significant cultural resources (i.e., “historical resources” and “unique archaeological resources”). The CEQA Guidelines provide three ways in which a resource can be a “historical resource,” and thus a cultural resource meriting analysis:

1. The resource is listed on the CRHR;
2. The resource is included in a local register of historical resources (pursuant to PRC Section 5020.1[k]), or identified as significant in an historical resources survey (meeting the criteria in PR Section 5024.1[g]); or
3. The lead agency determines the resource is “historically significant” by assessing CRHR listing guidelines that parallel the federal criteria (CEQA Guidelines Section 15064.5[a][1]–[3] [as amended]).

To qualify as a historical resource under 1) or 3), the resource must also retain the integrity of its physical identity that existed during its period of significance. Integrity is evaluated with regard to retention of location, design, setting, materials, workmanship, feeling, and association (14 CCR 4852[c]).

Finally, under both federal and California state law, Native American human remains and associated grave goods are granted special consideration. Direct and indirect impacts only to historic properties

(NRHP) and historical resources (CRHR) are considered in the assessment. Management of cultural resources not eligible for listing in the NRHP or CRHR is not required (36 CFR 800 and Section 15064.5[c][4] of the CEQA Guidelines [as amended]).

The significance criteria for assessing the impacts to cultural resources come from the CEQA Environmental Checklist and states that a project causes a potentially significant impact if it would:

- Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5;
- Cause a substantial adverse change in the significance of an archeological resource pursuant to Section 15064.5; and/or
- Disturb any human remains, including those interred outside of formal cemeteries.

4.5.6 Cultural Resources Impact Analysis

CEQA guidelines specify that a "substantial adverse change in the significance of an historical resource means physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired" (CEQA Guidelines Section 15064.5). Material impairment occurs when a project alters in an adverse manner or demolishes "those physical characteristics of an historical resource that convey its historical significance and that justify its inclusion" or eligibility for inclusion in the NRHP, CRHR, or local register. In addition, pursuant to CEQA Guidelines section 15126.2, the "direct and indirect significant effects of the project on the environment shall be clearly identified and described, giving due consideration to both the short-term and long-term effects."

The following guides and requirements are of particular relevance to this study's analysis of indirect impacts to historic resources. Pursuant to CEQA Guidelines (Section 15378), study of a project under CEQA requires consideration of "the whole of an action, which has the potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment." CEQA Guidelines (section 15064[d]) further defines direct and indirect impacts as follows:

1. A direct physical change in the environment is a physical change in the environment which is caused by and immediately related to the project.
2. An indirect physical change in the environment is a physical change in the environment which is not immediately related to the project, but which is caused indirectly by the project. If a direct physical change in the environment in turn causes another change in the environment, then the other change is an indirect physical change in the environment.
3. An indirect physical change is to be considered only if that change is a reasonably foreseeable impact which may be caused by the project.

In terms of archaeological resources, PRC Section 21083.2(g) defines a unique archaeological resource as an archaeological artifact, object, or site about which it can be clearly demonstrated that without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

1. Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.
2. Has a special and particular quality such as being the oldest of its type or the best available example of its type.
3. Is directly associated with a scientifically recognized important prehistoric or historic event or person.

If it can be demonstrated that a proposed project would cause damage to a unique archaeological resource, the lead agency may require reasonable efforts be made to permit any or all of these resources to be preserved in place or left in an undisturbed state. To the extent that they cannot be left undisturbed, mitigation measures are required (PRC Sections 21083.2[a], [b], and [c]). CEQA notes that if an archaeological resource is neither a unique archaeological resource nor a historical resource, the effects of the project on those resources shall not be considered to be a significant effect on the environment (CEQA Guidelines section 15064.5[c][4]).

4.5.6.1 Would the Project cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5?

4.5.6.1.1 Construction

This analysis would be provided under separate cover following completion of pedestrian surveys and approval of technical report(s) by the responsible agency(ies).

4.5.6.1.2 Operation

Less than Significant Impact. Normal operation and maintenance (O&M) of subtransmission lines would be controlled remotely through SCE control systems, and manually in the field as required. Maintenance would occur as needed and could include activities such as repairing conductors, washing or replacing insulators, repairing or replacing other hardware components, replacing poles, tree trimming, brush and weed control, and access road maintenance. Most regular O&M activities of overhead facilities are performed from existing access roads with no surface disturbance. Repairs to facilities, such as repairing or replacing poles and structures, could occur in undisturbed but previously surveyed areas. Therefore, operation impacts to historical resources as defined in Section 15064.5 would be less than significant.

4.5.6.2 Would the Project cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?

4.5.6.2.1 Construction

This analysis would be provided under separate cover following completion of pedestrian surveys and approval of technical report(s) by the responsible agency(ies).

4.5.6.2.2 Operation

Less than Significant Impact. Normal operation of substation, transmission, subtransmission, distribution, and telecommunications lines would be controlled remotely through SCE control systems, and manually in the field as required. Maintenance would occur as needed and could include activities such as repairing conductors, washing or replacing insulators, repairing or replacing other hardware components, replacing poles, tree trimming, brush and weed control, and access road maintenance. Most regular O&M activities of overhead facilities are performed from existing access roads with no surface disturbance. Repairs to facilities, such as repairing or replacing poles and structures, could occur in undisturbed, but previously surveyed areas. Therefore, operation impacts to archaeological resources as defined in Section 15064.5 would be less than significant.

4.5.6.3 Would the Project disturb any human remains, including those interred outside of dedicated cemeteries?

4.5.6.3.1 Construction

Less than Significant Impact. Records searches and a cultural resources inventory identified no human remains in the IC Project area. Although known burial features and potential locations of human remains would be avoided, cultural resources, including Native American human remains, could potentially be encountered during ground-disturbing construction activities. It is not always possible to predict where Native American human remains might occur outside of formal cemeteries. Ground-disturbing activities could disturb human remains, including those interred outside of formal cemeteries. However, implementation of a Workers Environmental Awareness Program (WEAP) would help workers identify potential human remains and establish procedures for stopping work and notifying SCE's cultural resource staff and construction supervisors in the event that human remains are detected.

If human remains are inadvertently discovered during construction activities, all work in the vicinity of the find would cease within a 100-foot (30.5-m) radius of the remains, and the area would be secured and protected to ensure that no additional disturbance occurs. The county coroner would then be contacted in accordance with CEQA Guidelines Section 15064.5(e), AB 2641, PRC Sections 15064.5(e) and 15064.5(d), and California Health and Safety Code (HSC) Section 7050.5. The coroner would have two working days to examine the remains after being notified. If the coroner determines that the remains are Native American (i.e., not subject to the coroner's authority) and located on private or state land, the coroner has 24 hours to notify the NAHC of the determination. The NAHC is required under PRC Section 5097.98 to identify an MLD, notify that person, and request that they inspect the remains and make recommendations for treatment and/or disposition. The MLD would have 48 hours to inspect the find and make recommendations for treatment of the human remains. Work would be suspended in the area of the find until the MLD and landowner confer on the mitigation and treatment of the human remains. However, the human remains and associated burial items would be reburied, with appropriate dignity, on the property in a location not subject to further subsurface disturbance if one of the following occurs:

- The NAHC is unable to identify an MLD.
- The MLD identified fails to make a recommendation.
- The recommendation of the MLD is rejected and the mediation provided in PRC Section 5097.94(k) fails to provide measures acceptable to the landowner.

This procedure would ensure that the remains are treated in accordance with Section 15064.5(d) and (e) of the CEQA Guidelines, California HSC Section 7050.5, and PRC Sections 5097.98 and 5097.99.

As described in Section 4.5.4, Cultural Resources Regulatory Setting, cultural resources intentionally or unintentionally excavated and removed from federal lands may be subject to NAGPRA if the resources are confirmed to be of Native American origin. In the event that Native American items are inadvertently discovered on federal lands, NAGPRA requires that the responsible federal agency must be immediately notified by telephone and in writing. Following the receipt of the written notification, the federal agency must certify the receipt of it within three days. The activity that resulted in the discovery must be stopped immediately after discovery and may not resume until 30 days after the applicable federal agency certifies the receipt of the notification. The federal agency would also be responsible for taking immediate steps, if necessary, to further secure and protect the remains and/or items that were discovered. During this process, the federal agency would notify any MLDs or applicable Native American tribes of the discovery, obtain written confirmation of the notification, and initiate consultation, if necessary. Following consultation, the federal agency would prepare, approve, and sign a written NAGPRA POA (43 CFR 10.3 and 10.5), which would specify the treatment, care, and handling of the discovered remains and cultural resources.

SCE would comply with the applicable regulations to ensure the protection of human remains and burial sites during construction. Based on implementation of APM WEAP and APMs CUL-1, CUL-2, CUL-3, and

CUL-4, and the consideration of sites that may contain human remains during the final design of the IC Project, impacts to human remains during construction would be reduced to less-than-significant levels.

4.5.6.3.2 Operations

Less than Significant Impact. O&M activities for subtransmission lines would include repairing conductors, washing or replacing insulators, repairing or replacing other hardware components, replacing poles and towers, tree trimming, brush and weed control, and access road maintenance. O&M activities would also include routine inspections and emergency repair, which would require the use of vehicles and equipment, and are typically short term in nature. Ground disturbance during O&M activities could occur in previously disturbed or potentially undisturbed but previously surveyed areas. However, O&M activities would have a low potential to encounter human remains, if any are present. If human remains are discovered during O&M activities of the Full-Rebuild Concept, work would stop, best management practices similar to those previously outlined would be implemented, and the remains would be treated in accordance with applicable laws. Therefore, any potential impacts would be less than significant.

4.5.7 Paleontological Resources Environmental Setting

The IC Project Alignment is within California's Basin and Range and Mojave Desert geomorphic provinces. Within California, the Basin and Range Geomorphic Province is bordered on the west by the Sierra Nevada, on the southeast by the Mojave Desert, and on the northeast by the Nevada border (Harden 2004). The Mojave Desert Geomorphic Province is bound on the southwest by the San Andreas Fault Zone and the Transverse Ranges; on the north and northeast by the Garlock Fault, the Tehachapi Mountains, and the Basin and Range; and on the south by the Colorado Desert (Harden 2004; Norris and Webb 1990).

Both geomorphic provinces share a similar and related geologic history until the Neogene (approximately 23.5 million years ago), when younger structural deformation from faulting and volcanic activity changed the two related provinces. Within both geomorphic provinces, the oldest rocks consist of a complex of early to middle Proterozoic schists and gneisses of sedimentary origin with associated granitic rocks, some of which date to 2.5 to 1.7 billion years ago (Hall 2007; Norris and Webb 1990). The overlying younger Proterozoic rocks consist of regularly bedded conglomerates, sandstones, siltstones, shales, limestones, and dolomites deposited as nearshore marine sediments near the continental shelf edge as subsidence and supercontinental divergence occurred at this time (Hall 2007; Norris and Webb 1990).

The Basin and Range contains thick sections of marine siliciclastic and carbonaceous sedimentary rocks of latest Proterozoic to Paleozoic age, particularly in the Death Valley and Inyo mountains, the latter of which contains the thickest Paleozoic section in California's Basin and Range, with an aggregate thickness of approximately 7,010 meters (23,000 feet), nearly half of which is of Cambrian age (Norris and Webb 1990). Deposition of thick strata representative of most Paleozoic periods implies relatively continuous sedimentary deposition in a tectonically stable setting, with the deposition of limestone and dolomite implying shallow, warm paleoenvironments throughout the Paleozoic (Hall 2007; Harden 2004; Norris and Webb 1990). Unlike within the Basin and Range, the Mojave Desert province yields only partial Paleozoic sections, which are mainly present within its eastern ranges and are relatively thinner than those exposed in the Basin and Range province and divided by unconformities. For example, the lower Paleozoic of the Mojave Desert is represented by less than 1,524 meters (5,000 feet) thick of cumulative rock, with no continuous sections greater than 762 to 914 meters (2,500 to 3,000 feet) thick throughout most of the province; however, the thickest marine Paleozoic section within the Mojave Desert is exposed in the Providence Mountains, totaling approximately 3,050 meters (10,000 feet) thick, and Upper Paleozoic strata are recognized in the Ord Mountains and near Victorville (Hall 2007). Thick Paleozoic rock sections, specifically those of Cambrian age in the Basin and Range province, have been important for understanding the adaptation and evolution of shelled forms and the rapid evolution and diversification of marine life during the "Cambrian Radiation" and metazoan evolution during the early to middle Paleozoic.

Throughout the Paleozoic and into the early Mesozoic, shallow seas and low lands persisted in the area, with the rifting away of the Mojave region west of Barstow, giving rise to the recognizable north-south coastline of California (Hall 2007). Shallow seas transgressed and regressed repeatedly over mudflat low lands throughout the Triassic. By the late Triassic and early Jurassic, the seas had regressed to the northwest during orogenic and volcanic activities associated with the Sierra Nevada, Owens Valley, and Inyo Mountains in the Basin and Range province (Norris and Webb 1990), and arid conditions became widespread within the Mojave Desert province, depositing nonmarine deposits such as eolian red sands (Hall 2007). Throughout the middle of the Mesozoic era, erosion and nondeposition persisted until the middle to late Cretaceous when granitic intrusions developed due to tectonic subduction and subsequently caused contact metamorphism of the rocks surrounding the intrusions (Hall 2007; Norris and Webb 1990). Within the Mojave Desert, continued orogenic activity associated with the neighboring ranges thrust older rocks eastward on top of younger strata during the Cretaceous, but by the end of the Mesozoic, Nevadan orogenic activities and erosion reduced the Mojave and the Sierra Nevada to relatively lower topographic relief (Hall 2007; Harden 2004; Norris and Webb 1990; Prothero 2017).

Widespread erosion and/or nondeposition persisted from the late Cretaceous to the Oligocene in both provinces, representing a significant unconformity (Hall 2007; Norris and Webb 1990). However, by the Oligocene, sediment deposition resumed in both the Basin and Range and Mojave Desert geomorphic provinces, with nonmarine sediments deposited in the savanna-type environment with moderately moist climates, water-retaining vegetation, and numerous vertebrate fossils (Norris and Webb 1990). From the Oligocene to the Miocene, both provinces became increasingly more arid, and nonmarine basinal deposition became widespread. In addition, both provinces became increasingly more tectonically active, with structural extension and faulting increasing throughout the Miocene. Structural extension caused the creation of basins and ranges, as well as volcanoes in the southern Nevada (Hall 2007). Within the Basin and Range province, crustal extension occurred simultaneously with the transition from oblique subduction near the continental margin to transform faulting along the San Andreas fault system (Hall 2007; Norris and Webb 1990). Due to increased tectonics, the Mojave Desert block was uplifted by 3,050 to 4,572 meters (10,000 to 15,000 feet) by the late Miocene, with some basins accruing at least 10,000 feet of nonmarine sedimentary deposits overlying pre-Cretaceous basement rocks (Hall 2007). Tectonic extension in both provinces during the Miocene resulted in the formation of detachment faults, more noticeably in the eastern Mojave Desert, with numerous faults occurring throughout this time in the western Mojave Desert that parallel the San Andreas and are truncated by the Garlock Fault (Hall 2007; Harden 2004; Norris and Webb 1990). Tectonic extension and periods of subduction at the continental margin increased volcanic activity from the Miocene and into the Plio-Pleistocene, with basins filled with tuff, ash, andesites, rhyolites, volcanic flows, and flow breccias often interbedded with lacustrine, playa, and evaporite deposits (Norris and Webb 1990). Within the Basin and Range province, erosion had reduced the ancestral Sierra Nevada to a range of low hills, allowing grasslands to be more widespread in the area (Norris and Webb 1990). During the late Pliocene and Holocene, volcanic activity was abundant in both the Basin and Range and Mojave Desert provinces, with several cinder cones and flow deposits present today at the surface (Hall 2007; Norris and Webb 1990). Throughout the Pleistocene and into the Holocene, lakes, playas, dune fields, and lava flows continued to fill basins, with lacustrine environments occurring during cooler periods with less evaporation (Harden 2004; Norris and Webb 1990). During the Pleistocene, snowmelt from the Sierra Nevada drained to the Owens Valley, Mono Lake, and Owens Lake areas within the Basin and Range before draining to the lower Lake Manly along the floor of Death Valley, and within the Mojave Desert, snowmelt from the San Gabriel and San Bernardino mountains drained into Lake Manix, located northwest of Barstow, before also draining to Lake Manly (Norris and Webb 1990; Prothero 2017). However, by the late Pleistocene and Holocene, the entire region became hotter and drier, resulting in more noticeable climate gradients between mountainous ranges and intermontaine basins and the reduction of lakes in the region (Norris and Webb 1990).

The regional geology of the Basin and Range and Mojave Desert geomorphic provinces is characteristic of crustal extension, giving the characteristic north-south–trending peaks, valleys, and detachment faults; volcanic eruptions from crustal extension; and filling of dropped basins with alluvial and colluvial sediments eroded and transported downslope from ranges of higher relief (Harden 2004). The Basin and Range Geomorphic Province has much more prominent north-south–trending ranges, basins, and faults from consistent east-west crustal extension over the past 16 million years to the present (Harden 2004; Norris and Webb 1990). Conversely, the Mojave Desert province has a much more subdued landscape, with broader basins and less continuous ranges due to relatively less crustal extension within the province since the Miocene and the recent right-lateral faulting due to transform faulting near the San Andreas and Garlock faults (Harden 2004; Prothero 2017).

Geologic mapping indicates that the IC Project Alignment is underlain by Precambrian igneous and metamorphic rocks; Precambrian (Neoproterozoic) Noonday Dolomite; Cambrian to Devonian Goodsprings Dolomite; Devonian Sultan Limestone; Carboniferous Monte Cristo Limestone; Paleozoic and Mesozoic igneous and metamorphic rocks; Cenozoic (Quaternary and Tertiary) igneous rocks; Tertiary sedimentary rocks; Paleocene to Eocene Goler Formation; Miocene Ricardo Group; Miocene to Pliocene Tropico Group; Miocene to Pliocene Coso Formation; Pliocene Bedrock Spring Formation; Pliocene volcanic sediments; Pleistocene Manix Lake Beds; older Quaternary (Pleistocene) alluvial deposits; and younger Quaternary (Holocene) deposits (Bateman 1964a, 1964b; Dibblee 2008a, 2008b, 2008c, 2008d, 2008e, 2008f, 2008g, 2008h, 2008i; du Bray and Moore 1985; Hewett 1956; Jennings et al. 1962; Nelson 1966; Ross 1965; Stinson 1977a, 1977b; Stone et al. 2000). Paleontological potential rankings for each geologic unit were assigned using the federal Potential Fossil Yield Classification (PFYC) system (BLM 2016) based on the results of a literature search and two institutional record searches completed during preparation of the IC Project's paleontological resources survey work plan (Aron et al. 2018).

A summary of the paleontological resources and paleontological potential of the geologic units within the IC Project Alignment is provided in Table 4.5-2. Full discussions of the geologic units and associated paleontological resources are provided in the paleontological resources survey work plan (Aron et al. 2018).

Table 4.5-2: Paleontological Potential by Geologic Unit

Geologic Unit	Age	Common Fossil Types	Paleontological Potential	General Location
Unnamed Igneous and Metamorphic Rocks (includes metamorphic rocks in the Soda Mountains area, and gneiss and granite)	Precambrian	**None**	Very Low (PFYC 1)	Eastern portion of the IC Project Alignment near I-15 from Baker to northeast of Mountain Pass, CA (San Bernardino County)
Rand Schist	Precambrian	**None**	Very Low (PFYC 1)	Central portion of the IC Project Alignment near Randsburg, CA (Kern County)
Noonday Dolomite	Precambrian	**Trace fossils**	Low (PFYC 2)	Eastern portion of the IC Project Alignment near I-15 between Halloran Springs and Mountain Pass, CA (San Bernardino County)

Table 4.5-2: Paleontological Potential by Geologic Unit

Geologic Unit	Age	Common Fossil Types	Paleontological Potential	General Location
Waterman Gneiss	Precambrian or Paleozoic	**None**	Very Low (PFYC 1)	Southern portion of the IC Project Alignment in the vicinity of Hinkley and Barstow, CA
Garlock Series Meta-Sediments and Meta-Volcanics	Paleozoic	**None**	Very Low (PFYC 1)	Central portion of the IC Project Alignment to the south of Inyokern and north of Randsburg, CA (Kern County)
Goodsprings Dolomite	Late Cambrian to Devonian (?)	**Scarce Invertebrate fossils:** brachiopod, gastropod, sponge, coral, cephalopod	Low (PFYC 2)	Eastern portion of the IC Project Alignment near I-15 between Halloran Springs and Mountain Pass, CA (San Bernardino County)
Sultan Limestone	Middle to Late Devonian	**Invertebrate fossils:** sponge, coral, brachiopod	Moderate (PFYC 3)	Eastern portion of the IC Project Alignment north of I-15 near Mountain Pass, CA (San Bernardino County)
Monte Cristo Group	Early Mississippian	**Invertebrate fossils:** coral, brachiopod, bryozoan, crinoid, bivalve, gastropod, cephalopod, trilobite, ostracod	Moderate (PFYC 3)	Eastern portion of the IC Project Alignment north of I-15 near Mountain Pass, CA (San Bernardino County)
Unnamed Igneous and Metamorphic Rocks (includes pelitic hornfels, quartzite, and schist; marble; granitic rocks; felsite dikes; hornfels; quartz latite dikes; metavolcanics rocks; granodiorite; quartz diorite; granite to quartz monzonite; quartz monzonite porphyry; plutonic diorite; syenite; aplite dikes; and leucogranite)	Paleozoic to Mesozoic	**None**	Very Low (PFYC 1)	Sporadically throughout the extent of the IC Project Alignment (Inyo, Kern, and San Bernardino counties)
Tungsten Hill Granite	Late Triassic	**None**	Very Low (PFYC 1)	Northern portion of the IC Project Alignment along Highway 395 north of Big Pine, CA (Inyo County)
Volcanic Complex of the Alabama Hills	Middle Jurassic	**None**	Very Low (PFYC 1)	Northern portion of the IC Project Alignment along Highway 395 near Lone Pine, CA (Inyo County)

Table 4.5-2: Paleontological Potential by Geologic Unit

Geologic Unit	Age	Common Fossil Types	Paleontological Potential	General Location
Tinemaha Granodiorite	Jurassic or Cretaceous	**None**	Very Low (PFYC 1)	Northern portion of the IC Project Alignment along Highway 395 near Tinemaha Reservoir (Inyo County)
Cathedral Peak Granite	Cretaceous	**None**	Very Low (PFYC 1)	Northern portion of the IC Project Alignment along Highway 395 near Big Pine, CA (Inyo County)
Teutonia Quartz Monzonite	late Cretaceous or lower Tertiary	**None**	Very Low (PFYC 1)	Eastern portion of the IC Project Alignment along I-15 near Halloran Springs, CA (San Bernardino County)
Igneous Rocks (includes felsite, andesite and/or dacite, diabase, tuff breccia, silicious veins in volcanic rocks, felsitic rhyolite or quartz latite, and rhyolitic breccia, includes younger basalt and cinders, basalt, andesite, basalt dikes, intrusive basalt)	Cenozoic (Quaternary and Tertiary)	**Scarce to None** Fossils can rarely be preserved in tuffs and breccias. No fossils will be preserved in the remainder of the igneous rocks.	Very Low (PFYC 1) with the exception of tuff breccia and rhyolitic breccia, which have Unknown Potential (PFYC U)	Sporadically throughout the extent of the IC Project Alignment
Red Buttes Quartz Basalt	Tertiary (Pliocene, or possibly Miocene)	**None**	Very Low (PFYC 1)	Southern portion of the IC Project Alignment in the vicinity of Kramer Junction, CA (San Bernardino County)
Unnamed Sedimentary Rocks (includes limestone, shale, undifferentiated nonmarine sedimentary rocks, fanglomerates, conglomerate, and sandstone)	Tertiary	**Undetermined:** There are no recorded fossils from the unnamed rocks, however, fossils are known from named formations of similar age and lithology, including horse, rhinoceros, peccary, camel, antelope, elephant, dog, cat, and microvertebrates. If these unnamed sediments are determined to be equivalent, then similar types of fossils may be present.	Unknown (PFYC U)	Southern and eastern portions of the IC Project Alignment, sporadically between the Barstow area and Halloran Springs

Table 4.5-2: Paleontological Potential by Geologic Unit

Geologic Unit	Age	Common Fossil Types	Paleontological Potential	General Location
Goler Formation	Paleocene to Early Eocene	**Invertebrate fossils:** foraminifera, mollusk **Vertebrate fossils:** turtle, ray, lizard, crocodile, shark, marsupial, primate **Plant fossils:** wood	Very High (PFYC 5)	Central portion of the IC Project Alignment to the south of Inyokern and north of Randsburg, CA (Kern County)
Ricardo Group (includes the Ricardo and Dove Springs formations)	Miocene	**Vertebrate fossils:** fish, amphibians, reptiles, birds, rodent, rabbit, perissodactyl, artiodactyl, elephant **Plant fossils:** wood, grass, pollen	High (PFYC 4)	Central portion of the IC Project Alignment to the south of Inyokern and north of Randsburg, CA (Kern County)
Tropico Group	Miocene and Pliocene	**Vertebrate fossils:** camel, oreodont, rodents, extinct deer-like animal, artiodactyl, snake	High to Very High (PFYC 4-5)	Southern portion of the IC Project Alignment in the vicinity of Kramer Junction, CA (San Bernardino County)
Coso Formation (includes both sedimentary and pyroclastic units)	Miocene and Pliocene	**Sedimentary Units–Vertebrate fossils:** mastodon, hyena-like canid, peccary, camel, bear, hare **Pyroclastic Units–Scarce fossils:** Fossils can rarely be preserved in pyroclastic sediments	High (PFYC 4) in sedimentary units Low (PFYC 2) in pyroclastic units	Central portion of the IC Project Alignment near the Haiwee Reservoir (Inyo County)
Volcanic Sediments (diatomite interbedded with lacustrine silt and sand and pebble conglomerate)	Pliocene	**Undetermined:** No recorded fossils, but fossils have been preserved in similar types of Pliocene-aged sediments.	Unknown (PFYC U)	Northern portion of the IC Project Alignment along Highway 395 near Tinemaha Reservoir (Inyo County) and in the southern portion along I-15 near Manix, Midway, and Dunn, CA (San Bernardino County)
Bedrock Spring Formation	Middle Pliocene	**Vertebrate fossils:** ungulate, camel, horse, pronghorn, elephant, saber-toothed cat	Moderate (PFYC 3)	Central portion of the IC Project Alignment along Highway 395 near Red Mountain, CA (westernmost San Bernardino County)

Table 4.5-2: Paleontological Potential by Geologic Unit

Geologic Unit	Age	Common Fossil Types	Paleontological Potential	General Location
Manix Lake Beds	Pleistocene	**Vertebrate fossils:** mammoth, dire wolves, pronghorn, sheep, sloth, camel, saber-toothed cat, bear, rabbit, rodents, turtle, birds, fish **Invertebrate fossils**	Very High (PFYC 5)	Southern portion of the IC Project Alignment along I-15 near Manix, Midway, and Dunn, CA (San Bernardino County)
Unnamed Older Quaternary Deposits (includes older alluvium, older alluvium and fanglomerate, fanglomerate of andesitic detritus, fanglomerate of metasediment and basalt detritus, older fanglomerate and gravel, older alluvial gravel, older debris flow gravels, younger debris flow gravels, lacustrine deposits, older lake deposits, older alluvial fan and lakebed deposits, and clay and marl)	Pleistocene	**Vertebrate fossils:** mastodon, mammoth, horse, bison, antelope, cougar, sloth, bighorn sheep, camel, llamas, coyote, dog, fox, wolf, saber-toothed cat, mole, rabbit, rodent, bat, snake, frog, lizard, turtle, bird **Plant fossils** **Insect fossils**	Unknown and Moderate (PFYC U and 3) – Potential is dependent on lithology	Throughout the extent of the IC Project Alignment in lower lying areas and potentially underlying younger Quaternary deposits at shallow depths (Inyo, Kern, and San Bernardino counties)
Unnamed Younger Quaternary Deposits (includes alluvium, alluvial fan deposits, inactive alluvium, colluvium, river terrace gravel, Mojave River channel sand, dune/eolian sand, lake deposits, Owens Lake deposits, Waucobi Lake deposits, talus, valley fill, and clay)	Holocene	**Scarce reworked fossils and subfossils:** typically too young to contain in situ fossils, but may overlie higher paleontological potential units	Low (PFYC 2)	Throughout the extent of the IC Project Alignment in lower lying areas (Inyo, Kern, and San Bernardino counties)

Source: Aron et al. 2018

4.5.8 Paleontological Resources Survey Results

4.5.8.1 Paleontological Resources Locality Searches

Paleontological records searches were requested from the Natural History Museum of Los Angeles County (LACM) and the University of California Museum of Paleontology (UCMP) to identify if there are any known fossils along the IC Project Alignment. LACM responded on August 18, 2017, and July 27, 2018, that they do not have any vertebrate localities within the IC Project Alignment, but do have localities nearby from sedimentary deposits similar to those within the IC Project Alignment, including fossils from Owens Lake and Manix Lake sediments, which are crossed by the IC Project Alignment (McLeod 2017, 2018; see

Confidential Appendix A in Aron et al. 2018). Exact fossil locations were not provided by the museum, but general locations with regard to the IC Project area are provided in the discussion below where available. UCMP responded on March 7, 2017, that they have no record of vertebrate localities within the project area (Finger 2017; see Confidential Appendix A in Aron et al. 2018).

Numerous vertebrate localities were reported from the Coso Formation, including LACM (CIT) 131, 284–285, LACM 1106, 1182, 3515, 4102, and 4591–4600, which are all approximately 5 miles east to east-northeast of Dirty Socks hot spring on the northern flank of the Coso Mountains and southeast of Highway 190. These localities have produced fossil chub, eagle, loon, pelican, cormorant, and large and small mammals including camel, peccary, dog, horse, mammoth, mastodon, rabbit, and rodents. The most notable are the holotypes of the mastodon *Pliomastodon cosoensis*, field mouse *Cosomys primus* [now *Mimomys primus*], and bone-crushing dog *Hyaenognathus solus* [now *Borophagus diversidens*] (McLeod 2017).

Manix Lake Beds along the Manix Wash and Mojave River have produced an extensive fossil fauna, consisting primarily of birds, from localities LACM (CIT) 540–542, LACM 1093, 3496, 4032–4039, 4054–4061, and 5746–5756. The exact locations of the Manix Lake Bed localities were not provided by LACM, however, the project crosses Manix Lake Beds and the Manix Wash approximately one mile east of Manix, CA. In this area, the IC Project Alignment is situated between I-15 to the north and the Mojave River to the south. A single fossil is also recorded from these sediments near Dunn (locality LACM [CIT] 582), approximately 1.5 miles south of the IC Project Alignment. The composite fossil fauna consists of minnows, carp, pond turtles, eagles, hawks, geese, ducks, gulls, extinct gull relatives, terns, sandpipers, avocets, storks, cranes, coots, pelicans, cormorants, grebes, cattle, sheep, goats, camels, cats, bears, rabbits, horses, mammoths, and ground sloths (McLeod 2018).

Localities in and around Owens Lake and China Lake have produced diverse fossil assemblages. Recovered fossils include bony fish, suckers, chub, turtle, legless lizard, frog, golden eagle, bald eagle, ducks, swan, goose, gulls, California quail, loon, coot, rail, grebes, crane, cormorant, mammoth, elephantoid, horse, camels, deer, sheep, bison, dire wolf, wolf, saber-toothed cat, puma, bobcat, jackrabbit, cottontail, vole, meadow mouse, deer mouse, pocket gopher, pocket mouse, house mouse, squirrel, and pronghorn antelope (McLeod 2017). Localities LACM 4691, 7716–7719, 7992–7998, and 8027–8029 were reported from older Quaternary lacustrine deposits in and around Owens Lake. The exact locations of the Owens Lake localities were not provided by LACM, however, the project area crosses Owens Lake sediments as it traverses along Highway 395 from north of Bartlett to Cartago, and the current lake is located immediately east of the IC Project Alignment in this area. Localities LACM (CIT) 226, LACM 1543, 3659, 5151–5157, 7013, and 7262 are located near the current dry China Lake approximately 7 miles east of the IC Project Alignment as it crosses through Inyokern (McLeod 2017).

Locality LACM 4538 from older Quaternary alluvium near the current dam for the North Haiwee Reservoir less than a half-mile east of the IC Project Alignment produced a specimen of Columbian mammoth (McLeod 2017). Older Quaternary alluvium to the west of the IC Project Alignment on the southern flank of the El Paso Mountains as the line transverses form Inyokern to Randsburg has produced Ice Age fossils. Localities near Goler Gulch (approximately 2 miles west of the project), Mesquite Canyon (approximately 2.5 miles west of the project), and Garlock (approximately 6 miles west of the project) have produced fossil horse, antelope, camel, and rabbit from localities LACM 3721, 5853–5854, and 6263–6267. Fossil horse and camel were reported from older alluvial deposits to the west of the Mesquite Hills (locality LACM 1208), approximately 8 miles south of the IC Project Alignment as it traverses northeast towards Beacon Station along I-15.

In Nevada, more than 10 miles northeast of the IC Project Alignment, older Quaternary sediments in the beds of the dry Mesquite Lake produced fossils of dog and camel from localities LACM 8000 and 8001, respectively. South of the Las Vegas Mountain Range, fossil specimens of undermined carnivore, mammoth, horse, camel, and bison were recovered from locality LACM 7797 (McLeod 2018).

4.5.8.2 Paleontological Sensitivity Analysis

Based on the abundance and significance of the fossils identified during the literature review and record searches (summarized in Table 4.5-2 and Section 4.5.7.1 and described in detail in Aron et al., 2018), the Paleocene to Eocene Goler Formation and Pleistocene Manix Lake Beds are assigned a very high paleontological potential (PFYC 5). Sediments of the Tropico Group have a high to very high paleontological potential (PFYC 4-5). The Miocene Ricardo Group and sedimentary units of the Miocene to Pliocene Coso Formation are assigned a high paleontological potential (PFYC 4). The Devonian Sultan Limestone, Carboniferous Monte Cristo Group, and Pliocene Bedrock Spring Formation are all considered to have a moderate paleontological potential (PFYC 3). Older Quaternary (Pleistocene) alluvial deposits have undetermined and moderate potential (PFYC U and 3) depending on the lithology. The Precambrian (Neoproterozoic) Noonday Dolomite, Cambrian to Devonian Goodsprings Dolomite, and younger Quaternary (Holocene) deposits all have low paleontological potential (PFYC 2); however, the younger Quaternary deposits may be underlain by higher sensitivity geologic units at unknown depth. Precambrian igneous and metamorphic rocks, Paleozoic and Mesozoic igneous and metamorphic rocks, and Cenozoic (Quaternary and Tertiary) igneous rocks (with the exception of breccia units) have very low paleontological potential (PFYC 1). Breccia units of the Cenozoic igneous rocks, pyroclastic units of the Miocene to Pliocene Coso Formation, Tertiary sedimentary rocks, and Pliocene volcanic sediments are all considered have an unknown paleontological potential (PFYC U).

Table 4.5-3: Potential Fossil Yield Classification (BLM 2016)

BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary (PFYC System)
1 = Very Low Potential	Geologic units are not likely to contain recognizable paleontological resources. Units are igneous or metamorphic, excluding air-fall and reworked volcanic ash units. Units are Precambrian in age. Management concern is usually negligible, and impact mitigation is unnecessary except in rare or isolated circumstances.
2 = Low Potential	Geologic units are not likely to contain paleontological resources. Field surveys have verified that significant paleontological resources are not present or are very rare. Units are generally younger than 10,000 years before present. Recent eolian deposits. Sediments exhibit significant physical and chemical changes (i.e., diagenetic alteration) that make fossil preservation unlikely. Management concern is generally low, and impact mitigation is usually unnecessary except in occasional or isolated circumstances.
3 = Moderate Potential	Sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence. Marine in origin with sporadic known occurrences of paleontological resources. Paleontological resources may occur intermittently, but these occurrences are widely scattered. The potential for authorized land use to impact a significant paleontological resource is known to be low-to-moderate. Management concerns are moderate. Management options could include record searches, pre-disturbance surveys, monitoring, mitigation, or avoidance. Opportunities may exist for hobby collecting. Surface-

Table 4.5-3: Potential Fossil Yield Classification (BLM 2016)

BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary (PFYC System)
	disturbing activities may require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action and whether the action could affect the paleontological resources.
4 = High Potential	Geologic units that are known to contain a high occurrence of paleontological resources. Significant paleontological resources have been documented but may vary in occurrence and predictability. Surface-disturbing activities may adversely affect paleontological resources. Rare or uncommon fossils, including nonvertebrate (such as soft body preservation) or unusual plant fossils, may be present. Illegal collecting activities may impact some areas. Management concern is moderate to high depending on the proposed action. A field survey by a qualified paleontologist is often needed to assess local conditions. On-site monitoring or spot-checking may be necessary during land disturbing activities. Avoidance of known paleontological resources may be necessary.
5 = Very High Potential	Highly fossiliferous geologic units that consistently and predictably produce significant paleontological resources. Significant paleontological resources have been documented and occur consistently. Paleontological resources are highly susceptible to adverse impacts from surface disturbing activities. Unit is frequently the focus of illegal collecting activities. Management concern is high to very high. A field survey by a qualified paleontologist is almost always needed and on-site monitoring may be necessary during land use activities. Avoidance or resource preservation through controlled access, designation of areas of avoidance, or special management designations should be considered.
U = Unknown Potential	Geologic units that cannot receive an informed PFYC assignment. Geological units may exhibit features or preservational conditions that suggest significant paleontological resources could be present, but little information about the actual paleontological resources of the unit or area is unknown. Geologic units represented on a map are based on lithologic character or basis of origin, but have not been studied in detail. Scientific literature does not exist or does not reveal the nature of paleontological resources. Reports of paleontological resources are anecdotal or have not been verified. Area or geologic unit is poorly or under-studied. BLM staff has not yet been able to assess the nature of the geologic unit. Until a provisional assignment is made, geologic units with unknown potential have medium to high management concerns. Field surveys are normally necessary, especially prior to authorizing a ground-disturbing activity.

4.5.8.3 Field Survey

Information regarding the survey of the IC Project Alignment and the findings of the survey would be made available following completion of the survey and agency approval of the associated technical report.

4.5.9 Paleontological Resources Regulatory Setting

Federal, state, and local regulations were reviewed for applicability to the IC Project.

4.5.9.1 Federal

A federal undertaking is a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; those requiring a federal permit, license or approval; and those subject to state or local regulation administered pursuant to a delegation or approval by a federal agency (36 CFR 800.16[y]). Actions and undertakings may take place either on or off federally controlled property and include new and continuing projects, activities, or programs and any of their elements not previously considered under NEPA, the Federal Land Policy and Management Act (FLPMA), and CFR 43, among others. In addition to the federal regulations described in the following subsections, federal authorizations would also be required because portions of the IC Project area is under the jurisdiction of the BLM Bishop, Ridgecrest, Barstow, and Needles Field Offices; and Department of Defense (DoD) Naval Air Weapons Station China Lake, Edwards Air Force Base, and Marine Corps Logistics Base Barstow.

4.5.9.1.1 National Environmental Policy Act

The National Environmental Protection Act (NEPA) requires the federal government to carry out its plans and programs in such a way as to "preserve important historic, cultural, and natural aspects of our national heritage" (42 USC Section 4331[b][4]). The intent of the statute is to require that agencies obtain sufficient information regarding historic and cultural properties (including consulting, for example, appropriate members of the public; local, state, and other federal government agencies; and Native American tribes, organizations, and individuals) to make a determination of the historical and cultural significance of affected historic or cultural properties (including paleontological resources) and to take into account whether irreversible adverse impacts to such resources can or should be avoided, minimized, or mitigated.

4.5.9.1.2 Federal Land Policy and Management Act (FLPMA)

This law (Public Law [PL] 94-579; 90 Statute 2743, USC 1701–1782) requires that public lands be managed in a manner that will protect the quality of their scientific values. Specifically, FLPMA was established as a public land policy to "provide for the management, protection, development, and enhancement of the public lands." FLPMA requires federal agencies to manage public lands so that environmental, historic, archeological, and scientific resources are preserved and protected, where appropriate. Though FLPMA does not refer specifically to fossils, the law does protect scientific resources such as significant fossils, including vertebrate remains. FLPMA regulates the "use and development of public lands and resources through easements, licenses, and permits." The law requires the public lands to be inventoried so that the data can be used to make informed land-use decisions, and requires permits for the use, occupancy and development of the certain public lands, including the collection of significant fossils for scientific purposes (43 USC 1701 Section 102, 302 [U.S. Department of the Interior et al. 2001]).

4.5.9.1.3 Code of Federal Regulations, Title 43

Under Title 43, CFR Section 8365.1–5, the collection of scientific and paleontological resources, including vertebrate fossils, on federal land is prohibited. The collection of a "reasonable amount" of common invertebrate or plant fossils for noncommercial purposes is permissible (43 CFR 8365.1–5 [U.S. Government Printing Office 2014]).

4.5.9.1.4 Omnibus Public Lands Act

The Omnibus Public Lands Act (OPLA) directs the Secretaries of Interior and Agriculture to manage and protect paleontological resources on federal land using “scientific principles and expertise.” OPLA incorporates most of the recommendations of the report of the Secretary of the Interior titled “Assessment of Fossil Management on Federal and Indian Lands” (2000) to formulate a consistent paleontological resources management framework. In passing the OPLA, Congress officially recognized the scientific importance of paleontological resources on some federal lands by declaring that fossils from these lands are federal property that must be preserved and protected. Title VI, Subtitle D on Paleontological Resources Preservation (OPLA-PRP) codifies existing policies of federal agencies and provides the following:

- Uniform criminal and civil penalties for illegal sale and transport, and theft and vandalism of fossils from federal lands;
- Uniform minimum requirements for paleontological resource-use permit issuance (terms, conditions, and qualifications of applicants);
- Uniform definitions for “paleontological resources” and “casual collecting”; and
- Uniform requirements for curation of federal fossils in approved repositories.

Federal legislative protections for scientifically significant fossils applies to projects that take place on federal lands (with certain exceptions such as the Department of Defense), involve federal funding, require a federal permit, or involve crossing state lines. Since a portion of the IC Project area occurs on federal agency-managed lands, federal protections for paleontological resources for those areas apply under NEPA, FLPMA, and OPLA-PRP. All paleontological work on federal agency lands must be approved and coordinated by the federal agency. All fossils collected from federal agency lands must be housed in a federally approved paleontological repository. The paleontological repository would be determined following lead agency coordination and the issuance of applicable permits for the IC Project.

4.5.9.1.5 BLM Procedures and Policies for Managing Paleontological Resources

The PFYC system was developed by the BLM (2016) and provides an estimate of the potential that significant paleontological resources will be discovered within a particular mapped geological unit. The system is used to determine potential impacts to paleontological resources for federal actions involving surface disturbance, land use planning, or land tenure adjustment. Implementation of the PFYC system does not require changes to existing land use plans, project plans, or other completed efforts. However, integration into plans presently being developed is recommended. The IM 2016-124 revision is an update to the guidance that was introduced in IM 2008-009 (2007). The BLM Manual and Handbook H-8270-1 (1998) provides policies and direction for the BLM’s Paleontological Resource Management Program as well as detailed procedures and standards for implementing policies. According to Section 6 of the BLM Manual and Handbook H-8270-1 (1998), it shall be BLM’s policy to:

1. Actively work with other federal, state, and Local Government Agencies, professional organizations, private land owners, educational institutions, and other interested parties to enhance and further the BLM’s and the public’s needs and objectives for paleontological resources.
2. Consider paleontological resource management a distinct BLM program, to be given full and equal consideration in all its land use planning and decision making actions.
3. Maintain a staff of professional paleontologists to provide BLM decision makers with the most current and scientifically sound paleontological resource data and advice.
4. Mitigate adverse impacts to paleontological resources as necessary.
5. Facilitate appropriate public and scientific use of and interest in paleontological resources.

6. Utilize the additional skills and resources of the Bureau’s recreation and minerals programs to develop and implement interpretation strategies and products to enhance public understanding, appreciation, and enjoyment of paleontological resources.
7. Vigorously pursue the protection of paleontological resources from theft, destruction, and other illegal or unauthorized uses.
8. Authorize land tenure adjustments, when appropriate, as means to protect paleontological localities.

4.5.9.2 State

4.5.9.2.1 California Public Utilities Commission General Order 131-D

Pursuant to CPUC GO 131-D, the CPUC has sole and exclusive jurisdiction over the siting and design of electric power line projects, distribution lines, substations, or electric facilities constructed by public utilities in the State of California. Under CEQA, the CPUC is the lead agency with respect to such IC Project elements within the State of California. SCE is required to comply with GO 131-D and is seeking a PTC from the CPUC for the IC Project and therefore compliance with CEQA and other state environmental statutes involving cultural (including paleontological) resources. The CPUC is tasked with compliance of all provisions in CEQA and the CEQA Guidelines that concern cultural (including paleontological) resources as explained below.

4.5.9.2.2 California Environmental Quality Act

This law encourages the protection of all aspects of the environment by requiring state and local agencies to prepare multidisciplinary analyses of the environmental impacts of a proposed project, and to make decisions based on the findings of those analyses. CEQA also takes into account the laws and procedures of local California jurisdictions. CEQA includes in its definition of historical resources, “any object [or] site…that has yielded or may be likely to yield information important in prehistory” (14 CCR 15064.5[3]), which is typically interpreted as including fossil materials and other paleontological resources. More specifically, destruction of a “unique paleontological resource or site or unique geologic feature constitutes a significant impact under CEQA” (State CEQA Guidelines Appendix G). CEQA does not provide an explicit definition of a “unique paleontological resource,” but a definition is implied by comparable language within the act relating to archaeological resources: “The procedures, types of activities, persons, and public agencies required to comply with CEQA are defined in: Guidelines for the Implementation of CEQA, as amended March 29, 1999” (Title 14, Chapter 3, CCR 15000 et seq.; Association of Environmental Professionals 2012). Treatment of paleontological resources under CEQA is generally similar to treatment of cultural resources, requiring evaluation of resources in the project; assessment of potential impacts on significant or unique resources; and development of mitigation measures for potentially significant impacts, which may include avoidance, monitoring, or data recovery excavation.

4.5.9.2.3 Public Resources Code Section 5097.5

This law affirms that no person shall willingly or knowingly excavate, remove, or otherwise destroy a vertebrate paleontological site or paleontological feature without the express permission of the overseeing public land agency. It further states under PRC 30244 that any development that would adversely affect paleontological resources shall require reasonable mitigation. These regulations apply to projects located on land owned by or under the jurisdiction of the state or any city, county, district, or other public agency (PRC Section 5097.5; California OHP 2005).

4.5.9.3 Local

The California Public Utilities Commission (CPUC) has sole and exclusive state jurisdiction over the siting and design of the IC Project. Pursuant to CPUC General Order 131-D (GO 131-D), Section XIV.B, "Local jurisdictions acting pursuant to local authority are preempted from regulating electric power line projects, distribution lines, substations, or electric facilities constructed by public utilities subject to the CPUC's jurisdiction. However, in locating such projects, the public utilities shall consult with local agencies regarding land use matters." Consequently, public utilities are directed to consider local regulations and consult with local agencies, but the counties' and cities' regulations are not applicable as the counties and cities do not have jurisdiction over the IC Project. Accordingly, the following discussion of local land use regulations is provided for informational purposes only.

General plans and municipal codes were reviewed for relevant local policies pertaining to paleontological resources in the vicinity of the IC Project. General plans reviewed included the County of Inyo, County of Kern, and County of San Bernardino General Plans. Relevant goals, policies, and objectives are discussed in the following subsections.

4.5.9.3.1 Inyo County

Inyo County's General Plan (2001) has no mention of paleontological resources.

4.5.9.3.2 Kern County

Paleontological resources are briefly mentioned in the Land Use, Open Space and Conservation element of the Kern County General Plan (Kern County 2009) in Section 1.10.3, "Archaeological, Paleontological, Cultural, and Historical Preservation." Policy 25 states that the County will promote the preservation of cultural and historic resources that provide ties with the past and constitute a heritage value to residents and visitors. Implementation Measure M is the only measure that directly or indirectly addresses paleontological resources, and it states that in areas of known paleontological resources, the County should address the preservation of these resources where feasible.

4.5.9.3.3 San Bernardino County

The Conservation Element of the San Bernardino County General Plan (2007) contains one goal (CO 3) and one map (Paleontologic Resources Overlay Map, noted in the General Plan as "not available yet"), as well as three programs regarding paleontological resources within the County. Goal CO 3 requires that the County will preserve and promote its historic and prehistoric cultural heritage. Three programs within the General Plan delineate the required County actions regarding paleontological resources. In areas of potential but unknown sensitivity, field surveys prior to grading will be required to establish the need for paleontologic monitoring. Projects requiring grading plans that are located in areas of known fossil occurrences, or demonstrated in a field survey to have fossils present, will have all rough grading (cuts greater than 3 feet) monitored by trained paleontologic crews working under the direction of a qualified professional, so that fossils exposed during grading can be recovered and preserved. Fossils include large and small vertebrate fossils, the latter recovered by screen washing of bulk samples. Finally, a report of findings with an itemized accession inventory will be prepared as evidence that monitoring has been successfully completed. A preliminary report will be submitted and approved prior to granting of building permits, and a final report will be submitted and approved prior to granting of occupancy permits. The adequacy of paleontologic reports will be determined in consultation with the Curator of Earth Science, San Bernardino County Museum.

4.5.10 Paleontological Resources Significance Criteria

Appendix G (part V) of the CEQA Guidelines provides guidance relative to significant impacts on paleontological resources, which states, "a project will normally result in a significant impact on the environment if it will…disrupt or adversely affect a paleontological resource or site or unique geologic feature, except as part of a scientific study." The significance criteria for assessing the impacts to paleontological resources come from the CEQA Environmental Checklist, and state that a project causes a potentially significant impact if it would directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

4.5.11 Paleontological Resources Impact Analysis

4.5.11.1 Would the Project directly or indirectly destroy a unique paleontological resource or site or unique geological feature?

4.5.11.1.1 Construction

Less than Significant Impact with Mitigation. No previously recorded fossil localities occur within the Full-Rebuild Concept footprint. However, scientifically significant fossils have been found in the vicinity and elsewhere in Kern and San Bernardino counties from several of the same formations and from sediments of similar age, lithology, and depositional environment. Similar fossils may be encountered during excavation into geologic units with very high, high, moderate, or unknown paleontological potential (PFYC 5, 4, 3, or U; see Table 4.5-3). Excavation into these geologic units may well result in a significant adverse direct impact on paleontological resources. Excavations entirely within low-potential (PFYC 2) geologic units are unlikely to uncover significant fossil vertebrate remains. However, the unnamed low-potential younger Quaternary deposits may shallowly overlie older, more sensitive sedimentary deposits that could be encountered during project excavation. Excavation in areas of very-low-potential (PFYC 1) geologic units (i.e., igneous and metamorphic rocks) would not result in impacts to paleontological resources. Direct adverse impacts on paleontological resources resulting from construction of the project would be less than significant with implementation of APMs PAL-1, PAL-2, and PAL-3. These measures include preparation of a Paleontological Resources Monitoring and Mitigation Plan (PRMMP), construction monitoring, and procedures to implement if paleontological resources are encountered during construction. The Full-Rebuild Concept would not result in indirect impacts on paleontological resources during construction since it would not increase public access.

4.5.11.1.2 Operations

Less than Significant Impact. Normal operation of substation, transmission, subtransmission, distribution, and telecommunications lines would be controlled remotely through SCE control systems, and manually in the field as required. Maintenance would occur as needed and could include activities such as repairing conductors, washing or replacing insulators, repairing or replacing other hardware components, replacing poles, tree trimming, brush and weed control, and access road maintenance. Most regular O&M activities of overhead facilities are performed from existing access roads with no surface disturbance. Repairs to facilities, such as repairing or replacing poles and structures, could occur in undisturbed, but previously surveyed areas. Therefore, operation impacts to unique paleontological resources would be less than significant.

4.5.12 Applicant Proposed Measures

CUL-1: Develop Cultural Resource Management Plan. SCE shall prepare and submit for approval a Cultural Resource Management Plan (CRMP) to guide all cultural resource management activities during project construction. Management of cultural resources shall follow all applicable federal and state standards and guidelines for the management of historic properties/historical resources. The CRMP shall be submitted to the BLM, CPUC and tribes for review and approval at least 90 days prior to the start of construction. The CRMP shall include, but not be limited to, the following sections:

- Cultural Resources Management Plan: The CRMP shall define and map all known cultural resources, including all NRHP- and CRHR-eligible properties in or within 100 feet of the Proposed Project APE/API.
- The CRMP will also contain details about how all NRHP- and CRHR-eligible properties will be avoided and protected during construction. Protective measures shall include, at a minimum designation and marking of Environmentally Sensitive Areas (ESAs), archaeological monitoring, personnel training, and reporting. The plan shall also detail what avoidance measures will be used, where and when they will be implemented, lines of authority and communication, and how avoidance measures and enforcement of ESAs will be coordinated with construction personnel.
- Cultural Resource Monitoring and Field Reporting: Detail procedures for archaeological and Native American monitoring, for reporting protocols, and for determining when monitoring is no longer necessary. Include guidelines for monitoring in Areas of High Sensitivity for the discovery of buried NRHP and/or CRHR eligible cultural resources, including burials, cremations, or sacred sites.
- Unanticipated Discovery Protocol: Detail procedures for halting construction, defining work stoppage zones, notifying stakeholders (e.g. agencies, Native Americans, utilities), and assessing NRHP and/or CRHR eligibility in the event unanticipated discoveries are encountered during construction. Include methods, timelines for assessing NRHP and/or CRHR eligibility, formulating mitigation plans, and implementing treatment. Mitigation and treatment plans for unanticipated discoveries shall be reviewed by appropriate Native American tribes and approved by the BLM and CPUC, prior to implementation.
- Data Analysis and Reporting: Detail methods for data analysis in a regional context, reporting of results within one year of completion of field studies, curation of artifacts and data (maps, field notes, archival materials, recordings, reports, photographs, GIS shapefiles, and analytical data) at a facility that is approved by the BLM and CPUC, and dissemination of reports to appropriate repositories.

CUL-2: Avoid Environmentally Sensitive Areas (ESAs). SCE shall perform surveys for any project areas not yet surveyed (e.g. new or modified staging areas, pull sites, or other work areas) and areas covered by expired surveys (older than 10 years). Resources discovered during the surveys would be subject to Mitigation Measures CUL-1 (Develop CRMP). Where operationally feasible, all NRHP- and CRHR-eligible resources shall be protected from direct project impacts by project redesign (i.e., relocation of the line, ancillary facilities, or temporary facilities or work areas). In addition, all historic properties/historical resources shall be avoided by all project construction, operation and maintenance, and restoration activities, where feasible. Avoidance mechanisms shall include fencing off Environmentally Sensitive Areas (ESAs) for the duration of the Proposed Project or as outlined in the CRMP.

CUL-3: Conduct Construction Monitoring. Archaeological monitoring shall occur as outlined in the CRMP, including but not limited to the archaeological monitor's authority, duties and reporting requirements. Archaeological monitoring shall be conducted by a qualified archaeologist familiar with the types of historic and prehistoric resources that could occur within the Proposed Project area. A Native American monitor may be required at culturally sensitive locations specified during government-to-government consultation with Native American tribes. SCE shall retain and schedule any required Native American monitors. The qualifications of the principal archaeologist and monitors shall be approved by the BLM and CPUC.

Brief monitoring reports shall be submitted to the BLM and CPUC on a weekly basis. A monitoring report presenting the results of the monitoring effort shall be prepared and submitted to BLM and the CPUC for review and approval within one year of the completion of monitoring.

CUL-4: Property Treat Human Remains. SCE shall follow all federal and state laws, statutes, and regulations that govern the treatment of human remains. Minimally, all work in the vicinity of such as find will cease within a 200-foot radius of the remains and, the area will be protected to ensure that no additional disturbance occurs. Should inadvertent effects to or unanticipated discoveries of human remains be made on federal lands, the BLM, and County Coroner (California Health and Safety Code 7050.5(b)) shall be notified immediately. If the remains are determined to be Native American or if Native American cultural items pursuant to the Native American Graves Protection and Repatriation Act (NAGPRA) are uncovered, the remains shall be treated in accordance with the provisions of NAGPRA (43 CFR 10) and the Archaeological Resources Protection Act (43 CFR 7). If the remains are not on federal land, the CPUC and County Coroner shall be notified immediately and the remains shall be treated in accordance with Health and Safety Code Section 7050.5, CEQA Section 15064.5€, and Public Resources Code Section 5097.98. SCE shall assist and support the BLM and/or state agencies, as appropriate, in all required NAGPRA and Section 106 actions, government to-government and consultations with Native Americans, agencies, and consulting parties as requested by the BLM and/or state agencies. SCE shall comply with and implement all required actions and studies that result from such consultations.

PAL-1: Develop Paleontological Resource Mitigation and Monitoring Plan. SCE shall prepare a Paleontological Resources Mitigation and Monitoring Plan (PRMMP), utilizing findings of the paleontological resource survey and technical report, to guide all paleontological management activities during project construction. The PRMMP shall be submitted to the BLM and CPUC for review and approval at least 60 days prior to the start of construction. The PRMMP shall be prepared by a qualified paleontologist, based on Society of Vertebrate Paleontology (SVP) 2010 guidelines, and meet all regulatory requirements. The qualified paleontologist shall have a Master's Degree or Ph.D. in paleontology or geology, have local paleontology knowledge, and shall be familiar with paleontological procedures and techniques. The PRMMP will include, but not be limited to, the following sections:

- Paleontological Resource Monitoring and Reporting: Detail monitoring procedures and methodologies, which shall require a qualified paleontological monitor for all construction-related ground disturbance that reach approximate depths for significant paleontological resources in sediments with moderate (PFYC 3a) to very high (PFYC 5) sensitivity. Sediments of undetermined sensitivity shall be monitored on a part-time basis as outlined in the PRMMP. Sediments with very low or low sensitivity will not require monitoring. Paleontological monitors shall meet standard qualifications per the SVP (2010).
- Unanticipated Discovery Protocol: Detail procedures for halting construction, defining work stoppage zones, notifying stakeholders, and assessing the paleontological find for scientific significance. If indicators of potential microvertebrate fossils are found, screening of a test sample shall be carried out as outlined in SVP 2010.
- Data Analysis and Reporting: Detail methods for data recovery, analysis in a regional context, reporting of results within one year of completion of field studies, curation of all fossil specimens in an accredited museum repository approved by the BLM and CPUC, and dissemination of reports to appropriate repositories.

PAL-2: Monitor Construction for Paleontological Resources. Based upon the paleontological sensitivity assessment and Paleontological Resource Mitigation and Monitoring Plan consistent with

Mitigation Measure PAL-1 (Develop Paleontological Resource Mitigation and Monitoring Plan), SCE will conduct full-time construction monitoring through its qualified paleontological monitor(s) in areas determined to have moderate (PFYC 3a) to very high (PFYC 5) sensitivity. Quaternary paleosols will be included in the PFYC 3a designation. Sediments of very low (PFYC 1), low (PFYC 2), or unknown (PFYC 3b) sensitivity shall not be monitored, unless geologic mapping is found to be in error.

Paleontological resource monitors per SVP (2010) shall have the equivalent of the following qualifications:

- BS or BA degree in geology or paleontology and one-year experience monitoring in the state or geologic province of the specific project. An associate degree and/or demonstrated experience showing ability to recognize fossils in a biostratigraphic context and recover vertebrate fossils in the field may be substituted for a degree. An undergraduate degree in geology or paleontology is preferable, but is less important than documented experience performing paleontological monitoring, or
- AS or AA in geology, paleontology, or biology and demonstrated two years of experience collecting and salvaging fossil materials in the state or geologic province of the specific project, or
- Enrollment in upper division classes pursuing a degree in the fields of geology or paleontology and two years of monitoring experience in the state or geologic province of the specific project.

Monitors must demonstrate proficiency in recognizing various types of fossils, in collection methods, and in other paleontological field techniques. Copies of Monitoring Reports shall be submitted to the BLM and the CPUC on a weekly basis.

PAL-3: Final Reporting and Curation. At the conclusion of laboratory work, a final report will be prepared describing the results of the paleontological monitoring efforts associated with the project. The report will include a summary of the field and laboratory methods, an overview of the Proposed Project area geology and paleontology, a list of taxa recovered (if any) and their scientific significance, and recommendations. If the monitoring effort produced fossils, then a copy of the report will also be submitted to the designated museum repository. All significant fossils collected will be prepared in a properly equipped paleontology laboratory to a point ready for curation no more than 60 days after all fieldwork analyses are completed. Preparation will include the careful removal of excess matrix from fossil materials and stabilizing and repairing specimens, as necessary. Following laboratory work, all fossil specimens will be identified to the lowest taxonomic level, catalogued, analyzed, and delivered to an accredited museum repository for permanent curation and storage. The cost of curation is assessed by the repository and is the responsibility of SCE.

4.5.13 Alternatives

Alternatives to the Full-Rebuild Concept are addressed in Section 5.2, Description of Project Alternatives and Impact Analysis.

4.5.14 References

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4.6 Energy

This section of the PEA describes the energy-consumption attributes of the Ivanpah-Control Project (IC Project), as well as an assessment of impacts that have the potential to occur during construction and operation of the Full-Rebuild Concept and its Alternatives.

4.6.1 Environmental Setting

As described in *Chapter 3—Project Description*, construction, and operations and maintenance, of the Full-Rebuild Concept would require the consumption of energy in the form of liquid fuels (gasoline, diesel).

4.6.2 Regulatory Setting

4.6.2.1 Federal

There are no federal plans or regulations applicable to the IC Project.

4.6.2.2 State

Senate Bill 100, signed into law in September 2018, amends the California Renewables Portfolio Standard Program. The Program requires the PUC to establish a renewables portfolio standard requiring all retail sellers to procure a minimum quantity of electricity products from eligible renewable energy resources so that the total kilowatt-hours of those products sold to their retail end-use customers achieve 25 percent of retail sales by December 31, 2016, 33 percent by December 31, 2020, 40 percent by December 31, 2024, 50 percent by December 31, 2026, and 60 percent by December 31, 2030. The program additionally requires each local publicly owned electric utility to procure a minimum quantity of electricity products from eligible renewable energy resources to achieve the procurement requirements established by the program.

4.6.2.3 Local

The California Public Utilities Commission (CPUC) has sole and exclusive state jurisdiction over the siting and design of the IC Project. Pursuant to CPUC General Order 131-D (GO 131-D), Section XIV.B, “Local jurisdictions acting pursuant to local authority are preempted from regulating electric power line projects, distribution lines, substations, or electric facilities constructed by public utilities subject to the CPUC’s jurisdiction. However, in locating such projects, the public utilities shall consult with local agencies regarding land use matters.” Consequently, public utilities are directed to consider local regulations and consult with local agencies, but the counties’ and cities’ regulations are not applicable as the counties and cities do not have jurisdiction over the IC Project. Accordingly, the following discussion of local land use regulations is provided for informational purposes only.

4.6.2.3.1 Inyo County, Renewable Energy General Plan Amendment

The Inyo County Renewable Energy General Plan Amendment consists of additions to the language in the General Plan. The updates to the General plan focus on identifying the appropriate means to develop renewable wind and solar energy resources, provided that social, economic, and environmental impacts are minimized; balancing costs to the County and lost economic development potential, and mitigation of economic effects; working to protect military readiness, and considering conversions of lands utilized for agriculture, mining, and recreation. There are no new policies or implementation measures pertinent to the IC Project.

4.6.2.3.2 Kern County General Plan, Energy Element

The Kern County General Plan’s Energy Element contains goals, policies, and implementation measures that address renewable energy development in the County; none are relevant or applicable to the Full-

Rebuild Concept. There are no goals, policies, or implementation measures related to energy efficiency that are applicable or relevant to the IC Project.

4.6.2.3.3 San Bernardino County General Plan, Renewable Energy and Conservation Element

The Renewable Energy and Conservation Element is intended to ensure efficient consumption of energy and water, reduce greenhouse gas emissions, pursue the benefits of renewable energy and responsibly manage its impacts on the environment, communities and economy. The Element contains goals, objectives, policies, and implementation strategies; none are applicable or relevant to the IC Project.

4.6.2.3.4 City of Barstow General Plan, Resource Conservation and Open Space Element

Goal: 6 of the Resource Conservation and Open Space Element calls for the City to "[p]rovide programs and incentives to encourage residents, businesses and developers to reduce consumption and efficiently use energy resources." The Element contains policies and strategies intended to reduce consumption and efficiently use energy resources; none are applicable or relevant to the IC Project.

4.6.3 Significance Criteria

The significance criteria for assessing the impacts to public services are derived from the California Environmental Quality Act (CEQA) Environmental Checklist. According to the CEQA Checklist, a project would cause a potentially significant impact if it would:

- Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?
- Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?
  Impact Analysis

4.6.3.1 Would the Project result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?

4.6.3.1.1 Construction

No Impact. The Full-Rebuild Concept's consumption of energy resources during construction is necessary to remediate the approximately 2,950 discrepancies identified through SCE's TLRR Program along the 115 kV circuits included in the Full-Rebuild Concept, thus ensuring compliance with CPUC GO 95 and meeting the purpose of the Full-Rebuild Concept.

SCE employs a rigorous, multi-disciplinary project planning and management process that is focused on the efficient engineering and economic optimization of its projects. This process includes value engineering analyses to ensure that proposed designs cost-effectively meet the Full-Rebuild Concept's purpose as well as timely and efficiently meet the Full-Rebuild Concept's projected in-service date. Because of this thorough project planning and management process, Full-Rebuild Concept construction does not result in wasteful, inefficient or unnecessary consumption of energy resources.

4.6.3.1.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept. No energy additional to that which is presently consumed would be consumed and therefore no impacts would be realized under this criterion during operations and maintenance.

4.6.3.2 Would the Project conflict with or obstruct a state or local plan for renewable energy or energy efficiency?

4.6.3.2.1 Construction

No Impact. The Full-Rebuild Concept entails the reconstruction of existing subtransmission lines in or immediately adjacent to these subtransmission lines' existing alignments. The Full-Rebuild Concept is not designed to facilitate or encourage renewable energy project development, and because it would be constructed in or immediately adjacent to existing alignments, would not impede the development of renewable energy projects. As stated in Section 4.6.2 above, none of the local plans that address energy efficiency are applicable to the Full-Rebuild Concept. Therefore, the Full-Rebuild Concept would not conflict with or obstruct a state or local plan for renewable energy or energy efficiency.

4.6.3.2.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept. Therefore, operation of the Full-Rebuild Concept would not conflict with or obstruct a state or local plan for renewable energy or energy efficiency.

4.6.4 Applicant Proposed Measures

Because no potentially significant impacts would occur as a result of the Full-Rebuild Concept, no avoidance or minimization measures are proposed.

4.6.5 Alternatives

Alternatives to the Full-Rebuild Concept are addressed in Section 5.2, Description of Project Alternatives and Impact Analysis.

4.6.6 References

California Renewables Portfolio Standard Program: emissions of greenhouse gases, California Senate Bill 100 (2017-2018), Chapter 312 (Cal Stat. 2018)

City of Barstow. 2015-2020 General Plan. Resource Conservation and Open Space Element. Available at http://www.barstowca.org/home/showdocument?id=5367

Inyo County. 2015. Inyo County Renewable Energy Amendment. Available at http://www.inyoplanning.org/projects/REGPA.htm

Kern County. 2009. Kern County General Plan – Energy Element. Available at http://www.co.kern.ca.us/planning/pdfs/kcgp/KCGP.pdf

San Bernardino County. 2014. County of San Bernardino 2007 General Plan. Available at http://www.sbcounty.gov/Uploads/lus/GeneralPlan/FINALGP.pdf

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4.7 Geology and Soils

This section of the PEA describes the geology and soils in the area of the Ivanpah-Control Project (IC Project). This analysis describes the existing geology and soils in the vicinity of the Full-Rebuild Concept and assesses the potential impacts that have the potential to occur as a result of construction and operations of the Full-Rebuild Concept and its Alternatives.

4.7.1 Environmental Setting

4.7.1.1 Regional Geologic Setting

The IC Project Alignment is located within the Basin and Range and the Mojave Desert Geologic Provinces of California. Both of these provinces are characterized by narrow mountain ranges, generally trending north-south or northwest-southeast, which are separated by roughly parallel basins. In the Basin and Range Province, which includes the northern part of the IC Project Alignment, the mountain ranges are generally higher and longer, and the valleys are narrower. In the Basin and Range Province, which includes the northern part of the IC Project Alignment, the mountain ranges are generally higher and longer, and the basins are narrower. In the Mojave Desert Province, which includes the southern part of the IC Project Alignment, the mountain ranges are generally lower and shorter, and the basins are broader.

The northern part of the IC Project Alignment is also located close to the eastern edge of the Sierra Nevada Geomorphic Province. The Sierra Nevada is a major north-south trending mountain range that rises steeply on the west side of the Owens Valley, and which forms the western boundary of the Basin and Range Province.

4.7.1.2 Physiography

The principal mountain and valley areas crossed by the five Segments of the IC Project Alignment are shown in Figureset 4.7-1 and described below. The boundaries between these areas are not sharply defined, and so the descriptions are general.

4.7.1.2.1 Segment 1

Segment 1 runs for approximately 126 miles in a generally north-south direction, between the Control and Inyokern substations; it also includes the intermediate Coso and Haiwee substations. Segment 1 runs roughly parallel to US Route 395 through the Owens Valley, over the Coso Range, and through Rose Valley and Indian Wells Valley.

4.7.1.2.1.1 Owens Valley

The northern terminus of Segment 1 is at the Control Substation, approximately 5 miles southwest of Bishop, California. The Control Substation is located near the western edge of the Owens Valley, at an elevation of approximately 4,800 feet above mean sea level (ft msl). The Control Substation is located near the base of the Sierra Nevada, which rises to the southwest. The Segment 1 alignment runs generally southward from the Control Substation through the Owens Valley for approximately 90 miles. The Owens Valley is a roughly linear valley, drained by the Owens River, bordered by the Sierra Nevada to the west and by the White Mountains and Inyo Mountains to the east. The IC Project Alignment passes west of the community of Big Pine, and east of the communities of Independence, Lone Pine, Cartago, and Olancha.

In some parts of the valley, the IC Project Alignment runs near the base of the adjacent Sierra Nevada or Inyo Mountains. It also passes east of Crater Mountain, the Poverty Hills, and the Alabama Hills, which are smaller topographical features located within the valley.

The alignment passes west of Owens Lake, which is the principal surface water body in the Owens Valley. Owens Lake is a largely dry lake bed that occupies much of the southern part of the valley. The IC Project Alignment also passes west of the Tinemaha Reservoir in the northern part of the valley, and west of the North and South Haiwee Reservoirs at the southern end of the valley.

South of Owens Lake, the Owens Valley is bound by the Sierra Nevada to the west and by the Coso Range to the east. The IC Project Alignment rises in elevation as it approaches the North and South Haiwee Reservoirs, which are located at the base of the Coso Range.

The surface elevations along Segment 1 in the Owens Valley generally decrease from north to the south. The lowest elevations are about 3,600 ft msl, between Owens Lake and Cartago.

4.7.1.2.1.2 Coso Range and Rose Valley

At the southern end of the Owens Valley, Segment 1 reaches the western edge of the Coso Range. It runs across the bedrock of the Coso Range for approximately 6 miles, reaching an elevation of approximately 3,900 ft msl, and then descends to the floor of Rose Valley, a small valley bound by the Sierra Nevada to the west and by the Coso Range to the east. The Haiwee Substation is located along the IC Project Alignment at the northern end of Rose Valley.

The IC Project Alignment runs southward across Rose Valley for approximately 13 miles, generally decreasing in elevation. The Coso Substation is located in the northern part of the valley, approximately 2 miles south of the Haiwee Substation. Further south, the IC Project Alignment runs along the western side of Red Hill, a late Pleistocene cinder cone that is part of the Coso Volcanic Field.

At the southern end of Rose Valley, the IC Project Alignment crosses the southwestern end of Little Lake, a small natural lake. The alignment spans the surface waters of the lake for a distance of approximately 1,000 feet.

The IC Project Alignment descends to an elevation of approximately 3,100 ft msl south of Little Lake. It then rises over a small ridge on the western side of the Coso Range at an elevation of approximately 3,150 ft msl. After about 1 mile, it descends into Indian Wells Valley. The total length of the IC Project Alignment in the Coso Range and Rose Valley is approximately 20 miles.

4.7.1.2.1.3 Indian Wells Valley

Segment 1 of the IC Project Alignment runs for approximately 20 miles across the floor of Indian Wells Valley, generally decreasing in elevation and crossing the Inyo-Kern county line. It runs adjacent to the southwestern boundary of the Naval Air Weapons Station China Lake in most of the valley.

The alignment descends to an elevation of approximately 2,250 ft msl approximately 5 miles north of the Inyokern Substation. It then rises slightly in elevation to the southern terminus of Segment 1 at the Inyokern Substation at an elevation of approximately 2,430 ft msl. The Inyokern Substation is located near the intersection of U.S. Route 395 (US 395) and California State Route (SR-) 178, approximately one mile northeast of the community of Inyokern and about 6 miles west of Ridgecrest.

4.7.1.2.2 Segment 2

Segment 2 of the IC Project Alignment runs for approximately 48 miles in a generally north-south direction, between the Inyokern and Kramer substations; it also includes the intermediate Randsburg Substation. Segment 2 runs roughly parallel to US 395 through the Indian Wells Valley and Mojave Desert.

4.7.1.2.2.1 Indian Wells Valley

The northern terminus of Segment 2 is at the Inyokern Substation, at an elevation of about 2,430 feet above mean sea level (ft msl). The Inyokern Substation is in the southern part of Indian Wells Valley between the Sierra Nevada to the west and the Coso Range to the east. The IC Project Alignment runs to the southern end of the valley and into the adjacent El Paso Mountains.

Indian Wells Valley and the El Paso Mountains are within the Basin and Range Geologic Province. The alignment descends from the El Paso Mountains and crosses the Garlock Fault Zone, which represents the boundary with the Mojave Desert Geologic Province.

4.7.1.2.3 Mojave Desert

The IC Project Alignment then crosses Fremont Valley and the Rand Mountains. The Randsburg Substation is located along Segment 2 in the Rand Mountains about 0.5 mile southeast of the community of Randsburg at an elevation of approximately 3,670 ft msl.

The alignment descends from the Rand Mountains, crosses from Kern County into San Bernardino County, and enters a broad plain associated with the Cuddeback and Harper Valley groundwater basins. Segment 2 terminates at the Kramer Substation in the southern part of this plain. The Kramer Substation is located near the intersection of US 395 and SR-58 approximately six miles east of the community of Boron at an elevation of about 2,500 ft msl.

The lowest elevation along Segment 2 is approximately 2,430 feet msl at the Inyokern Substation. The highest elevation, approximately 3,950 ft msl, is attained in the El Paso and Rand mountains.

4.7.1.2.4 Segment 3N

Segment 3N of the IC Project Alignment is approximately 44 miles long. From the Kramer Substation, Segment 3N runs east across the plain associated with the Harper Valley groundwater basin. It runs directly south of the Harper Dry Lake Bed and the Mojave Solar Project facility. Segment 3N passes between the Waterman Hills and the Mitchel Range approximately six miles north of Barstow, and then enters the valley of the Mojave River, specifically the Lower Mojave River Valley as recognized by the California Department of Water Resources. (CDWR 2016)

It then turns to the southeast, crosses Interstate 15 (I-15) and the Mojave River, and terminates at the Coolwater Substation. The Coolwater Substation is on the south side of the Mojave River, approximately 2 miles east of the community of Daggett and 1 mile north of I-40 at an elevation of approximately 1,970 ft msl.

The lowest elevation along Segment 3N is approximately 1,960 feet msl at the Mojave River. The highest elevation is approximately 3,100 ft msl between the Waterman Hills and the Mitchel Range.

4.7.1.2.5 Segment 3S

Segment 3S of the IC Project Alignment is approximately 44 miles long. From the Kramer Substation, Segment 3S runs southeast across the plain associated with the Harper Valley groundwater basin. It then turns east and crosses a ridge associated with Iron Mountain about three miles southwest of the community of Hinkley. Segment 3S continues eastward to the Lower Mojave River Valley; it crosses the Mojave River about one mile northwest of the community of Lenwood.

On the south side of the Mojave River, Segment 3S turns southeast. It then reaches the Tortilla Substation, located approximately two miles south of Barstow at an elevation of approximately 2,700 ft msl. It runs generally eastward from the Tortilla Substation to its terminus at the Coolwater Substation.

The lowest elevation along Segment 3S is approximately 2,180 feet msl near the Mojave River. The highest elevation is approximately 2,740 ft msl near the Tortilla Substation.

4.7.1.2.6 Segment 4

Segment 4 of the IC Project Alignment is approximately 96 miles in length, running generally northeast from the Coolwater Substation to the Ivanpah Substation; it also includes the intermediate Dunn Siding, Baker, and Mountain Pass substations. Segment 4 runs roughly parallel to I-15. It crosses a series of valleys separated by relatively narrow mountainous areas.

Segment 4 initially runs north from the Coolwater Substation to the north side of the Mojave River. It then turns to the northeast and runs across a plain associated with the Lower Mojave River Valley and Caves Canyon Valley groundwater basins. The Dunn Siding Substation is near the northeastern end of this plain at an elevation of approximately 1,670 ft msl.

The alignment then runs between the Cronese Mountains (to the north) and Cave Mountain (to the south) and enters the Cronese Valley. It continues northeast, passing south of the East Cronese Dry Lake, crosses an arm of the Soda Mountains, and enters Soda Lake Valley. The Baker Substation is in this area, about one mile north of the community of Baker, at an elevation of approximately 5,300 ft msl.

Segment 4 continues to the northeast, crosses an unnamed range of hills near Yucca Grove, and enters the Upper Kingston Valley. It then ascends between the Clark and Ivanpah mountains. The Mountain Pass Substation is in this area, approximately two miles north of the community of Mountain Pass, at an elevation of approximately 5,300 ft msl.

Segment 4 then descends to the Ivanpah Valley. The eastern terminus of the IC Project Alignment is at the Ivanpah Substation, located approximately six miles southwest of the community of Primm, Nevada, at an elevation of approximately 3,000 ft msl.

The lowest elevation along Segment 4 is approximately 920 feet msl west of the Baker Substation. The highest elevation is approximately 5,400 feet msl west of the Mountain Pass Substation. These represent the highest and lowest elevations along the IC Project Alignment.

4.7.1.3 Geology

Geologic units along the IC Project Alignment are summarized in Table 4.7-1, based on U.S. Geological Survey (USGS 2018) generalized maps for California (Figureset 4.7-2).

Table 4.7-1: Geologic Units Along the IC Project Alignment

Project Segment	Unit	Rock Type	Rock Type
1	Tertiary (4-22 Ma)	rhyolite	basalt
1	Quaternary (0-4 Ma)	basalt	rhyolite
1	Quaternary	basalt	andesite
1	Pliocene to Holocene	alluvium	terrace
1	Permian to Tertiary; most Mesozoic	granodiorite	quartz monzonite
1	Miocene to Pleistocene	sandstone	conglomerate
2	Pliocene to Holocene	alluvium	terrace
2	Permian to Tertiary; most Mesozoic	granodiorite	quartz monzonite
2	Miocene to Pleistocene	sandstone	conglomerate
2	Late Cretaceous to Eocene	mica schist	mica schist
2	Early Proterozoic to Miocene	gneiss	granitoid
2	Cambrian to Jurassic	argillite	chert

Table 4.7-1: Geologic Units Along the IC Project Alignment

Project Segment	Unit	Rock Type	Rock Type
3N	Tertiary	rhyolite	basalt
3N	Pliocene to Holocene	alluvium	terrace
3N	Permian to Tertiary; most Mesozoic	granodiorite	quartz monzonite
3N	Miocene to Pleistocene	sandstone	conglomerate
3S	Pliocene to Holocene	alluvium	terrace
3S	Permian to Tertiary; most Mesozoic	granodiorite	quartz monzonite
3S	Miocene to Pleistocene	sandstone	conglomerate
3S	Late Proterozoic to Pennsylvanian	marble	limestone
4	Triassic to Cretaceous	felsic volcanic rock	intermediate volcanic rock
4	Tertiary (4-22 Ma)	rhyolite	basalt
4	Pliocene to Holocene	alluvium	terrace
4	Permian to Tertiary; most Mesozoic	granodiorite	quartz monzonite
4	Pennsylvanian to Triassic	limestone	sandstone
4	Paleocene to Pliocene	conglomerate	sandstone
4	Oligocene to Pleistocene	sandstone	conglomerate
4	Miocene to Pleistocene	sandstone	conglomerate
4	Middle to Late Devonian	limestone	dolostone (dolomite)
4	Late Proterozoic to Middle Devonian	sandstone	dolostone (dolomite)
4	Early to Middle Triassic	mudstone	limestone
4	Early Proterozoic to Miocene	gneiss	granitoid

4.7.1.4 Soils

The availability of soil data varies across the IC Project Alignment. Where available, soils data from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database are used to inform the descriptions below; SSURGO data is not available for approximately 44 percent of the IC Project Alignment (158.2 miles, including Segment 2). (NRCS 2017a) Supplemental coverage for areas not included in the SSURGO database is provided by the more generalized NRCS State Soil Geographic (STATSGO2) soil database. (NRCS 2017b) Selected SSURGO soil properties including hydrologic group, erodibility, and linear extensibility are summarized in Table 4.7-2. Figureset 4.7-3 illustrates mapped soil unit distribution along the IC Project Alignment.

The hydrologic group classification is a measure of infiltration rate and runoff potential that can provide general information about soil depth and texture. (NRCS 2018) Group A soils have the highest infiltration rates and lowest runoff potentials; they are typically coarse-grained and deep. Conversely, Group D soils have the lowest infiltration rates and highest runoff potential; they are typically fine-grained and shallow, or in areas with high water tables. Groups B and C soils are intermediate. Soils from all four hydrologic groups can be found locally in both mountain and valley areas along the IC Project Alignment.

4.7.1.4.1 Segment 1

4.7.1.4.1.1 Owens Valley

The soils found in the Owens Valley area in the northern portion of Segment 1 are commonly deep to very deep and are associated with alluvial deposits derived from granitic or mixed rock sources, including alluvial fans, floodplains, and river terraces.

4.7.1.4.1.2 Rose and Indian Wells Valleys

SSURGO soil data are not available for the portions of the Rose and Indian Wells valleys crossed by the IC Project Alignment. Soil associations from the STATSGO2 soils database in the Rose and Indian Wells valleys in Segment 1 are as follows:

- White Hills, China Lake. Rosamond variant – Rosamond-Playas-Gila-Cajon variant-Cajon soil association (soil map unit s768; soil map unit key 660871).
- Majority of the Indian Wells Valley. Wasco-Rosamond-Cajon soil association (soil map unit s1024; soil map unit key 660471).
- Volcano Peak. Rock outcrop-Mexispring soil association (soil map unit s1077; soil map unit key 660524).
- Rose Valley, along valley floor. Yermo-Ulymeyer-Tinemaha-Goodale-Cartago general soil association (soil map unit s1086; soil map unit key 660533).
- Owens Valley, along valley floor. Hesperia family-Cajon soil association (soil map unit s1090; soil map unit key 660537).
- Little Lake area, surrounding Volcano Peak. Upspring-Sparkhule-Rock outcrop soil association (soil map unit S1127; soil map unit key 660574). (NRCS 2017)

4.7.1.4.2 Segment 2

SSURGO soil data for Segment 2 are limited to areas just west of the IC Project Alignment south of the Rand Mountains and a small area near the community of Kramer Junction. Soil associations from the STATSGO2 soils database in Segment 2 are as follows:

- Rand Mountains. Tecopa-Rock outcrop-Lithic Torriorthents (soil map unit s1126; soil map unit key 660573).
- Rand Mountains. Randsburg-Muroc (soil map unit s770; soil map unit key 660873).
- El Paso Mountains. Trigger-Sparkhule-Rock outcrop (soil map unit s813; soil map unit key 660916).
- Plains associated with the Cuddeback and Harper Valley. Neuralia-Garlock-Cajon-Alko (soil map unit s769; soil map unit key 660872).
- Indian Wells Valley, El Paso Mountains, Fremont Valley, Cuddeback and Harper Valley. Wasco-Rosamond-Cajon (soil map unit s1024; soil map unit key 660471).

4.7.1.4.3 Segment 3N

SSURGO soils data are available for portions of Segment 3N in Harper Valley and the Lower Mojave River Valley. Most soils within these areas are deep, well drained sandy soils associated with alluvial deposits derived from granitic sources. Soils with higher clay content and lower infiltration rates are found between ephemeral drainages in the Harper Valley. Soil associations from the STATSGO2 soils database in Segment 3N are as follows:

- Harper Valley, Lower Mojave River Valley. Wasco-Rosamond-Cajon (soil map unit s1024; soil map unit key 660471).
- Hinkley Valley. Norob-Halloran-Cajon-Bryman (soil map unit s1039; soil map unit key 660486).
- Plains associated with the Cuddeback and Harper Valley. Neuralia-Garlock-Cajon-Alko (soil map unit s769; soil map unit key 660872).

Table 4.7-2: Mapped Soil Units and Soil Properties, SSURGO2, Segment 1

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group	Off-Road Erosion Hazard[1]	Linear Extensibility Percent[2]
110	488003	Aquents-Aquic torripsamments association, 0 to 2% slopes	4.3	1.7	C	3	Slight	1.5
115	488008	Arizo gravelly loamy sand, 5 to 9% slopes	2.4	1.0	A	2	Slight	1.5
116	488009	Arizo gravelly loamy sand, 9 to 15% slopes	2.0	0.8	A	2	Slight	1.5
118	488011	Arizo-Yellowrock complex, 5 to 9% slopes	9.3	3.7	A	2	Slight	1.5
145	488038	Cajon loamy sand, stratified substratum, 0 to 5% slopes	2.2	0.9	A	2	Slight	1.5
146	488039	Cajon gravelly loamy sand, 0 to 5% slopes	9.2	3.6	A	2	Slight	1.5
148	488041	Cajon-Mazourka-Eclipse complex, 0 to 2% slopes	1.5	0.6	A	1	Slight	1.6
149	488042	Cajon-Typic Torriorthents complex, 0 to 5% slopes	1.5	0.6	A	1	Slight	1.5
152	488045	Cartago gravelly loamy coarse sand, 5 to 30% slopes	4.0	1.6	A	2	Moderate	1.5
154	488047	Cartago gravelly loamy sand, 0 to 2% slopes	4.6	1.8	A	2	Slight	1.5
155	488048	Cartago gravelly loamy sand, 2 to 5% slopes	1.4	0.5	A	2	Slight	1.5
184	488077	Dehy loam, 0 to 2 percent slopes	0.1	0.0	C	5	Slight	1.5
187	488080	Dehy sandy loam, loamy substratum, 0 to 2% slopes	1.1	0.4	C	3	Slight	1.5
191	488084	Division-Numu complex, 0 to 2% slopes	3.85	1.4	D	3	Slight	3
196	488089	Goodale loamy coarse sand, 5 to 15% slopes	0.3	0.1	A	3	Slight	1.5
200	488094	Goodale-Cartago complex, 5 to 15% slopes	4.8	1.9	A	3	Slight	1.5
201	488096	Goodale-Cartago complex, moist, 2 to 5% slopes	0.9	0.4	A	3	Slight	1.5
202	488100	Goodale-Cartago complex, moist, 5 to 15% slopes	3.9	1.6	A	3	Slight	1.5
207	488112	Helendale-Cajon complex, 0 to 5% slopes	5.3	2.1	A	2	Slight	1.5
208	488113	Helendale-Cajon complex, dry, 0 to 5% slopes	2.5	1.0	A	2	Slight	1.5
210	488116	Hesperia-Cartago complex, 0 to 5% slopes	0.8	0.3	A	3	Slight	1.5
221	488136	Inyo sand, 0 to 9% slopes	1.1	0.4	A	1	Slight	1.5
230	488157	Lithic Torriorthents-Badland complex, 15 to 75% slopes	1.8	0.7	D	2	Severe	1.5

Table 4.7-2: Mapped Soil Units and Soil Properties, SSURGO2, Segment 1

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group	Off-Road Erosion Hazard[1]	Linear Extensibility Percent[2]
231	488158	Lithic Torriorthents-Lithic Haplargids-Rock outcrop complex, 30 to 75% slopes	1.8	0.7	D	2	Very Severe	2.1
245	488177	Lubkin-Tinemaha complex, moist, 5 to 15% slopes	1.2	0.5	A	2	Slight	1.5
247	488179	Lucerne gravelly loamy sand, 2 to 5% slopes	2.7	1.1	A	2	Slight	1.5
249	488181	Manzanar silt loam, 0 to 2% slopes	10.8	4.3	B	4L	Slight	3.4
251	488186	Manzanar-Westguard association, 0 to 2% slopes	1.9	0.8	C	4L	Slight	3.3
252	488188	Manzanar-Winnedumah association, 0 to 2% slopes	3.4	1.3	B	4L	Slight	3.7
257	488197	Mazourka-Eclipse complex, 0 to 2% slopes	2.3	0.9	C	1	Slight	1.8
259	488199	Mazourka-Slickspots-Cajon complex, 0 to 2% slopes	1.5	0.6	C	1	Slight	1.9
261	488203	Mazourka hard substratum-Mazourka-Eclipse complex, 0 to 2% slopes	9.5	3.8	C	1	Slight	2
273	488219	Neuralia-Timosea-Typic Argidurids complex, 2 to 15% slopes	11.5	4.6	C	2	Slight	2.4
283	488233	Playa	0.8	0.3	—	—	—	7.5
290	488244	Pokonahbe-Rindge family association, 0 to 5% slopes	2.5	1.0	C	2	Slight	2.7
293	488248	Poleta-Mazourka-Eclipse complex, 0 to 2% slopes	3.8	1.5	B	1	Slight	1.7
294	488249	Poleta-Mazourka-Slickspots complex, 0 to 2% slopes	2.4	0.9	B	1	Slight	1.7
296	488252	Rienhakel sand, 0 to 2% slopes	5.9	2.4	C	1	Slight	2.5
297	488253	Riverwash	0.1	0.0	—	—	—	—
308	488265	Seaman-Yellowrock complex, 2 to 5% slopes	2.2	0.9	A	2	Slight	1.5
311	488270	Shabbell sandy loam, 0 to 2% slopes	0.6	0.2	A	5	Slight	1.5
318	488279	Shondow-Hessica association, 0 to 2% slopes	0.7	0.03	C	5	Slight	3.1
321	488283	Taboose-Lava flows complex, 5 to 30% slopes	9.8	3.9	A	3	Moderate	1.5
324	488286	Timosea-Neuralia complex, warm, 2 to 9% slopes	5.3	2.1	C	5	Slight	1.8

Table 4.7-2: Mapped Soil Units and Soil Properties, SSURGO2, Segment 1

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group	Off-Road Erosion Hazard[1]	Linear Extensibility Percent[2]
327	488289	Torrifluvents, 0 to 2% slopes	4.2	1.7	C	6	Slight	3.1
328	488290	Torrifluvents-Fluvaquentic Endoaquolls complex, 0 to 2% slopes	1.9	0.7	C	6	Slight	3
332	488294	Typic Psammaquents, 0 to 2% slopes	4.3.	1.7	A/D	1	Slight	1.5
358	488320	Westguard-Rienhakel association, 0 to 2% slopes	3.7	1.5	C	1	Slight	1.8
359	488321	Whitewolf-Toquerville families association, 15 to 50% slopes	1.7	0.7	A	1	Moderate	1.5
360	488322	Whitewolf-Toquerville families association, warm, 15 to 50% slopes	0.6	0.3	A	1	Moderate	1.5
362	488324	Winerton-Hessica complex, 0 to 2% slopes	5.4	2.1	D	3	Slight	3.5
363	488325	Winnedumah silt loam, 0 to 2% slopes	10.6	4.2	C	5	Slight	3.3
364	488326	Winnedumah fine sandy loam, 0 to 2% slopes	2.9	1.1	—	—	Slight	2
366	488328	Xeric Argidurids, 2 to 9% slopes	2.8	1.1	D	2	Slight	4.8
369	488331	Xeric Haplodurids, 2 to 9% slopes	3.3	1.3	A	2	Slight	1.5
370	488332	Xerofluvents, 0 to 5 percent slopes	0.1	0.0				
372	488334	Yellowrock sand, 0 to 5% slopes	1.2	0.5	A	1	Slight	1.5
374	488336	Yellowrock-Seaman complex, 2 to 5% slopes	0.8	0.3	A	2	Slight	1.5
378	488340	Yermo stony-Yermo complex, 5 to 15% slopes	2.4	0.9	A	5	Slight	1.5
379	488341	Yermo stony-Yermo complex, cool, 5 to 15% slopes	1.2	0.5	A	5	Slight	1.5

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number

1. The NRCE “Erosion Hazard (Off-Road, Off-Trail)” ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface
2. Linear Extensibility Percent represents the weighted average of representative values for all layers in the SSURGO database
3. (—) indicates no data available

Sources: NRCS 2019a

Table 4.7-2: Mapped Soil Units and Soil Properties, SSURGO2, Segment 3N

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group	Off-Road Erosion Hazard[1]	Linear Extensibility Percent[2]
112	463931	Cajon Sand, 0 To 2 Percent Slopes (112)	5.3	11.9	A	1	Slight	1.5
113	463932	Cajon Sand, 2 To 9 Percent Slopes (113)	3.3	7.4	—	—	Slight	1.5
115	463934	Cajon Gravelly Sand, 2 To 15 Percent Slopes (115)	4.6	10.4	A	1	Slight	1.5
117	463936	Cajon Loamy Sand, Loamy Substratum, 0 To 2 Percent Slopes (117)	1.5	3.4	A	2	Slight	1.5
131	463950	Helendale Loamy Sand, 0 To 2% Slopes	0.5	1.1	A	2	Slight	1.5
137	463956	Kimberlina Loamy Fine Sand, Cool, 0 To 2 Percent Slopes (137)	0.1	0.2	A	2	Slight	1.9
151	463970	Nebona-Cuddeback Complex, 2 To 9 Percent Slopes* (151)	0.7	1.7	D	3	Slight	1.7
152	463971	Norob-Halloran Complex, 0 To 5 Percent Slopes* (152)	4.7	10.7	C	2	Slight	2.6
156	463975	Playas	0.2	0.4	—	—	—	—
157	463976	Riverwash (157)	0.4	0.9	—	—	—	—
158	463977	Rock Outcrop-Lithic Torriorthents Complex, 15 To 50 Percent Slopes* (158)	0.2	0.4	—	—	—	—
159	463978	Rosamond Loam, Saline-Alkali (159)	0.7	1.5	C	5	Slight	3.5
170	463989	Victorville Variant Sand	0.3	0.8	B	1	Slight	1.5

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
1. The NRCE “Erosion Hazard (Off-Road, Off-Trail)” ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface
2. Linear Extensibility Percent represents the weighted average of representative values for all layers in the SSURGO database
3. (—) indicates no data available
Sources: NRCS 2019a

Table 4.7-2: Mapped Soil Units and Soil Properties, SSURGO2, Segment 3S

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	**Soil Map Unit Key**	**Map Unit Name**	**Length with Soils (miles)**	**Alignment Percentage with Soil**	**Hydrologic Group**	**Wind Erodibility Group**	**Off-Road Erosion Hazard[1]**	**Linear Extensibility Percent[2]**
100	463919	Arizo Gravelly Loamy Sand, 2 To 9% Slopes	0.8	1.8	A	2	Slight	1.5
105	463924	Bryman Loamy Fine Sand, 0 To 2% Slopes	0.2	0.5	C	2	Slight	2.1
112	463931	Cajon Sand, 0 To 2 Percent Slopes	0.2	0.4	A	1	Slight	1.5
113	463932	Cajon Sand, 2 To 9 Percent Slopes	3.8	8.6	—	—	Slight	1.5
115	463934	Cajon Gravelly Sand, 2 To 15 Percent Slopes	7.5	16.9	A	1	Slight	1.5
117	463936	Cajon Sand, 0 To 2 Percent Slopes	0.4	1.0	A	2	Slight	1.5
120	463939	Cave Loam, Dry, 0 To 2% Slopes	0.8	1.8	D	6	Slight	1.5
123	463942	Dune Land	0.1	0.3	—	—	—	—
124	461703	Lavic-Norob Complex, 2 To 9% Slopes	0.5	1.1	B	2	Slight	—
135	463954	Joshua Loam, 2 To 5% Slopes	0.1	0.2	B	5	Slight	2.4
136	461722	Norob Sandy Loam, 2 To 5% Slopes	0.3	0.7	C	3	Slight	3.4
140	463959	Lavic Loamy Fine Sand	0.2	0.3	B	2	Slight	1.5
141	463960	Lovelace Loamy Sand, 5 To 9% Slopes	0.5	1.1	A	1	Slight	1.5
151	463970	Nebona-Cuddeback Complex, 2 To 9 Percent Slopes*	1.9	4.4	D	3	Slight	1.7
152	463971	Norob-Halloran Complex, 0 To 5% Slopes*	2.2	5.0	C	2	Slight	2.6
157	463976	Riverwash	0.4	1.0	—	—	—	—
158	463977	Rock Outcrop-Lithic Torriorthents Complex, 15 To 50 Percent Slopes*	0.4	1.0	—	—	—	—
159	463978	Rosamond Loam, Saline-Alkali	1.2	2.7	C	5	Slight	3.5
168	463987	Typic Haplargids-Yermo Complex, 8 To 30% Slopes*	1.1	2.6	—	—	—	1.5
169	463988	Victorville Sandy Loam	0.6	1.3	A	3	Slight	2.1
171	463990	Villa Loamy Sand	1.6	3.6	A	2	Slight	1.5
172	463991	Villa Loamy Sand, Hummocky	0.2	0.5	A	2	Slight	1.5

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number

1. The NRCE "Erosion Hazard (Off-Road, Off-Trail)" ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface
2. Linear Extensibility Percent represents the weighted average of representative values for all layers in the SSURGO database
3. (—) indicates no data available

Sources: NRCS 2019a

Table 4.7-2: Mapped Soil Units and Soil Properties, SSURGO2, Segment 4

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties			
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group	Off-Road Erosion Hazard[1]	Linear Extensibility Percent[2]
103	463922	Badland	1.1	1.7	—	—	—	—
112	463931	Cajon Sand, 0 To 2% Slopes	4.6	7.1	A	1	Slight	1.5
113	463932	Cajon Sand, 2 To 9% Slopes	6.8	10.4	—	-	Slight	1.5
114	463933	Cajon Sand, 9 To 15% Slopes	0.4	0.6	A	1	Slight	1.5
115	463934	Cajon Gravelly Sand, 2 To 15% Slopes	1.3	1.9	A	1	Slight	1.5
116	463935	Cajon Loamy Sand, 5 To 9% Slopes	0.2	0.3	—	—	Slight	1.5
117	463936	Cajon Loamy Sand, Loamy Substratum, 0 To 2% Slopes	2.7	4.2	A	2	Slight	1.5
127	463946	Halloran Sandy Loam	1.1	1.7	C	1	Slight	1.5
137	463956	Kimberlina Loamy Fine Sand, Cool, 0 To 2% Slopes	0.7	1.0	A	2	Slight	1.9
148	463967	Mirage Sandy Loam, 5 To 9% Slopes	0.1	0.2	C	3	Slight	
150	463969	Mohave Variant Loamy Sand, 0 To 2% Slopes	0.4	0.7	C	2	Slight	2.4
151	463970	Nebona-Cuddeback Complex, 2 To 9% Slopes*	0.1	0.2	D	3	Slight	1.7
157	463976	Riverwash	0.6	0.9	—	—	—	—
158	463977	Rock Outcrop-Lithic Torriorthents Complex, 15 To 50% Slopes*	0.1	0.2	—	—	—	—
3000	1860742	Copperworld Association, 30 To 60% Slopes	1.3	1.9	—	—	Moderate	1.5
3520	1860747	Arizo Loamy Sand, 2 To 8% Slopes	1.9	2.9	—	—	Slight	0.1
4122	1860752	Popups Sandy Loam, 4 To 30% Slopes	1.9	2.9	—	—	Slight	1.5
5000	1860763	Copperworld-Lithic Ustic Haplargids Association, 30 To 60% Slopes	0.3	0.4	D	5	Moderate	1.5

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number

1. The NRCE “Erosion Hazard (Off-Road, Off-Trail)” ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface
2. Linear Extensibility Percent represents the weighted average of representative values for all layers in the SSURGO database
3. (—) indicates no data available

Source: NRCS 2019a

Table 4.7-2: Mapped Soil Units and Soil Properties, STATSGO, Segment 1

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties	
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group
s1077	660524	Entic Haploxerolls, Loamy, Mixed, Mesic, Shallow	0.37	0.3	D	5
s1127	660574	Typic Durorthids, Loamy-Skeletal, Mixed, Thermic	4.3	3.4	C	7
s1086	660533	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	10.4	8.3	A	5
s768	660871	Typic Torripsamments, Mixed, Thermic	1.3	1.0	A	1
s1024	660471	Typic Torripsamments, Mixed, Thermic	18.0	14.2	A	2

Notes:
Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
Source: NRCS 2019b

Table 4.7-2: Mapped Soil Units and Soil Properties, STATSGO, Segment 2

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties	
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group
s1142	660589	Haplic Durargids, Fine-Loamy, Mixed, Thermic	1.0	2.0	C	7
s1126	660573	Lithic Camborthids, Loamy, Mixed, Thermic	3.1	6.3	D	3
s813	660916	Typic Durorthids, Loamy, Mixed, Thermic, Shallow	2.9	5.9	D	3
s769	660872	Typic Haplargids, Fine-Loamy, Mixed, Thermic	6.4	13.3	B	1
s1143	660590	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	1.0	21	A	4
s1024	660471	Typic Torripsamments, Mixed, Thermic	3.1	6.5	A	2
s1024	660471	Typic Torripsamments, Mixed, Thermic	16.4	33.9	A	2
s1024	660471	Typic Torripsamments, Mixed, Thermic	5.1	10.6	A	2

Notes:
Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
Source: NRCS 2019b

Table 4.7-2: Mapped Soil Units and Soil Properties, STATSGO, Segment 3N

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties	
Soil Map Unit	**Soil Map Unit Key**	**Map Unit Name**	**Length with Soils (miles)**	**Alignment Percentage with Soil**	**Hydrologic Group**	**Wind Erodibility Group**
s1142	660589	Haplic Durargids, Fine-Loamy, Mixed, Thermic	3.8	8.5	C	7
s1134	660581	Lithic Camborthids, Loamy, Mixed, Thermic	1.4	3.1	D	3
s769	660872	Typic Haplargids, Fine-Loamy, Mixed, Thermic	7.9	17.9	B	1
s1024	660471	Typic Torripsamments, Mixed, Thermic	11.8	26.5	A	2
s1024	660471	Typic Torripsamments, Mixed, Thermic	0.6	1.3	A	2
s1024	660471	Typic Torripsamments, Mixed, Thermic	2.7	6.0	A	2

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
Sources: NRCS 2019b

Table 4.7-2: Mapped Soil Units and Soil Properties, STATSGO, Segment 3S

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties	
Soil Map Unit	**Soil Map Unit Key**	**Map Unit Name**	**Length with Soils (miles)**	**Alignment Percentage with Soil**	**Hydrologic Group**	**Wind Erodibility Group**
s1039	660486	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	6.9	16.0	A	2
s1024	660471	Typic Torripsamments, Mixed, Thermic	11.4	26.2	A	2

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
Source: NRCS 2019b

Table 4.7-2: Mapped Soil Units and Soil Properties, STATSGO, Segment 4

Soil Description			Soil Occurrence on IC Project Alignment		Soil Properties	
Soil Map Unit	Soil Map Unit Key	Map Unit Name	Length with Soils (miles)	Alignment Percentage with Soil	Hydrologic Group	Wind Erodibility Group
s1126	660573	Lithic Camborthids, Loamy, Mixed, Thermic	0.1	0.1	D	3
s1134	660581	Lithic Camborthids, Loamy, Mixed, Thermic	0.3	0.3	D	3
s1134	660581	Lithic Camborthids, Loamy, Mixed, Thermic	2.3	2.4	D	3
s1126	660573	Lithic Camborthids, Loamy, Mixed, Thermic	0.6	0.6	D	3
s1126	660573	Lithic Camborthids, Loamy, Mixed, Thermic	0.6	0.6	D	3
s1124	660571	Typic Calciorthids, Loamy-Skeletal, Mixed, Thermic	0.4	0.4	B	5
s1124	660571	Typic Calciorthids, Loamy-Skeletal, Mixed, Thermic	5.4	5.7	B	5
s1140	660587	Typic Camborthids, Coarse-Loamy, Mixed, Hyperthermic	9.5	9.9	B	3
s1127	660574	Typic Durorthids, Loamy-Skeletal, Mixed, Thermic	1.1	1.2	C	7
s1138	660585	Typic Torrifluvents, Coarse-Loamy Over Clayey, Mixed (Calcareous), Hyperthermic	0.3	0.3	C	4L
s1137	660584	Typic Torrifluvents, Coarse-Loamy, Mixed (Calcareous), Hyperthermic	5.4	5.6	B	3
s1137	660584	Typic Torrifluvents, Coarse-Loamy, Mixed (Calcareous), Hyperthermic	7.7	8.1	B	3
s1137	660584	Typic Torrifluvents, Coarse-Loamy, Mixed (Calcareous), Hyperthermic	0.5	0.5	B	3
s1131	660578	Typic Torriorthents, Sandy-Skeletal, Mixed, Hyperthermic	2.4	2.5	A	5
s1143	660590	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	5.4	5.6	A	4
s1143	660590	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	10.4	10.9	A	4
s1143	660590	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	2.1	2.2	A	4
s1143	660590	Typic Torriorthents, Sandy-Skeletal, Mixed, Thermic	3.4	3.5	A	4
s1123	660570	Typic Torripsamments, Mixed, Thermic	3.2	3.4	A	5
s1024	660471	Typic Torripsamments, Mixed, Thermic	6.0	6.3	A	2
s1128	660575	Typic Torripsamments, Mixed, Thermic	1.5	1.6	A	1
s1128	660575	Typic Torripsamments, Mixed, Thermic	1.2	1.2	A	1

Notes: Soil map unit numbers are determined by soil survey area. Different soil map units from different soil survey areas may share the same map unit number
Source: NRCS 2019b

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4.7.1.4.4 Segment 3S

SSURGO soils data are available for the majority of Segment 3S, except areas within the Harper Valley east of Kramer. As with Segment 3N to the north, soils within the IC Project Alignment in Segment 3S are generally associated with alluvial soils derived from granitic or mixed sources. Most of these soils are deep, well drained sandy soils. Locally, some soils have higher clay content and lower infiltration rates. Soil associations from the STATSGO2 soils database in Segment 3S are as follows:

- Lower Mojave River Valley. Nebona-Mirage-Joshua-Cajon (soil map unit s1007; soil map unit key 660454).
- Along the Mojave River. Villa-Victorville-Riverwash-Cajon (soil map unit s1008; soil map unit key 660455).
- Hinkley Valley. Norob-Halloran-Cajon-Bryman (soil map unit s1039; soil map unit key 660486).
- Harper Valley, Lower Mojave River Valley. Wasco-Rosamond-Cajon (soil map unit s1024; soil map unit key 660471).

4.7.1.4.5 Segment 4

SSURGO soils data are available for portions of Segment 4 within the Lower Mojave River Valley from the Coolwater Substation to approximately 20 miles to the northeast and from approximately Mountain Pass to the eastern terminus of the IC Project Alignment in Ivanpah Valley. Within the Lower Mojave River Valley, mapped soil types are deep, well drained sandy soils associated with alluvium derived from granitic and mixed sources. Mountain soils near Mountain Pass are shallow, well drained soils formed on metamorphic residuum. Within Ivanpah Valley, soils are deep, extremely well drained sandy soils formed on alluvium derived from metamorphic and sedimentary sources. Soil associations from the STATSGO2 soils database in Segment 4 are as follows:

- Soda Mountains. Rillito-Gunsight (soil map unit s1140; soil map unit key 660587).
- Mojave Valley. Norob-Halloran-Cajon-Bryman (soil map unit s1039; soil map unit key 660486).
- Mojave Valley. Wasco-Rosamond-Cajon (soil map unit s1024; soil map unit key 660471).
- Along the Mojave River. Villa-Victorville-Riverwash-Cajon (soil map unit s1008; soil map unit key 660455).
- Soda Mountains, Clark and Ivanpah Mountains. Tecopa-Rock outcrop-Lithic Torriorthents (soil map unit s1126; soil map unit key 660573).
- Shadow Valley. Bluepoint-Arizo (soil map unit s1123; soil map unit key 660570).
- Lower Mojave River Valley and Caves Canyon Valley, unnamed range of hills near Yucca Grove, and Upper Kingston Valley. Cajon-Arizo (soil map unit s1143; soil map unit key 660590).
- Cronese Mountains and Cave Mountain. Cajon-Bitterwater-Bitter-Badland (soil map unit s1128; soil map unit key 660575).
- Dry lake beds in the Soda Valley. Playas (soil map unit s1138; soil map unit key 660585).
- Cronese Mountains and Cave Mountain and Cronese Valley, Baker Valley. Rositas-Carrizo (soil map unit s1137; soil map unit key 660584).
- Cronese Velley. Rock outcrop (soil map unit s1131; soil map unit key 660578).
- Between the Clark and Ivanpah Mountains. Nickel-Blackmount-Arizo (soil map unit s1124; soil map unit key 660571).
- Ivanpah Valley. Skyhaven-Rillito-Mead-McCullough-Ireteba-Bluepoint (soil map unit s1144; soil map unit key 660591).

4.7.1.4.6 Segments 2, 3N, 3S, and 4

Several soil associations were found in multiple locations across Segments 2, 3N, 3S, and 4:

- Various higher elevations associated with hills and mountains. Upspring-Sparkhule-Rock outcrop (soil map unit s1127; soil map unit key 660574).
- Various terraces. Nickel-Bitter-Arizo (soil map unit s1142; soil map unit key 660589).
- Various valley floors. Playas (soil map unit s1038; soil map unit key 660485).
- Various higher elevations associated with hills and mountains. Trigger-Rock outcrop-Calvista (soil map unit s1134; soil map unit key 660581).

4.7.1.5 Geologic Hazards

4.7.1.5.1 Faults and Seismicity

The IC Project Alignment is located in a seismically-active area with numerous Holocene (including "latest Quaternary") faults (Figureset 4.7-4) that have been identified as potential seismic sources by the California Geological Survey. ([CGS] 2017b) and the U.S. Geological Survey (USGS; 2019a, 2019b). Holocene faults are considered to have been active within approximately the past 11,000 to 15,000 years. Table 4.7-3 includes additional information about the Holocene faults crossed by the IC Project Alignment, including fault type, fault and section length, slip rate, and maximum estimated moment magnitude. There are also numerous older Quaternary and pre-Quaternary faults in the IC Project Alignment area, but these are not regarded as potential seismic sources by CGS or USGS.

4.7.1.5.1.1 Segment 1

The Holocene fault zones in the vicinity of Segment 1 of the IC Project Alignment are discussed in the sections below.

Owens Valley Fault Zone. This fault zone is generally located in the central part of the Owens Valley in Segment 1. The IC Project Alignment runs close to this fault zone in most parts of the valley. Most of the faults within this zone are classified as a right-lateral strike slip faults, with estimated slip rates of 1 to 5 millimeters per year (mm/yr).

Many of the fault segments near the IC Project Alignment are classified as historically active, with activity during the past 150 years. A major historical earthquake, the 1872 Lone Pine earthquake, was associated with the Owens Valley Fault Zone in the vicinity of the IC Project Alignment. This earthquake had an estimated moment magnitude of 7.4, and caused widespread destruction in Lone Pine and other communities in the Owens Valley. (ICCB 2016)

Southern Sierra Nevada Fault Zone. This fault zone occurs at the base of the Sierra Nevada generally west of the IC Project Alignment. Most of the faults within this zone are classified as normal faults with slip rates of 0.2 to 1 mm/yr. The youngest fault segments are classified as Holocene age.

White Mountains Fault Zone. This fault zone occurs at the base of the Inyo Mountains in the Owens Valley, east of the IC Project Alignment between Bishop and Big Pine. Most of the faults within this zone are classified as right-lateral strike-slip faults with slip rates of 0.2 to 1 mm/yr. The youngest fault segments are classified as Holocene age.

An historical earthquake, the July 21, 1986 Chalfant Valley earthquake, occurred along the White Mountains Fault Zone near the IC Project Alignment. This earthquake had an estimated moment magnitude of 6.5 and a maximum Mercalli intensity of VI. (Brewer 1989) Ground surface ruptures associated with the event have been mapped approximately 1 mile north of the IC Project Alignment (Figureset 4.7-4).

Table 4.7-3: Holocene Fault Properties

Project Segment	Fault Name	Fault Type	Fault/Section Length (miles)	Slip Rate (mm/yr)	Maximum Moment Magnitude	Distance to IC Project Alignment (miles)
1	Owens Valley fault zone (Keough Hot Springs section)	normal	84 / 13	1.0 to 5.0	7.3	0
1	Owens Valley fault zone (1872 Rupture section)	right lateral	84 / 73	1.0 to 5.0	7.3	0
1	Southern Sierra Nevada fault zone (Independence section)	normal	126 / 44	0.2 to 1.0	7.5	3.5
1	Southern Sierra Nevada fault zone (Haiwee section)	normal	126 / 81	0.2 to 1.0	7.5	0
1	White Mountains fault zone (central section)	right lateral	68 / 24	0.2 to 1.0	7.4	4.5
1	White Mountains fault zone (Inyo-Waucoba section)	right lateral	68 / 18	0.2 to 1.0	7.4	0.1
1	Little Lake fault zone	right lateral, normal	33	1.0 to 5.0	6.9	0
1	Airport Lake fault zone	normal, right-lateral	25	0.2 to 1.0	unspecified	5.2
2	Garlock fault zone (Central Garlock section)	left lateral	159 / 66	> 5.0	7.3	0
2, 3N	Lenwood-Lockhart fault zone (Lockhart section)	right lateral	88 / 43	0.2 to 1.0	7.5	0.5
3S	Lenwood-Lockhart fault zone (Lenwood section)	right lateral	88 / 46	0.2 to 1.0	7.5	0.2
2, 3N, 3S	Helendale-South Lockhart fault zone (South Lockhart section)	right lateral	84 / 31	0.2 to 1.0	7.4	0.8
3N	Harper fault zone	right lateral	49	unspecified	7.1	0.8
3N, 3S	Mt. General fault	right lateral	14	unspecified	unspecified	1.3
4	Calico-Hidalgo fault zone (Calico section)	right lateral	73 / 39	0.2 to 1.0	7.4	0
4	Manix	left lateral	unspecified	unspecified	unspecified	0.6
4	Red Pass fault (or Red Pass Lake fault)	right lateral	12	unspecified	unspecified	0.7

Notes:
Data from USGS (2019a); maximum moment magnitudes from USGS (2019b)

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The greatest damage associated with the 1986 Chalfant Valley earthquake was in the community of Chalfant, where many mobile homes were shaken off their foundations. Only non-structural damage was reported in Bishop.

Little Lake Fault Zone and Airport Lake Fault Zone. These fault zones occur in Segment 1 in the Indian Wells Valley. Some of the fault segments are considered historically active, based on surface rupture associated with the 5.2 magnitude Indian Wells Valley earthquake in 1982 and the 5.4 to 5.8 magnitude Ridgecrest earthquake sequence in 1995. (CGS 2010)

4.7.1.5.1.2 Segment 2

The Holocene fault zones in the vicinity of Segment 2 of the IC Project Alignment are discussed in the sections below.

Southern Sierra Nevada Fault Zone. This fault zone occurs at the base of the Sierra Nevada near the northern part of Segment 2. The youngest portions are classified as Holocene age.

Garlock Fault Zone. This fault zone occurs on the southern side of the El Paso Mountains in the northern part of Segment 2. In the vicinity of the IC Project Alignment, the youngest faults within this zone are classified as Holocene age. Some of the fault segments are considered historically active; the closest are about 8 miles southwest of Segment 2.

South Lockhart, Lockhart, Lenwood, Mt. General, and Harper Fault Zones. These fault zones occur near the southern part of Segment 2. The youngest faults within these zones are classified as Holocene in age.

4.7.1.5.1.3 Segment 3N

The Holocene fault zones in the vicinity of Segment 3N of the IC Project Alignment are discussed in the sections below.

South Lockhart, Lockhart, Lenwood, Mt. General, and Harper Fault Zones. These fault zones occur near Segment 3N. The youngest faults within these zones are classified as Holocene in age.

4.7.1.5.1.4 Segment 3S

The Holocene fault zones in the vicinity of Segment 3S of the IC Project Alignment are discussed in the sections below.

South Lockhart, Lockhart, Lenwood, Mt. General, and Harper Fault Zones. These fault zones occur near Segment 3S. The youngest faults within these zones are classified as Holocene in age. Fault creep has been historically documented along a short segment of the Lenwood Fault Zone near Segment 3S.

4.7.1.5.1.5 Segment 4

The Holocene fault zones in the vicinity of Segment 4 of the IC Project Alignment are discussed in the sections below.

Calico Fault Zone. The western part of Segment 4 crosses this fault zone. In the vicinity of the IC Project Alignment, the youngest faults within this zone are classified as Holocene. Some fault segments near the IC Project Alignment are considered historically active, based on surface rupture associated with the magnitude 7.3 Landers earthquake in 1992. (CGS 2010)

Manix Fault. The western part of Segment 4 crosses this fault. In the vicinity of the IC Project Alignment, the youngest fault segments are classified as Holocene age. Some fault segments near the IC Project Alignment are considered historically active, based on surface rupture associated with the magnitude 6.2 Manix earthquake in 1947. (CGS 2010)

Red Pass Lake Fault. The central part of Segment 4 runs near this fault. It is considered remote and little-studied, but is thought to be of Holocene age.

4.7.1.6 Surface Fault Rupture

There is a risk of surface fault rupture associated with Holocene faults such as those found along the IC Project Alignment. The State of California has established "Alquist-Priolo (AP) Special Studies Zones" in areas where Holocene faults are known to pose a risk of surface displacement. (CGS 2017a) There may be a risk of surface fault rupture in other area, outside of Alquist-Priolo Zones, where Holocene faults have not been identified or are incompletely studied.

There are 20 crossings of AP Special Studies Zones (Figureset 4.7-5) associated with the local Holocene faults along the IC Project Alignment. In some areas, such as the Alabama Hills along Segment 1, the IC Project Alignment trends in roughly the same direction as a Special Studies Zone and may run within the Zone for a distance of 1 to 2 miles. The IC Project Alignment makes multiple crossings of Alquist-Priolo Zones associated with the Owens Valley Fault Zone in Segment 1; it also crosses the Garlock Fault Zone in Segment 3N, the South Lockhart Fault Zone in Segment 3N, and the Calico Fault Zone in Segment 4. The IC Project Alignment runs near mapped Alquist-Priolo Special Studies Zones at several other locations along Segments 2, 3N, and 3S.

Most of the Special Studies Zones that affect the IC Project Alignment are associated with the Owens Valley Fault Zone in the central parts of the Owens Valley. The IC Project Alignment also crosses Special Studies Zones associated with the Southern Sierra Nevada Fault Zone on the western side of the Owens Valley, and Special Studies Zones associated with the Little Lake Fault Zone in Indian Wells Valley.

4.7.1.7 Seismic Ground Shaking

The expected long period (1.0 second) ground motions associated with a 2-percent exceedance probability in 50 years, based on Branum et al. (2016) and CGS (2017c), are shown in Figureset 4.7-6. This represents a recurrence interval of approximately 2,500 years. These estimates were calculated considering historical earthquakes, slip rates on major faults, and deformation throughout the region, and the potential for amplification of seismic waves by near-surface geologic materials.

In general, the estimated ground motions are highest where unconsolidated Quaternary alluvium coincides with Holocene faults. Ground motions greater than 0.65g (g = standard acceleration due to gravity, or 9.8 m/s^2) are often associated with heavy damage and violent perceived shaking. (Wald et al. 1999) Predicted ground motion values along the IC Project Alignment are commonly above 0.60g, except along Segment 4, east of the Soda Mountains (Figureset 4.7-6). The highest estimated ground motion values along the IC Project Alignment, up to 1.05g, occur in the Owens Valley in Segment 1. Other areas of very high predicted ground motions (greater than 0.95g) include the northern part of Segment 2 near the Garlock Fault Zone, and the western part of Segment 4 near the Mojave River.

4.7.1.8 Liquefaction

Liquefaction occurs where strong ground motions produce a rise in pore-water pressures that in turn causes granular material to briefly lose strength and liquefy. This can lead to settlement, lateral spreading, and damage to structures, even in areas of flat topography. Ground motions in excess of 0.1g can potentially trigger liquefaction in areas of unconsolidated granular sediment and shallow groundwater. (Southern California Earthquake Center [SCEC] 1999) The risk of liquefaction is highest in areas with high predicted ground motions, unconsolidated sediments, and shallow groundwater.

There is a potential risk of ground motions above this level throughout the IC Project Alignment, and the valley areas may contain unconsolidated granular sediment. However, with the exception of Segment 1, the IC Project Alignment is not generally characterized by shallow groundwater. The absence of shallow groundwater reduces the local liquefaction risk: The valley areas along Segments 2, 3N, 3S, and 4 are considered to have low to moderate susceptibility, which is typical for valley areas throughout Kern and San Bernardino counties. (USGS 2008, San Bernardino County 2011) No areas of "high" or "very high" liquefaction susceptibility were mapped along the IC Project Alignment.

The California Geological Survey's Seismic Hazard Zonation Program includes mapping of earthquake-induced liquefaction zones. However, this program focuses on the major metropolitan areas of California; it has not addressed the area along the IC Project Alignment.

4.7.1.8.1 Segment 1

Historical records of liquefaction in the Owens Lake area are extant as described below. Many parts of Segment 1 are characterized by both unconsolidated sediments and shallow groundwater, and potential liquefaction risks appear to exist in these areas.

The IC Project Alignment in Segment 1 crosses three valley areas filled with unconsolidated sediments. The potential occurrence of shallow groundwater in these valley areas is summarized below.

- Owens Valley. Shallow groundwater is likely to occur along the IC Project Alignment in many parts of the Owens Valley, particularly in the central parts near the Owens River, and in the southern part near Owens Lake. The California Department of Water Resources noted that "in extensive portions of the [Owens Valley] basin ground water levels are near or at the surface." (DWR 1964) The Safety Element of the City of Bishop General Plan notes that "the ground water under the [Owens] valley floor is shallow enough to suggest potential liquefaction problems." (City of Bishop 1993) However, no further evaluation or mapping are available. Historical records indicate that liquefaction occurred around the edges of Owens Lake in association with the 1876 Lone Pine earthquake. (ICCB 2016) More recently, liquefaction was observed in the Owens Lake area following the 2009 Olancha earthquake, which had a magnitude of 5.2. (Holzer et al. 2010) This study noted "extensive liquefaction as well as permanent horizontal ground deformation within [a] 1.2 km^2 area."
- Rose Valley. Current groundwater conditions in Rose Valley are not well documented. However, the CDWR (2004) reported shallow groundwater "about 20 feet below the surface" near Little Lake. The IC Project Alignment passes directly across the southwestern part of Little Lake, and the Full-Rebuild Concept includes proposed structures on the north and south shores of Little Lake.
- Indian Wells Valley. There are no permanent surface water bodies near the IC Project Alignment in Indian Wells Valley. Current groundwater conditions in this area are not well documented. In 1985, the groundwater elevations in the southern Kern County portion of Indian Wells Valley were estimated at approximately less than 2,200 ft msl (Berenbrock and Martin 1991), while the local surface elevations are consistently above 2,250 ft msl. Based on these findings, groundwater does not appear to occur at shallow depths in this area.
  The Kern County portion of Indian Wells Valley has been addressed as part of a liquefaction susceptibility map for southern California. (USGS 2008) Most of the valley areas of Kern County, including Indian Wells Valley, are considered to have "moderate" liquefaction susceptibility. No areas of "high" or "very high" liquefaction susceptibility are mapped near the IC Project Alignment in Kern County.

4.7.1.8.2 Segments 2, 3N, 3S, and 4

Liquefaction susceptibility zones in Segments 2, 3N, 3S, and 4 have been mapped by USGS. (USGS 2008; San Bernardino County 2011) In general, the mountainous areas along the IC Project Alignment are considered to have no susceptibility to liquefaction. The valley areas along the IC Project Alignment are considered to have low to moderate susceptibility, which is typical for valley areas throughout Kern and San Bernardino counties. No areas of "high" or "very high" liquefaction susceptibility are mapped along the IC Project Alignment.

4.7.1.9 Slope Instability

No records of major historical landslides were found along the IC Project Alignment. Much of the IC Project Alignment is in valley areas. The hazards of landslides, rockfalls, slope creep, or other slope-related concerns are low to absent in these areas as they are, in general, characterized by relatively flat topography.

The susceptibility to deep-seated landslides, based on Wills et al. (2011) and CGS (2017d), is shown in Figureset 4.7-7. The estimated values indicate the relative likelihood of deep landsliding based on regional estimates of rock strength and steepness of slopes. Localized areas of relatively steep slopes and increased landslide hazards occur where the IC Project Alignment runs within or along the edges of hills and mountains, such as the Coso, El Paso, Cronese, Soda, and Clark-Ivanpah mountains. Figureset 4.7-7 shows the location of the IC Project Alignment within these areas.

Ground motions associated with earthquakes could potentially trigger landslides or rockfalls in the IC Project Alignment. Seismically-induced landslides are most commonly associated with earthquakes of magnitude 4.0 or more. (Keefer 1984)

The California Geological Survey's Seismic Hazard Zonation Program includes mapping of earthquake-induced landslide zones. However, this program focuses on the major metropolitan areas of California; it has not addressed the area along the IC Project Alignment.

4.7.1.10 Soil Erosion

Susceptibility of soils to erosion by water along the IC Project Alignment are summarized in Tables 4.7-1 and 4.7-2. Water erosion hazard ratings developed by the United States Department of Agriculture (USDA) utilize SSURGO data and assume that vegetative cover has been removed, but soil horizons remain intact. The erosion hazard rating is influenced by slope and soil erosion factor K. (SSS 2016) Erosion by water is a slight hazard for the majority of mapped soils crossed by the IC Project Alignment. Approximately 3 percent of the mapped soil units within the IC Project Alignment have a moderate erosion hazard; approximately 0.5 percent have a severe or very severe hazard. Soils with higher erosion hazards are generally associated with steeper terrain along the IC Project Alignment.

Wind erosion is similarly most prevalent in silty and fine sandy soils with disturbed vegetation. Dust storms associated with wind erosion are identified as hazards in Inyo, Kern, and San Bernardino counties. (Kern 2012; ICCB 2016; SBC 2011) Wind erodibility groups (WEGs) are made up of soils that have similar properties affecting their susceptibility to wind erosion. The soils assigned to Wind Erodibility Group 1 are the most susceptible to wind erosion, and those assigned to Group 8 are the least susceptible. Table 4.7-4 presents the relative Wind Erodibility Group presence of soils along the IC Project Alignment. Soils with relatively high levels of wind erodibility (Wind Erodibility Groups 1 and 2) occur at various locations and make up the majority of soil units that have been assigned a WEG.

Table 4.7-4: Relative Wind Erodibility Group Presence of Soils along the IC Project Alignment

Wind Erodibility Group	Description	Percent of IC Project Alignment[1]
1	Coarse sands, sands, fine sands, and very fine sands.	13.0
2	Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.	13.8
3	Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.	5.8
4L	Calcareous loams, silt loams, clay loams, and silty clay loams.	2.2
4	Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.	0
5	Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.	3.3
6	Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.	1.1
7	Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.	0
8	Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.	0
Undefined	N/A	60.0

Notes:
1 Percentages rounded; total may not equal 100 percent.

4.7.1.11 Collapsible Soils

Soil collapse occurs when water enters the void space between soil particles and weakens the bonds between particles. The weight of overlying soils or structures causes the soil particles to shift, filling the voids and resulting in a reduced overall soil volume. Collapse of the soil at depth is translated to downward motion of the surface, causing differential settlement. Soils susceptible to collapse typically contain a large amount of void space (porosity), low bulk density, low clay content (less than 30 percent and most commonly 10 to 15 percent), and have formed rapidly in arid or semiarid climates, especially on alluvial fans. (Scheffe and Lacy 2004) Soil collapse has not been identified as a significant issue within Inyo, Kern, or San Bernardino counties. (Kern 2012; ICCB 2016; SBC 2011) However, soils with low clay content, formed on alluvial fans, are mapped in multiple locations along the IC Project Alignment. Potential for soil collapse may be locally present in those areas.

4.7.1.12 Expansive Soils

An expansive soil is any soil that is prone to large volume changes (shrinking and swelling) directly related to changing moisture conditions. The swelling capacity can cause heaving or lifting of structures whilst shrinkage can cause differential settlement. Linear extensibility percent (LEP) is the linear expression of the volume difference of natural soil; LEP is used to identify shrink-swell classes as follows: Low (<3), Moderate (3-6), High (6-9), and Very High (>9).

Expansive soil issues are not prevalent along the IC Project Alignment. (Kern 2012; ICCB 2016; SBC 2011) Most of the soils along Segment 1 have low to moderate shrink-swell potential (with LEP values of less than 6.0). Soils with high shrink-swell potential (LEP values of 6.0 to 9.0) are found locally along the IC Project Alignment near the edges of the Owens Lake bed. No soils with a very high (LEP above 9.0) shrink-swell potential have been mapped along the northern portion of Segment 1. All mapped soils within Segments 2, 3N, 3S, and 4 have LEP values of less than 6.0 and therefore have low to moderate shrink-swell potential.

4.7.1.13 Subsidence

No records of land subsidence were found along Segment 1; there are no historical or expected occurrences of subsidence in Inyo County, which includes most of Segment 1. (ICCB 2016)

Land subsidence associated with groundwater overdraft is a concern in several of the valley areas crossed by Segments 2, 3N, 3S, and 4. The IC Project Alignment crosses parts of ten groundwater basins recognized by the California Department of Water Resources (CDWR). The overall estimated potential for future subsidence in each of these basins, as rated by CDWR (2014), is summarized in Table 4.7-5.

Table 4.7-5: Subsidence Potential

Groundwater Basin	CDWR Basin No.	Project Segment(s)	Subsidence Potential
Indian Wells Valley	6-54	2	Low
Fremont Valley	6-46	2	Medium to High
Cuddeback Valley	6-50	2	Insufficient Data
Harper Valley	6-47	2, 3N, 3S	High
Lower Mojave River Valley	6-40	3N, 3S, 4	High
Caves Canyon Valley	6-38	4	Medium to Low
Cronese Valley	6-35	4	Insufficient Data
Soda Lake Valley	6-33	4	Insufficient Data
Upper Kingston Valley	6-22	4	Insufficient Data
Ivanpah Valley	6-30	4	Insufficient Data

The areas with the greatest documented subsidence potential are generally associated with the southern part of Segment 2; most parts of Segments 3N and 3S; and the western part of Segment 4. Segment 2 crosses a portion of the Fremont Valley where earth fissures attributed to land subsidence caused by groundwater pumping have been documented. (CDWR 2014) Segment 3N runs directly south of the Harper Dry Lake bed; between 1992 and 2009, more than 6 inches of subsidence was documented at the Harper Dry Lake, at a steady rate of about 0.4 inches per year. The subsidence was associated with a decline in groundwater elevations (Brandt and Sneed 2017).

4.7.2 Regulatory Setting

Federal, state, and local regulations were reviewed for applicability to the IC Project.

4.7.2.1 Federal

4.7.2.1.1 National Earthquake Hazards Reduction Act of 1977

The National Earthquake Hazards Reduction Act of 1977 (Public Law 95-124) created the National Earthquake Hazards Reduction Program (NEHRP), establishing a long-term earthquake risk reduction program to better understand, predict, and mitigate risks associated with seismic events. Four federal agencies are responsible for coordinating activities under NEHRP: U.S. Geological Survey (USGS); National Science Foundation (NSF); Federal Emergency Management Agency (FEMA); and National Institute of Standards and Technology (NIST). Since its inception, NEHRP has shifted its focus from earthquake prediction to hazard reduction. The current program objectives (NEHRP 2009) are as follows:

1. Developing effective measures to reduce earthquake hazards;
2. Promoting the adoption of earthquake hazard reduction activities by federal, state, and local governments, national building standards and model building code organizations, engineers,

architects, building owners, and others who play a role in planning and constructing buildings, bridges, structures, and critical infrastructure or "lifelines";

3. Improving the basic understanding of earthquakes and their effects on people and infrastructure through interdisciplinary research involving engineering, natural sciences, and social, economic, and decision sciences; and

4. Developing and maintaining the USGS seismic monitoring system (Advanced National Seismic System); the NSF-funded project aimed at improving materials, designs, and construction techniques (George E. Brown Jr. Network for Earthquake Engineering Simulation); and the global earthquake monitoring network (Global Seismic Network).

Implementation of NEHRP objectives is accomplished primarily through original research, publications, and recommendations and guidelines for state, regional, and local agencies in the development of plans and policies to promote safety and emergency planning.

4.7.2.1.2 Clean Water Act

Enacted in 1972, the Federal Clean Water Act (CWA; 33 U.S.C. § 1251 et seq.) and subsequent amendments outline the basic protocol for regulating discharges of pollutants to waters of the U.S. It is the primary federal law applicable to water quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. Enforced by the USEPA, it was enacted "… to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The CWA authorizes States to adopt water quality standards and includes programs addressing both point and non-point pollution sources. The CWA also established the NPDES, and provides the USEPA the authority to implement pollution control programs, such as setting wastewater standards for industry and water quality standards for surface waters (see below for a discussion of the NPDES program).

In California, programs and regulatory authority under the CWA have been delegated by USEPA to the SWRCB and its nine RWQCBs. Under Section 402 of the CWA as delegated to the State of California, a discharge of pollutants to navigable waters is prohibited unless the discharge complies with an NPDES permit. The SWRCB and RWQCBs have developed numeric and narrative water quality criteria to protect beneficial uses of state waters and waterways. Beneficial uses along the IC Project Alignment include water supply, groundwater recharge, aquatic habitat, wildlife habitat, and recreation.

4.7.2.2 State

4.7.2.2.1 Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo (AP) Earthquake Fault Zoning Act was enacted by the State of California in 1972 to mitigate the hazard of surface faulting to structures planned for human occupancy and other critical structures. The State has established regulatory zones, known as Earthquake Fault Zones and often referred to as AP zones, around the surface traces of active faults and has issued Earthquake Fault Zone Maps to be used by government agencies in planning and reviewing new construction. In addition to residential projects, structures planned for human occupancy that are associated with industrial and commercial projects are of concern.

4.7.2.2.2 California Public Utilities Commission General Order 95

California Public Utilities Commission (CPUC) General Order (GO) 95 Rules for Overhead Line Construction provides general standards for the design and construction of overhead electric transmission lines.

4.7.2.2.3 California Public Utilities Commission General Order 128

CPUC GO 128 (Rules for Construction of Underground Electric Supply and Communication Systems) provides general standards for the construction of underground electric systems.

4.7.2.2.4 Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (California Public Resources Code, Chapter 7.8, Segment 2690-2699.6) directs the California Department of Conservation (DOC) to identify and map areas prone to liquefaction, earthquake-induced landslides, and amplified ground shaking. The purpose of this program is to minimize loss of life and property through the identification, evaluation, and mitigation of seismic hazards. Seismic Hazard Zone Maps that identify Zones of Required Investigation have been generated as a result of the program. Cities and counties are then required to use the Seismic Hazard Zone Maps in their land use planning and building permit processes. As discussed previously, the IC Project Alignment is in an area that has not yet been mapped as part of the Seismic Hazards Mapping Act.

4.7.2.3 Local

The California Public Utilities Commission (CPUC) has sole and exclusive state jurisdiction over the siting and design of the IC Project. Pursuant to CPUC General Order 131-D (GO 131-D), Section XIV.B, "Local jurisdictions acting pursuant to local authority are preempted from regulating electric power line projects, distribution lines, substations, or electric facilities constructed by public utilities subject to the CPUC's jurisdiction. However, in locating such projects, the public utilities shall consult with local agencies regarding land use matters." Consequently, public utilities are directed to consider local regulations and consult with local agencies, but the counties' and cities' regulations are not applicable as the counties and cities do not have jurisdiction over the IC Project. Accordingly, the following discussion of local land use regulations is provided for informational purposes only.

4.7.2.3.1 Kern County General Plan

The Kern County General Plan has provisions that state that areas within the AP Special Study Zone and other recently active faults shall be designated with Map Code 2.1 – Seismic Hazard and areas of down-slope ground movement shall be designated with Map Code 2.2 – Landslide. (Kern County 2009) The Kern County General Plan outlines policies that aim to reduce to potential for exposure of residential, commercial, and industrial development to hazards of landslide, land subsidence, liquefaction, and erosion.

4.7.2.3.2 Kern County General Plan, Land Use, Open Space, and Conservation Element

Section 1.3, Physical and Environmental Constraints, of the Land Use, Open Space, and Conservation Element notes that natural hazards are a long-term constraint that may affect developed uses of land. The Section contains Goals, Policies, and Implementation Measures to mitigate the risks presented by physical and environmental constraints. These Goals, Policies, and Implementation measures are generally applicable to new developments and are designed to reduce to potential for exposure of residential, commercial, and industrial development to hazards of landslide, land subsidence, liquefaction, and erosion. The Element establishes Land Use Designations for areas with natural hazards, including seismic hazards, landslides, shallow groundwater, steep slopes, and flood hazards.

4.7.2.3.3 Kern County General Plan, Safety Element

Per Section 65302(g) of the California Government Code, the Safety Element includes Policies and Implementation Measures designed to protect the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides; subsidence, liquefaction and other seismic hazards; flooding; and wildland and urban fires.

4.7.2.3.4 Inyo County General Plan, Safety Element

The Safety Element of the Inyo County General Plan contains a number of goals, policies, and implementation measures designed to maintain a safe environment and to protect public safety and property. The Safety Element addresses avalanches and geologic and seismic hazards among other topics. The goals, policies, and implementation measures contained in the General Plan are directed toward traditional residential, commercial, and institutional projects, and are not applicable to the IC Project.

4.7.2.3.5 Inyo County and City of Bishop Multi-Jurisdictional Hazard Mitigation Plan

The Inyo County and City of Bishop Multi-Jurisdictional Hazard Mitigation Plan (ICCB 2016) establishes a strategy for Inyo County and the City of Bishop, California, to reduce hazard impacts. The Plan focuses on hazard mitigation in reducing the impacts of disasters by identifying effective and feasible actions to reduce the risks posed by potential hazards. The Plan develops mitigation actions to strengthen community resilience, which helps ensure coordinated and consistent hazard mitigation activities across Inyo County and Bishop. The County and the City have developed this Plan to be consistent with current standards and regulations, ensuring that the understanding of hazards facing the communities reflects best available science and current conditions. The Plan is also consistent with Federal Emergency Management Agency (FEMA) requirements.

4.7.2.3.6 San Bernardino General Plan, Safety Element

The Safety Element of the County of San Bernardino 2007 General Plan contains the following goals to address geologic and seismic hazards:

- Goal S 1: The County will minimize the potential risks resulting from exposure of County residents to natural and man-made hazards in the following priority: loss of life or injury, damage to property, litigation, excessive maintenance and other social and economic costs
- Goal S 6: The County will protect residents from natural and manmade hazards
- Goal S 7: The County will minimize exposure to hazards and structural damage from geologic and seismic conditions

4.7.2.3.7 City of Barstow General Plan, Safety Element

The Safety Element of the City of Barstow General Plan (City of Barstow 2015) sets forth goals, policies, and strategies geared toward ensuring the safety of City residents and visitors to the community. The City of Barstow General Plan's Safety Element contains the following:

> Emergency Preparation Goals, Policies, and Strategies
> **Goal 3 (Policies 3.1 and Strategies 3.1.A and 3.1.B).** Ensure that all development occurring under the General Plan is designed and built in accordance with current standards for seismic safety, fire protection and defensible space.

4.7.3 Significance Criteria

The significance criteria for assessing the impacts to geology and soils come from the California Environmental Quality Act (CEQA) Environmental Checklist. According to the CEQA Checklist, a project causes a potentially significant impact if it would:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, or injury, or death involving: rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault (Refer to Division of Mines and Geology Special Publication 42.); strong seismic ground shaking; seismic-related ground failure, including liquefaction; and landslides

- Result in substantial soil erosion or the loss of topsoil
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Proposed Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse
- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property
- Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water

4.7.4 Impact Analysis

4.7.4.1 Would the Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault strong seismic ground shaking; seismic-related ground failure, including liquefaction; and landslides?

4.7.4.1.1 Construction

Less than Significant Impact. The replacement components included in the Full-Rebuild Concept would have the potential to be directly impacted by surface rupture in the Alquist-Priolo Special Studies Zones crossed by the alignment. Portions of the Full-Rebuild Concept would be constructed within these zones, and as a result could experience strong seismic ground shaking. Even though the IC Project Alignment is located in an area susceptible to earthquake forces, the subtransmission infrastructure involved would not be used for human occupancy and would be designed consistent with CPUC GO 95, Rules for Overhead Line Construction, to withstand wind, temperature, and wire tension loads. Accounting for these factors would result in a design that would be adequate to withstand expected seismic loading, and therefore impacts due to strong seismic ground shaking would be less than significant.

The IC Project Alignment may pass through areas of liquefaction hazard in parts of Owens Valley and Rose Valley, particularly near surface water features such as the Owens River, Owens Lake, or Little Lake. Settlements induced by dynamic (earthquake) forces are anticipated to be uniform for the proposed TSPs and LWS poles given their small footprint, and thus use of these poles reduces the potential for differential settlements and other adverse effects including loss of functionality, or risk of injury or loss of life. Therefore, impacts associated with liquefaction would be less than significant in areas potentially subject to liquefaction.

Most of the IC Project Alignment passes through valley areas with relatively low to absent potential of landslides or other slope-related hazards. In localized areas with higher potential of landslides or other slope-related hazards, structures would be exposed to the risk of loss from a landslide or rockfall. These areas are uninhabited and non-SCE structures are generally not present proximate to the location of existing or replacement subtransmission poles. Therefore, reconstruction of the existing subtransmission lines in these areas would not expose people or non-SCE structures to potential substantial adverse effects, including the risk of loss, injury, or death, and thus impacts due to landslides would be less than significant.

4.7.4.1.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.7.4.2 Would the Project result in substantial soil erosion or the loss of topsoil?

4.7.4.2.1 Construction

Less than Significant Impact. Loss of topsoil and erosion could result from construction activities, including the operation of heavy machinery on unimproved roadways, grading activities, excavation, drilling, or wind or water erosion of stockpiled fill/excavated materials. Preparation of the staging areas may result in the loss of topsoil; however, the application of road base or crushed rock would serve to reduce erosivity. Use of existing access roads would also result in the loss of topsoil; however, compaction associated with that use would serve to minimize erosion on roadways.

Erosion due to water runoff and wind would be minimized by the implementation of best management practices (BMPs) that would be described in the Storm Water Pollution Prevention Plan (SWPPP) prepared for the Full-Rebuild Concept. During construction, water trucks and other measures would be used to minimize the quantity of fugitive dust created by construction. Implementation of the SWPPP and site-specific BMPs would ensure that no substantial soil erosion or loss of topsoil results from construction of the Full-Rebuild Concept, and thus impacts would be less than significant.

4.7.4.2.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.7.4.3 Would the Project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Proposed Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

4.7.4.3.1 Construction

Less than Significant Impact. The Full-Rebuild Concept is located on geologic units and soils that are unstable; no geologic units or soils would become unstable as a result of construction of the Full-Rebuild Concept.

The potential for risk from on- or off-site landslides is considered to be low because components of the Full-Rebuild Concept are generally located in valley areas with relatively low threats of landslide or other slope-related hazards. Localized areas of steeper slopes and higher landslide hazard occur where Full-Rebuild Concept components are located along the edges of hills and mountains; these few areas are unpopulated and third-party structures are generally not present, and thus potential effects from on- or off-site landslide are less than significant.

Ground subsidence related to decreasing groundwater levels has been documented along the southern part of Segment 2; most parts of Segments 3N and 3S; and the western part of Segment 4. The construction of the Full-Rebuild Concept would not result in subsidence.

The IC Project Alignment may pass through areas of liquefaction hazard in parts of Owens Valley and Rose Valley, particularly near surface water features such as the Owens River, Owens Lake, or Little Lake. These valleys are characterized by unconsolidated sediment, surface water or possible shallow groundwater. Liquefaction-induced lateral spreading may also be a hazard in these areas. Construction of the Full-Rebuild Concept would not in and of itself result in liquefaction of soils or lateral spreading, and therefore impacts would be less than significant.

Soils subject to collapse due to water infiltration may be locally present on alluvial fans. Construction of the Full-Rebuild Concept would not in and of itself result in the collapse of soils, and therefore impacts would be less than significant.

As presented above, impacts associated with the risk of landslides, lateral spreading, subsidence, liquefaction, and collapse would be less than significant.

4.7.4.3.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.7.4.4 Would the Project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

4.7.4.4.1 Construction

Less than Significant Impact. Soils along the IC Project Alignment have a low to moderate shrink-swell potential, with the exception of a limited area of high potential near Owens Lake. Inyo, Kern, and San Bernardino counties have determined that expansive soils are generally not a hazard along the IC Project Alignment. Components of the Full-Rebuild Concept are not located immediately proximate to residences or third-party improvements near Owens Lake. Therefore, less than significant impacts would be realized.

4.7.4.4.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.7.4.5 Would the Project have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

4.7.4.5.1 Construction

No Impact. No septic tanks or alternative waste water disposal systems are included in the Full-Rebuild Concept. Therefore, no impacts would be realized.

4.7.4.5.2 Operations

No Impact. No septic tanks or alternative waste water disposal systems are included in the Full-Rebuild Concept. Therefore, no impacts would be realized.

4.7.5 Applicant Proposed Measures

Because no significant impacts would occur as a result of the Full-Rebuild Concept, no avoidance or minimization measures are proposed.

4.7.6 Alternatives

Alternatives to the Full-Rebuild Concept are addressed in Section 5.2, Description of Project Alternatives and Impact Analysis.

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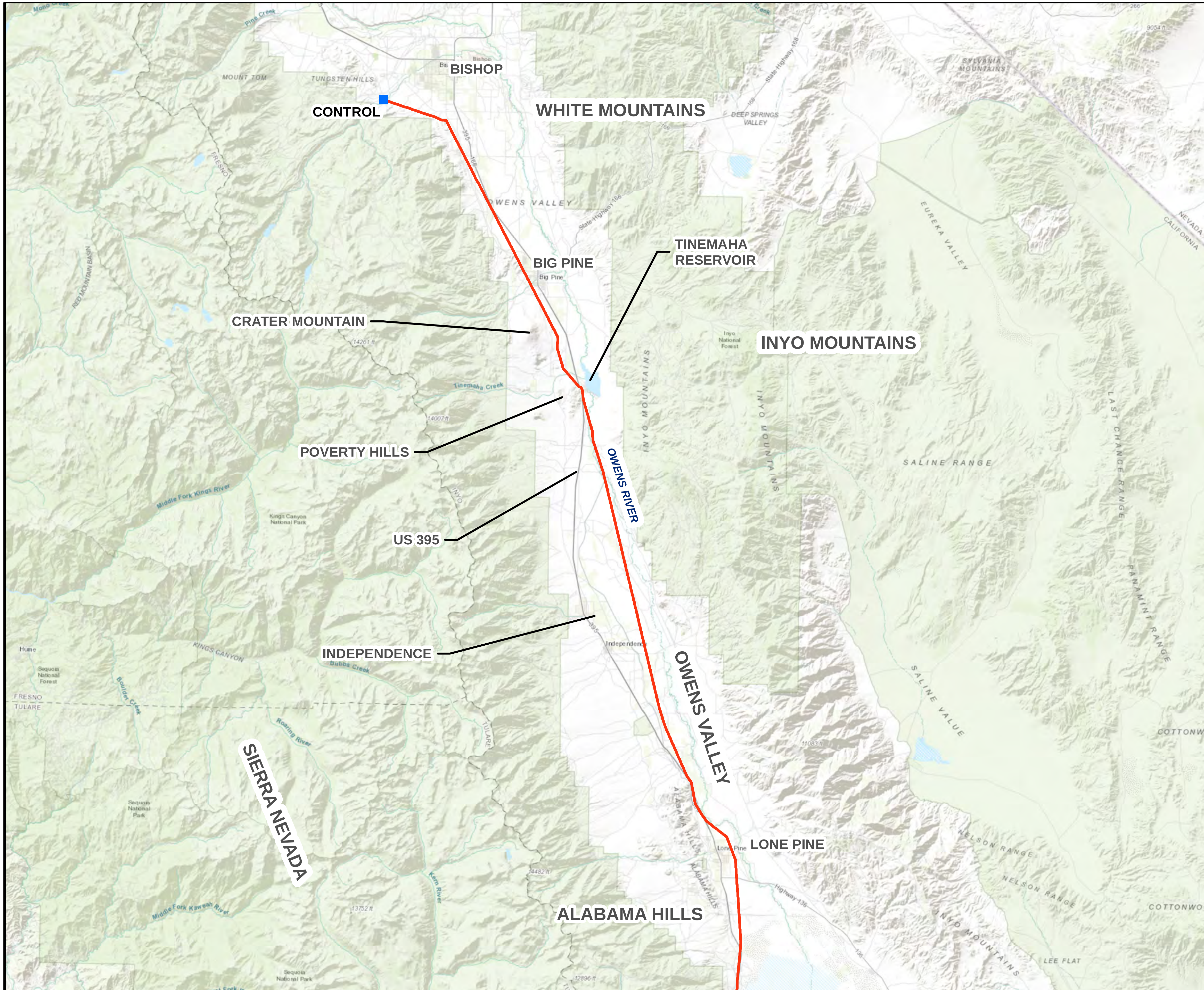

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IVANPAH-CONTROL PROJECT

SITE LOCATION MAP

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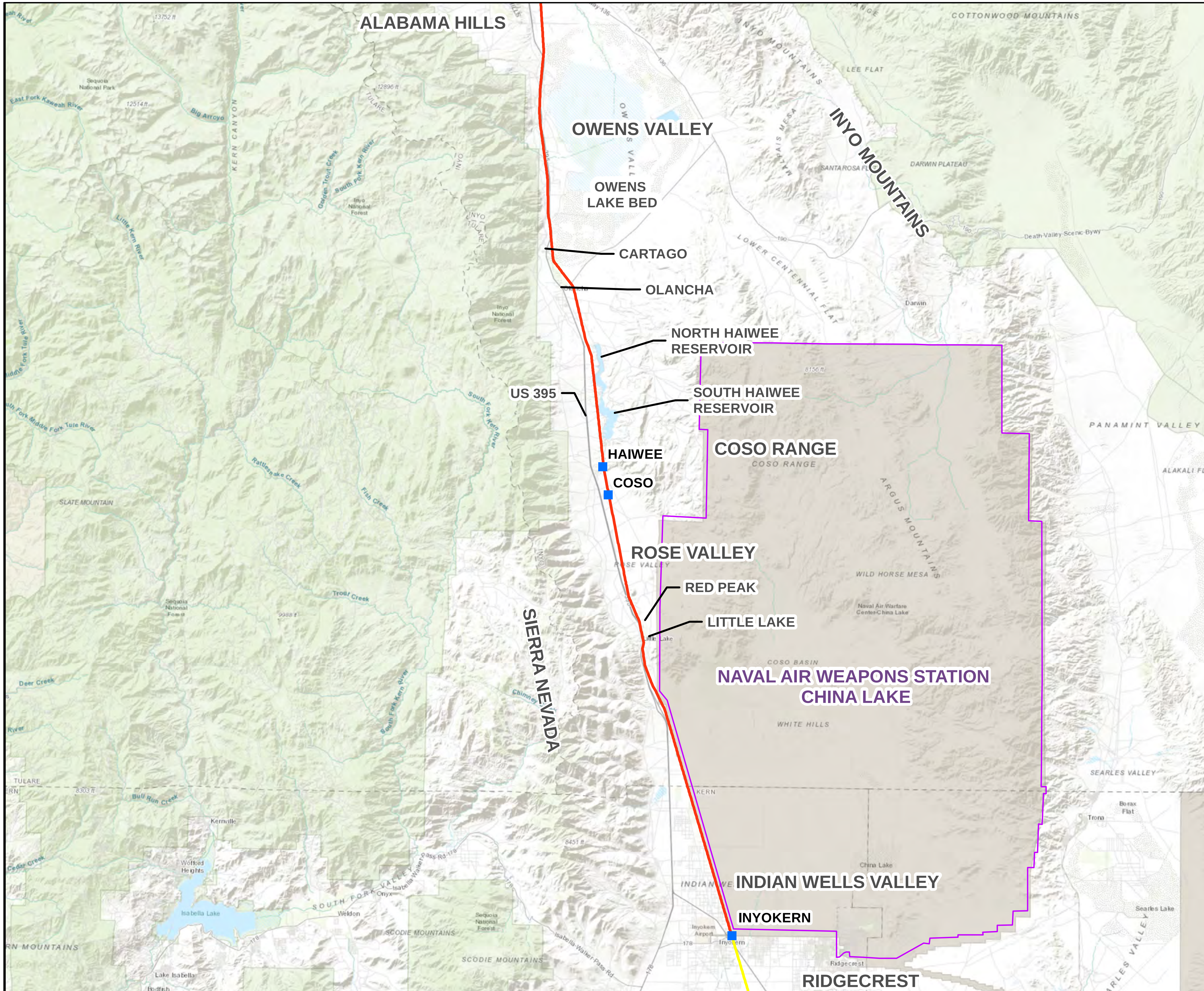

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IVANPAH-CONTROL PROJECT

SITE LOCATION MAP

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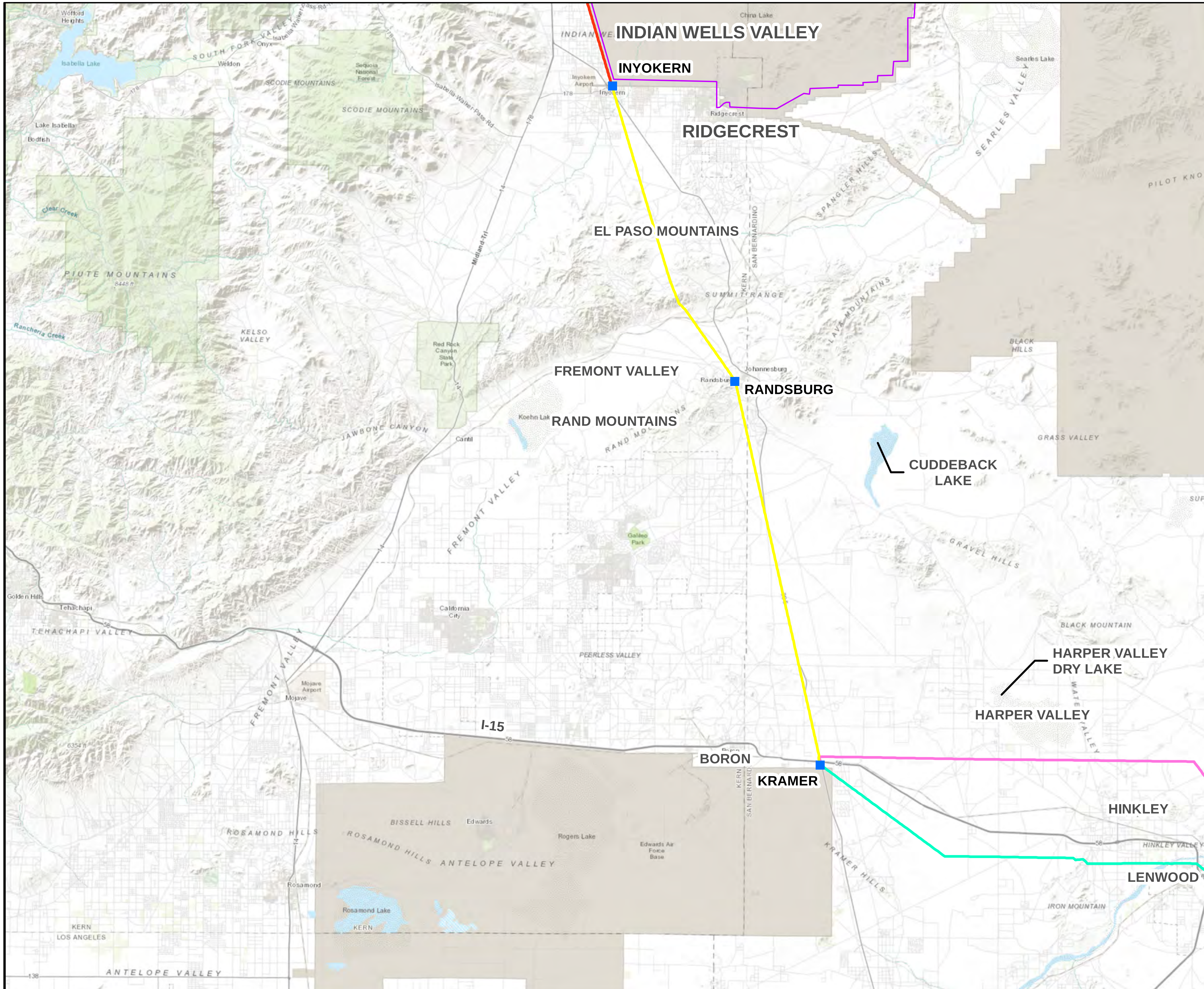

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SITE LOCATION MAP

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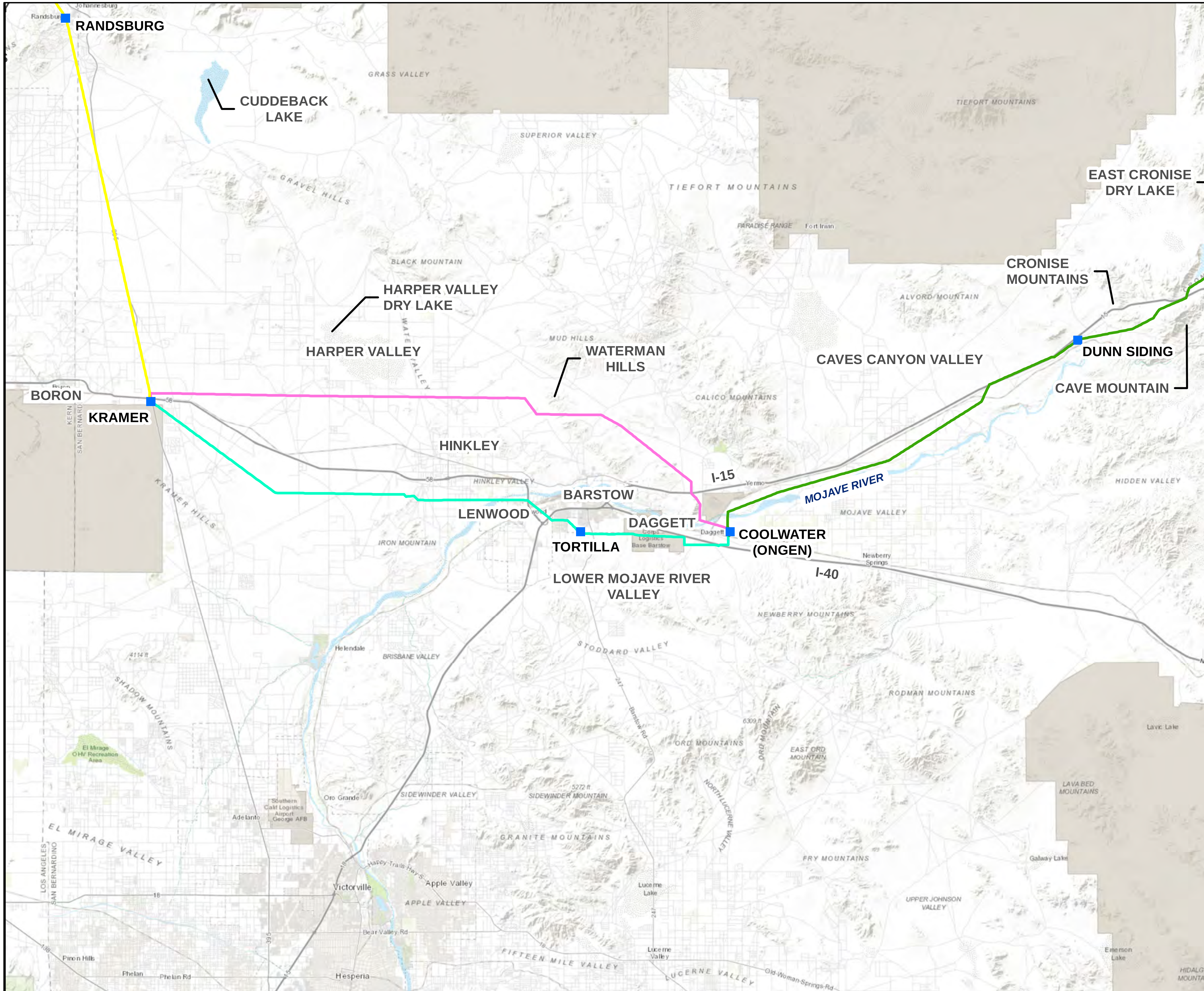

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SITE LOCATION MAP

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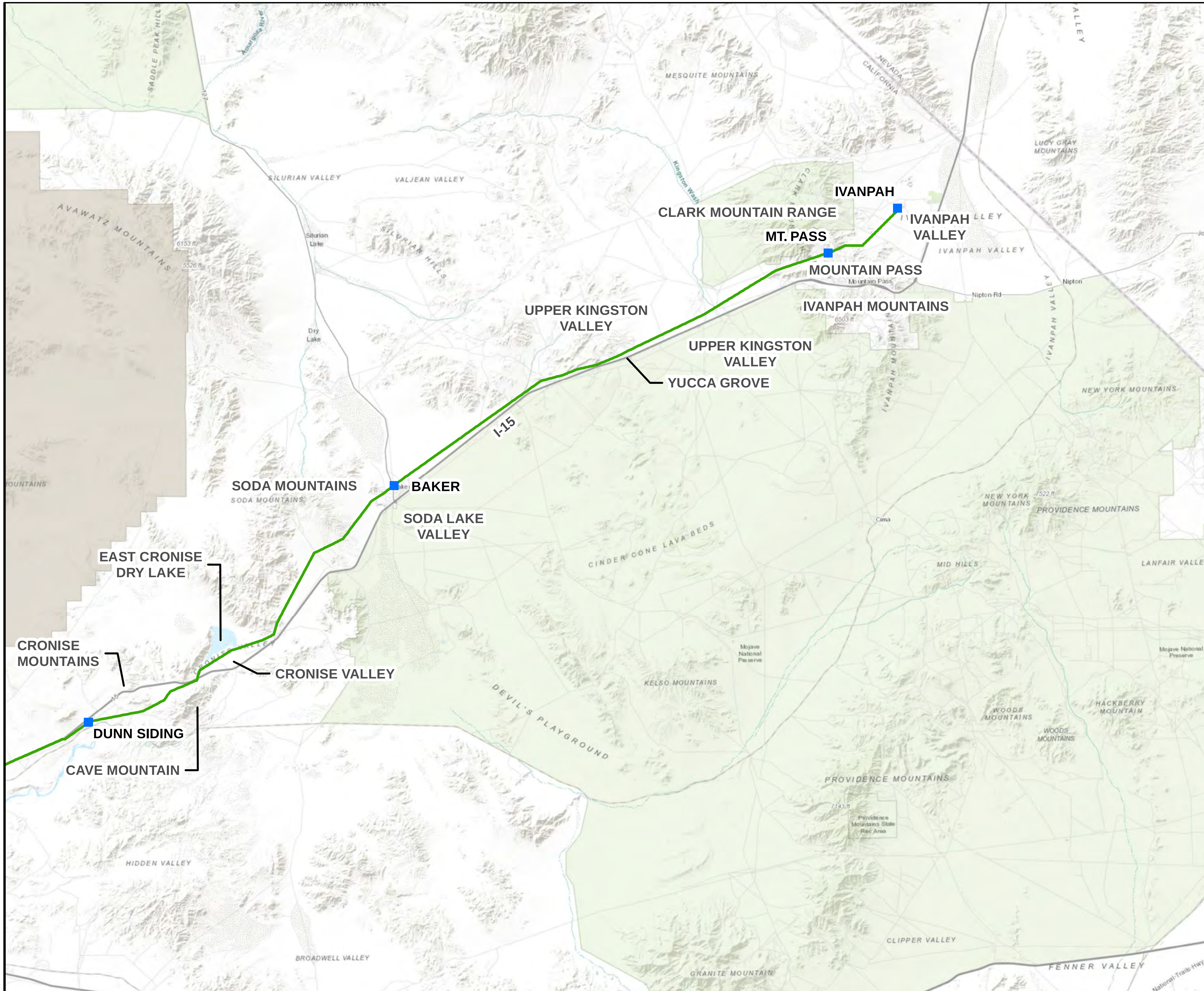

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SITE LOCATION MAP

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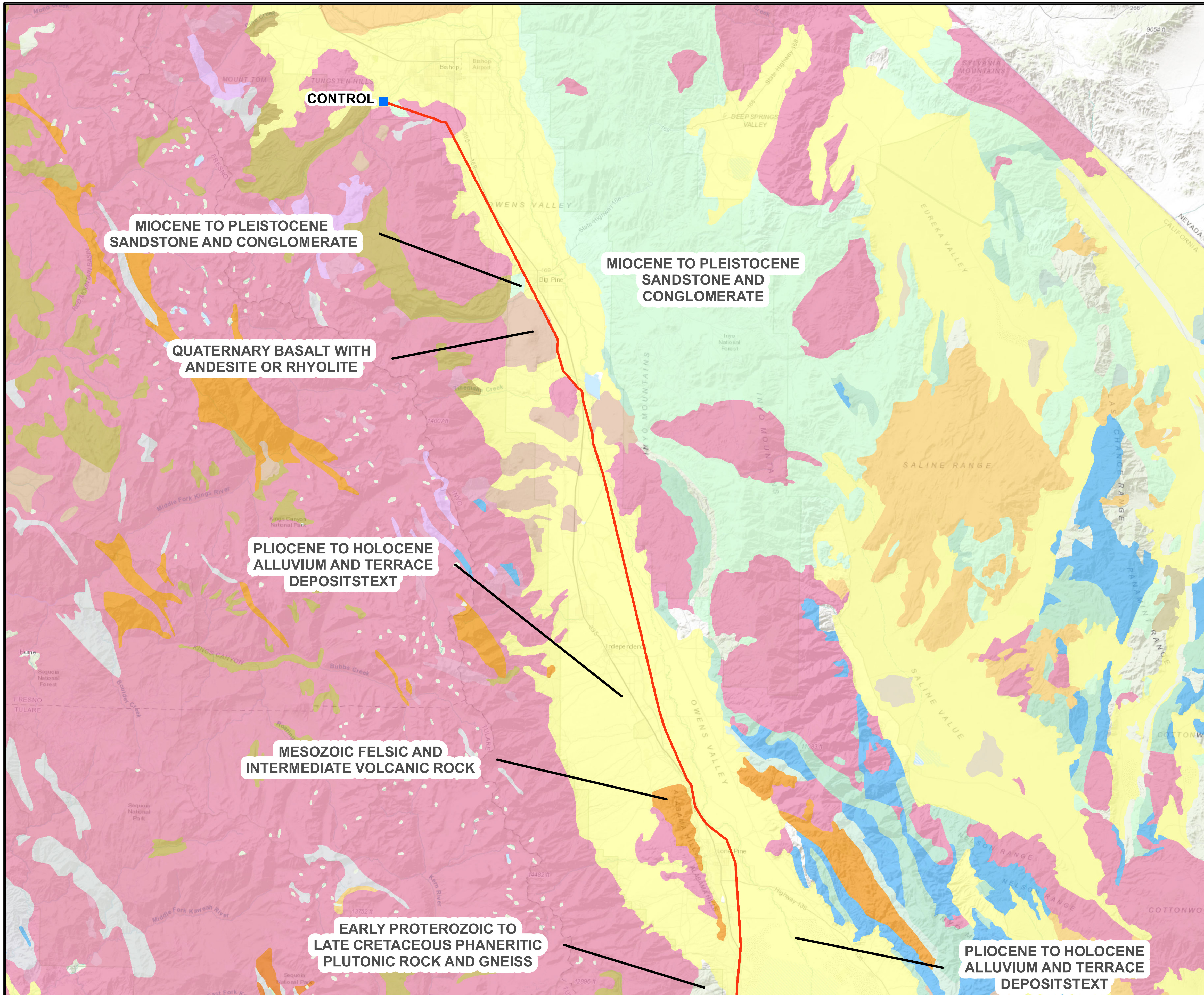

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- QUATERNARY BASALT WITH ANDESITE OR RHYOLITE
- TERTIARY RHYOLITE AND
- MESOZOIC FELSIC AND INTERMEDIATE VOLCANIC ROCK
- PRIMARILY MESOZOIC GRANODIORITE AND QUARTZ MONZONITE
- EARLY PROTEROZOIC TO LATE CRETACEOUS PHANERITIC PLUTONIC ROCK AND GNEISS

Source: USGS 2017a, 2017b

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IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

GENERALIZED GEOLOGIC MAP

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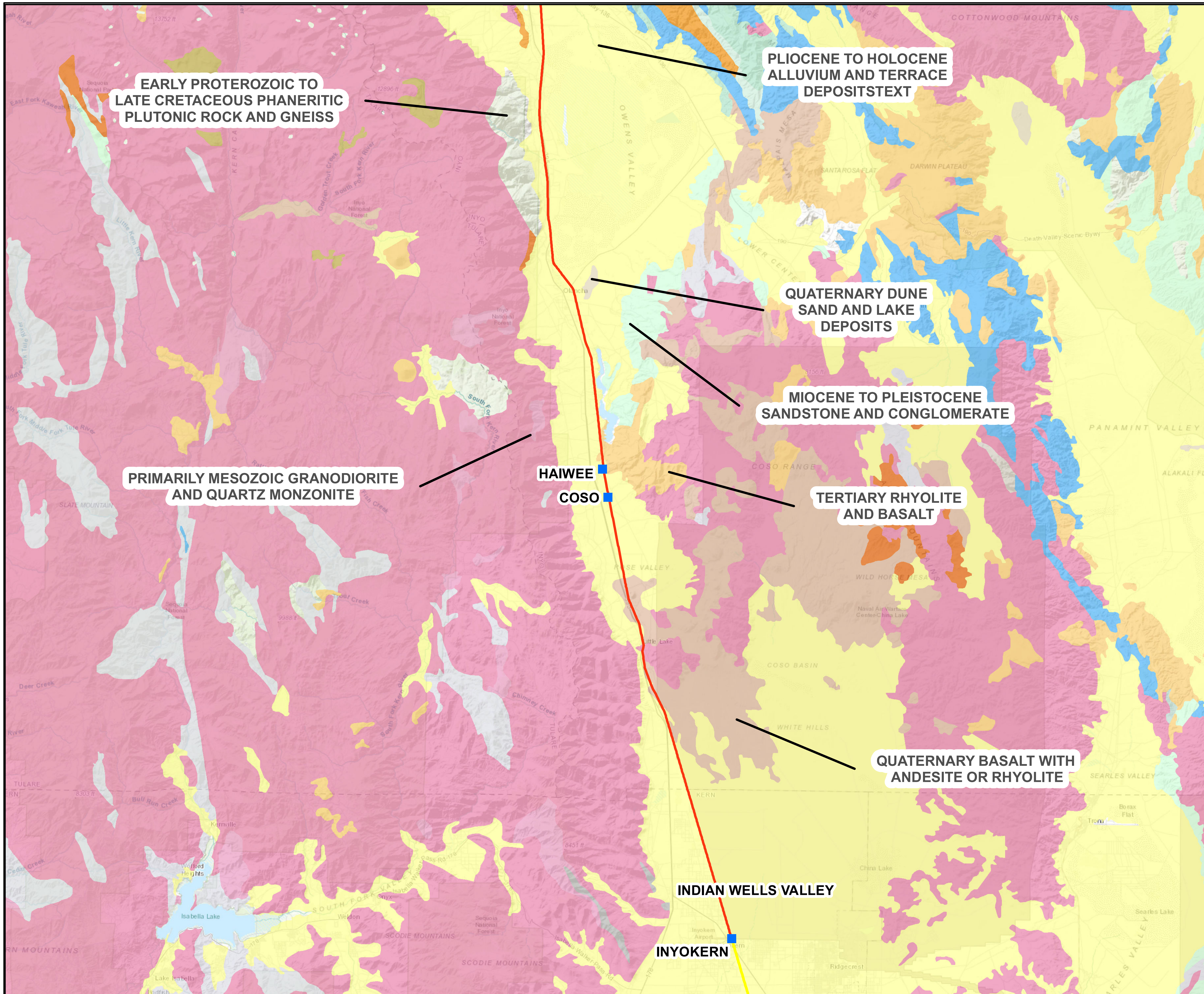

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- QUATERNARY BASALT WITH ANDESITE OR RHYOLITE
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Source: USGS 2017a, 2017b

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IVANPAH-CONTROL PROJECT

GENERALIZED GEOLOGIC MAP

ARCADIS Design & Consultancy for natural and built assets

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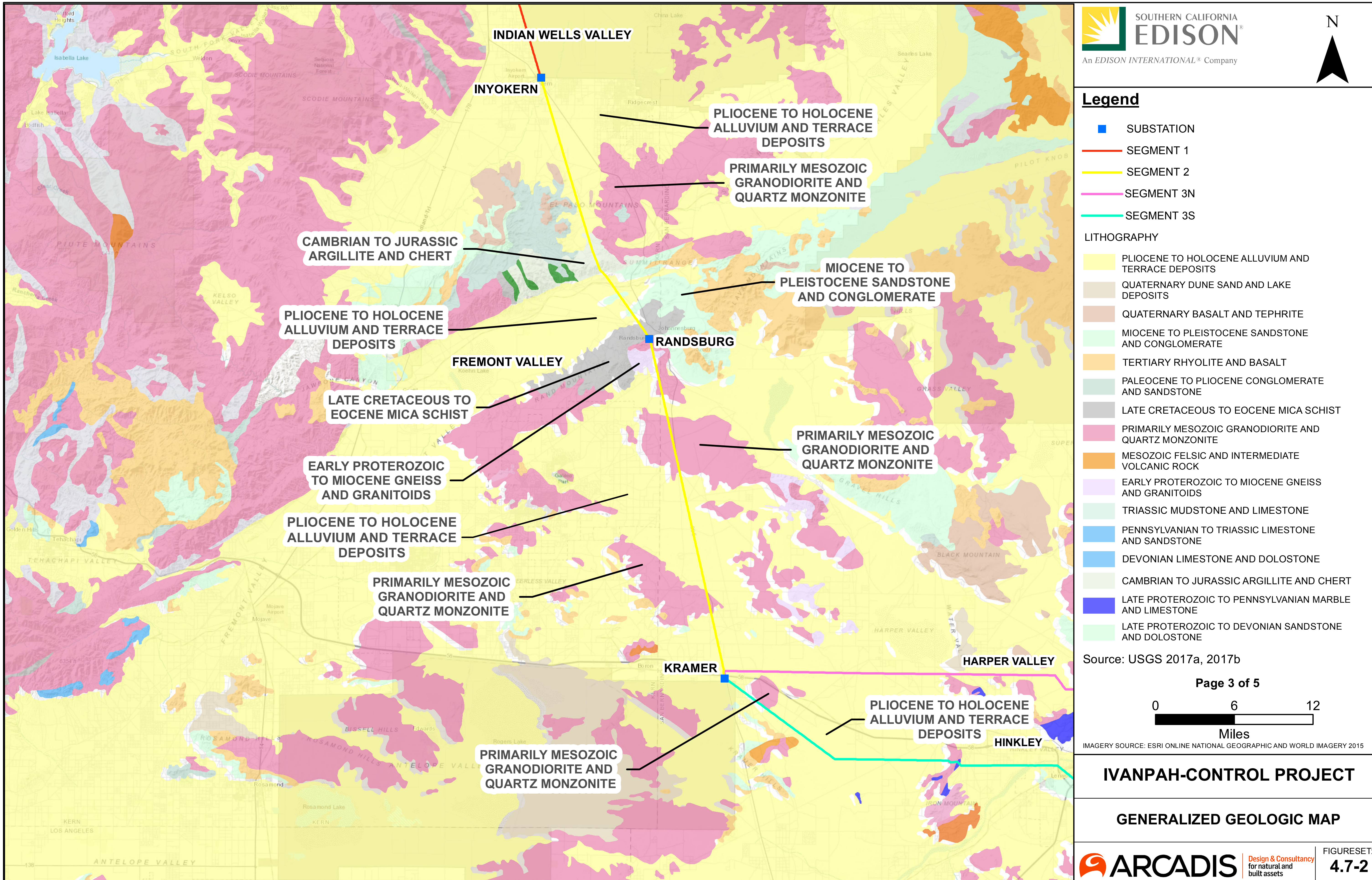

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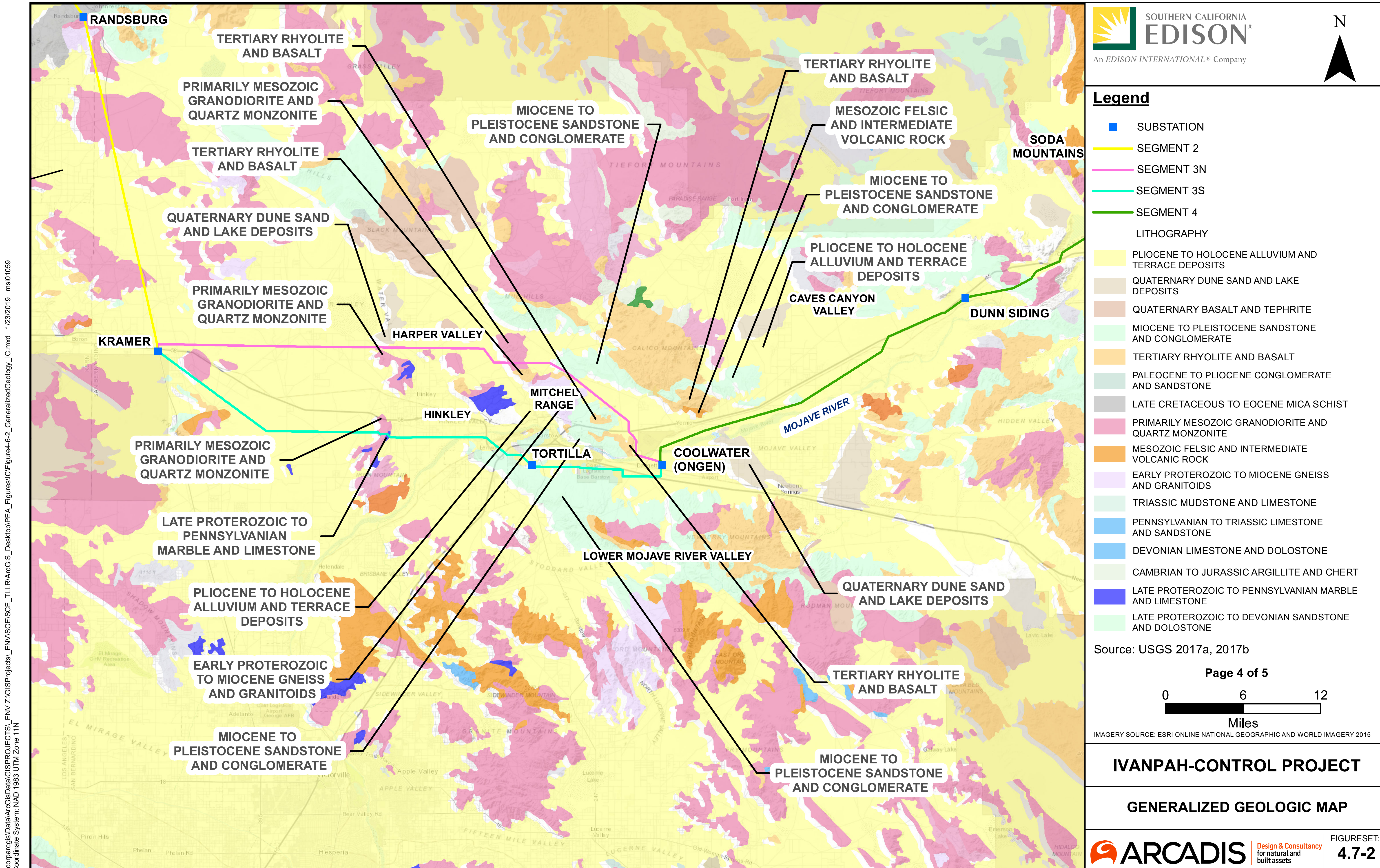
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PLIOCENE TO HOLOCENE ALLUVIUM AND TERRACE DEPOSITS
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SODA MOUNTAINS
DUNN SIDING
HARPER VALLEY
KRAMER
MITCHEL RANGE
HINKLEY
MOJAVE RIVER
PRIMARILY MESOZOIC GRANODIORITE AND QUARTZ MONZONITE
TORTILLA
COOLWATER (ONGEN)
LATE PROTEROZOIC TO PENNSYLVANIAN MARBLE AND LIMESTONE
LOWER MOJAVE RIVER VALLEY
PLIOCENE TO HOLOCENE ALLUVIUM AND TERRACE DEPOSITS
QUATERNARY DUNE SAND AND LAKE DEPOSITS
EARLY PROTEROZOIC TO MIOCENE GNEISS AND GRANITOIDS
TERTIARY RHYOLITE AND BASALT
MIOCENE TO PLEISTOCENE SANDSTONE AND CONGLOMERATE
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SUBSTATION
SEGMENT 2
SEGMENT 3N
SEGMENT 3S
SEGMENT 4
LITHOGRAPHY
PLIOCENE TO HOLOCENE ALLUVIUM AND TERRACE DEPOSITS
QUATERNARY DUNE SAND AND LAKE DEPOSITS
QUATERNARY BASALT AND TEPHRITE
MIOCENE TO PLEISTOCENE SANDSTONE AND CONGLOMERATE
TERTIARY RHYOLITE AND BASALT
PALEOCENE TO PLIOCENE CONGLOMERATE AND SANDSTONE
LATE CRETACEOUS TO EOCENE MICA SCHIST
PRIMARILY MESOZOIC GRANODIORITE AND QUARTZ MONZONITE
MESOZOIC FELSIC AND INTERMEDIATE VOLCANIC ROCK
EARLY PROTEROZOIC TO MIOCENE GNEISS AND GRANITOIDS
TRIASSIC MUDSTONE AND LIMESTONE
PENNSYLVANIAN TO TRIASSIC LIMESTONE AND SANDSTONE
DEVONIAN LIMESTONE AND DOLOSTONE
CAMBRIAN TO JURASSIC ARGILLITE AND CHERT
LATE PROTEROZOIC TO PENNSYLVANIAN MARBLE AND LIMESTONE
LATE PROTEROZOIC TO DEVONIAN SANDSTONE AND DOLOSTONE
Source: USGS 2017a, 2017b
Page 4 of 5
0 6 12
Miles
IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015
IVANPAH-CONTROL PROJECT
GENERALIZED GEOLOGIC MAP
ARCADIS Design & Consultancy for natural and built assets
FIGURESET: 4.7-2
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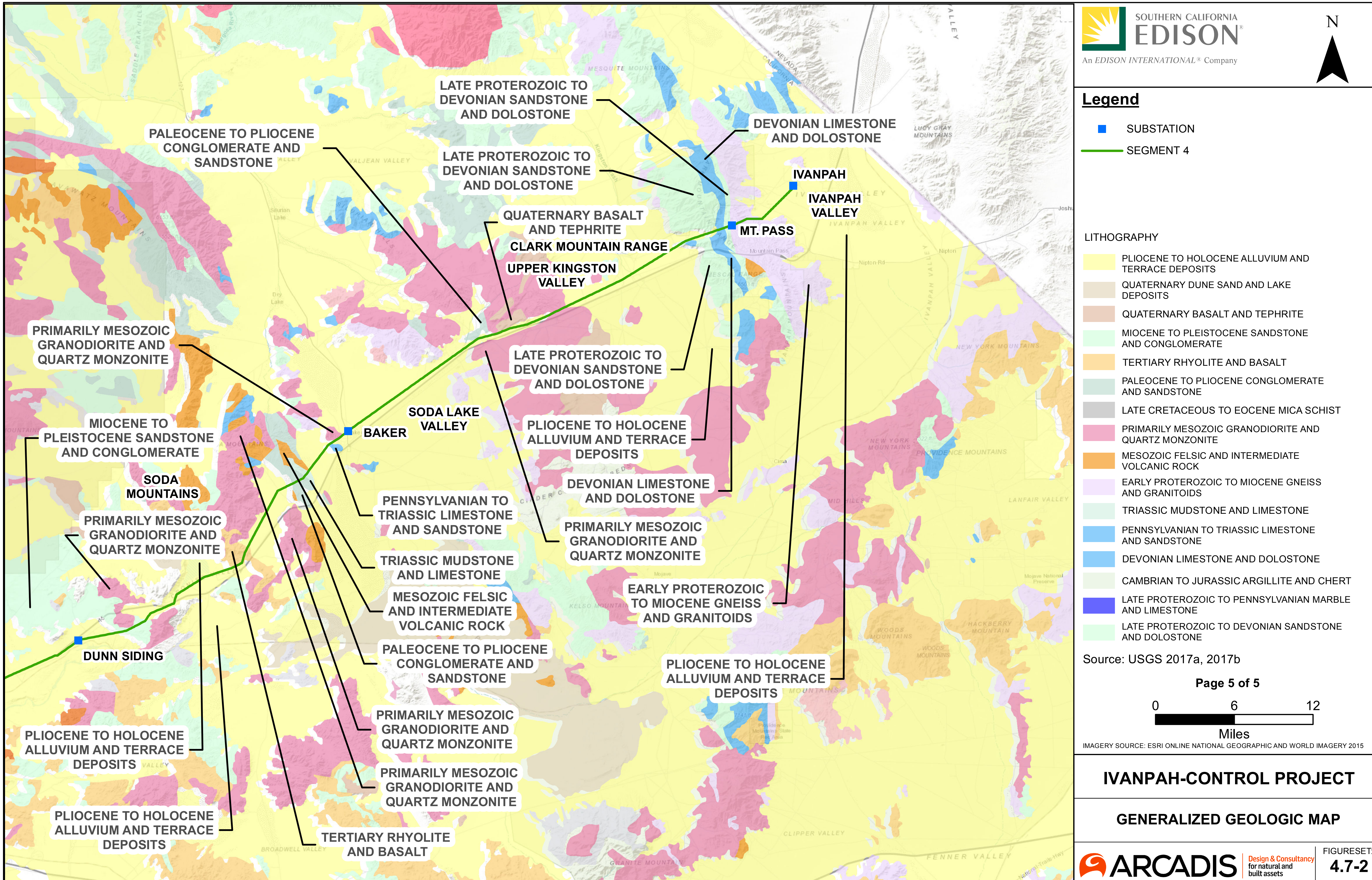

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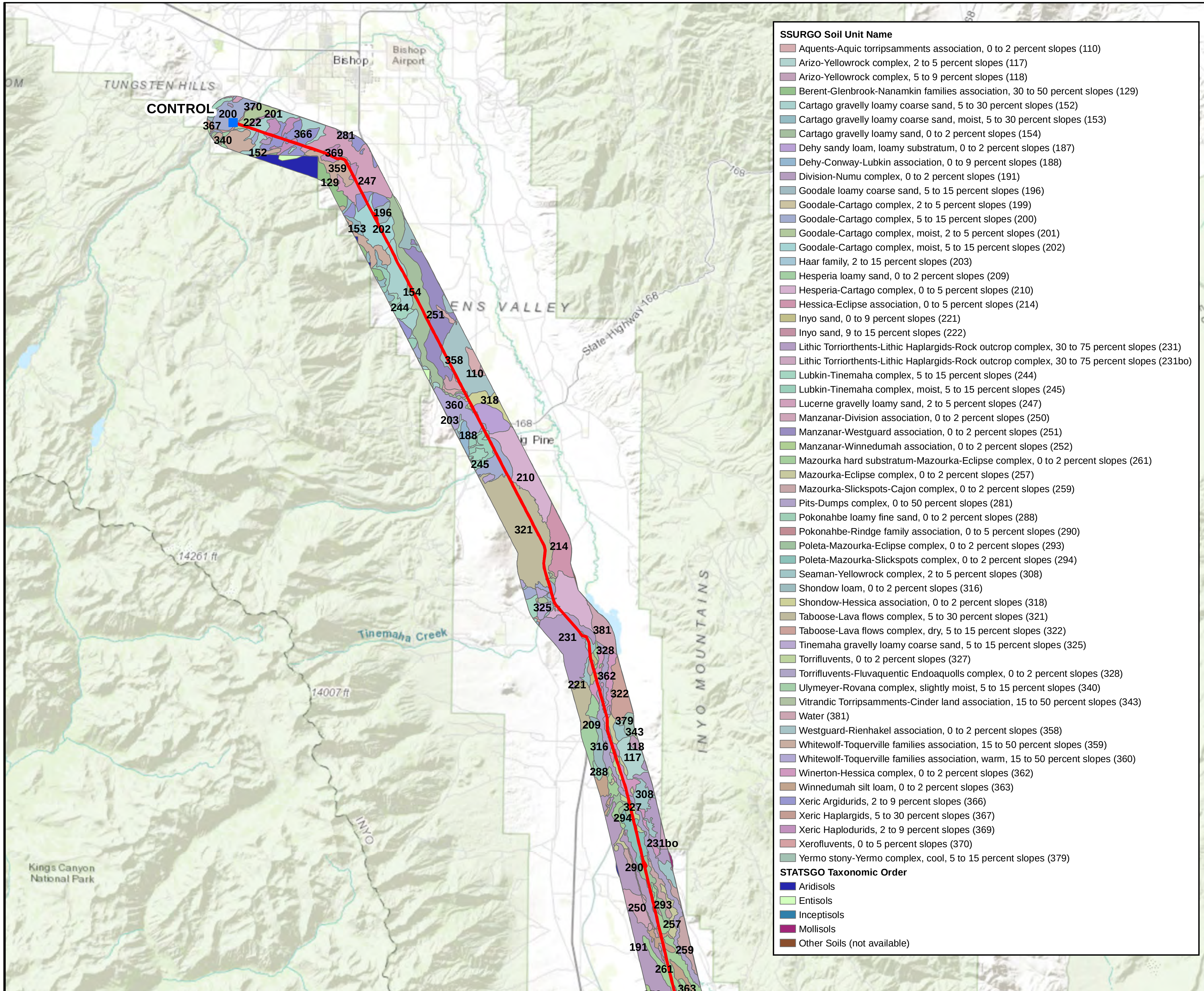

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N

Legend

- SUBSTATION
- SEGMENT 1

SOURCE:
SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL SURVEY GEOGRAPHIC (SSURGO) DATABASE. AVAILABLE ONLINE AT HTTPS://SDMDATAACCESS.SC.EGOV.USDA.GOV. ACCESSED 10/27/2017.
SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. U.S. GENERAL SOIL MAP (STATSGO2). AVAILABLE ONLINE AT HTTPS://SDMDATAACCESS.SC.EGOV.USDA.GOV. ACCESSED 10/27/2017.

Page 1 of 7

0 4 8
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-3

\\corparcgis\Data\ArcGis\Data\GIS\PROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-3_SoilUnits_IC.mxd 1/23/2019 adavis
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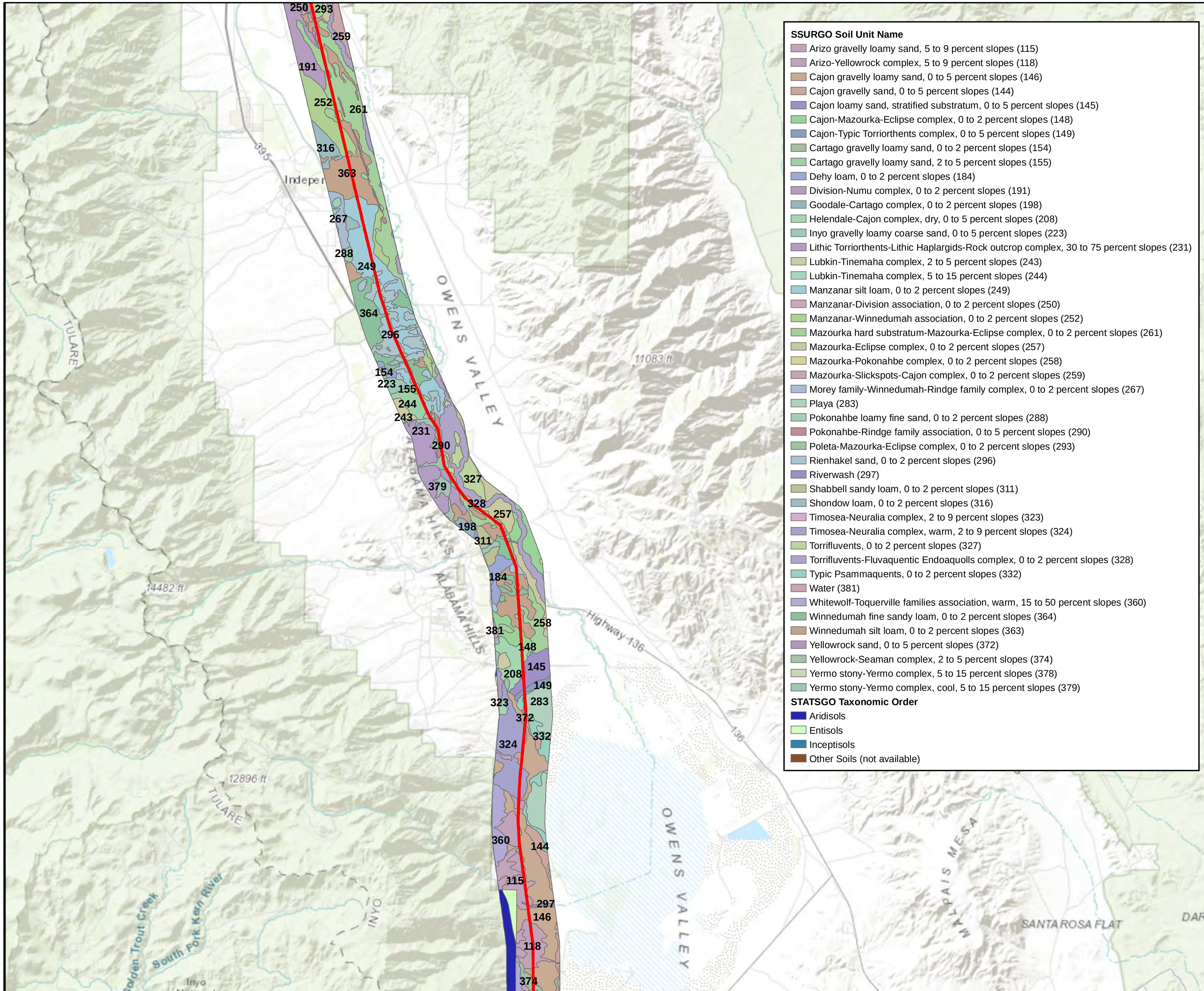

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Legend

SEGMENT 1

SOURCE:
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Page 2 of 7

0 4 8
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-3

\\corpargis\Data\ArcGis\Data\GIS\PROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-3_SoilUnits_IC.mxd 1/23/2019 adavis
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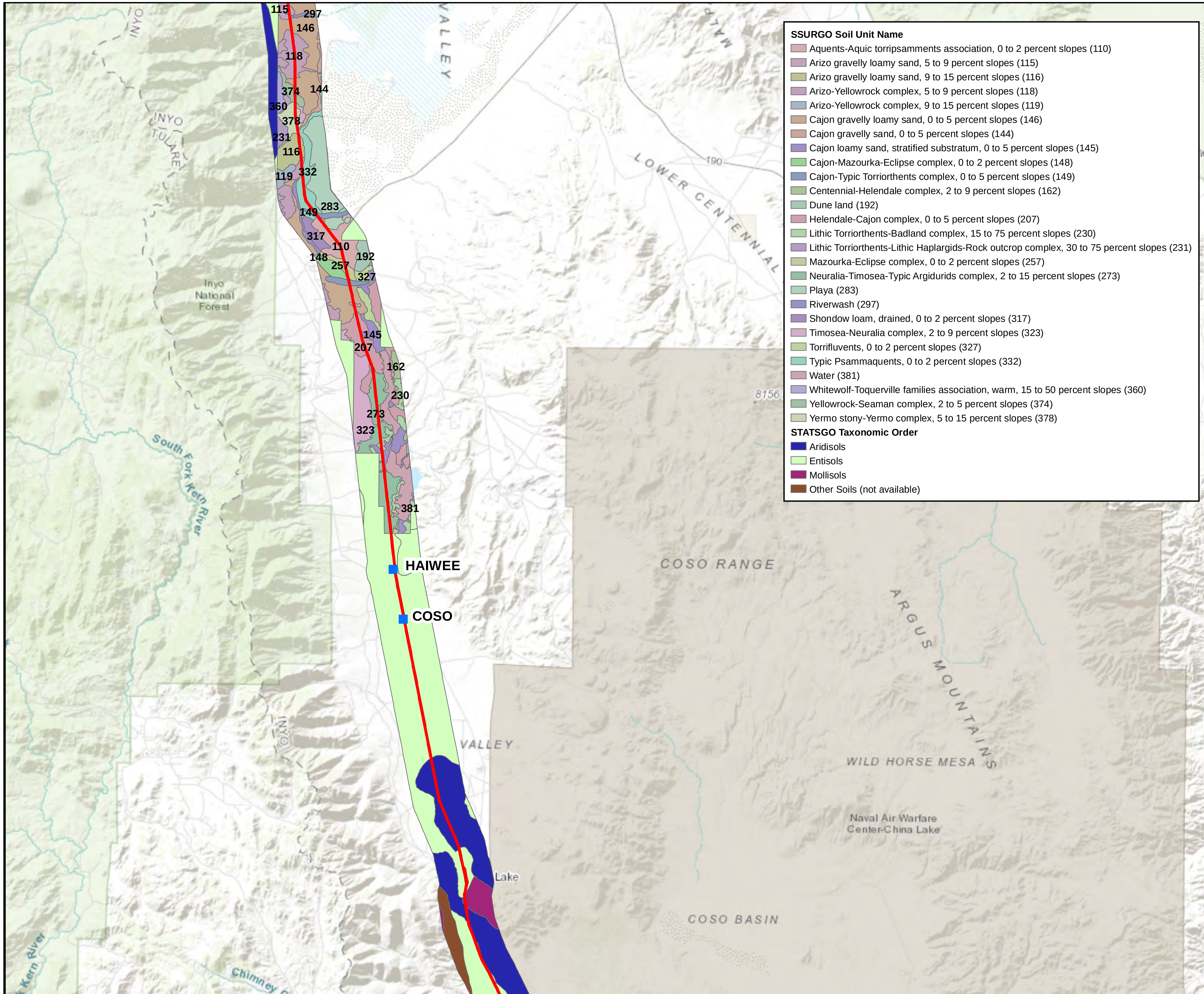

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Legend

- SUBSTATION
- SEGMENT 1

SOURCE:
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SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. U.S. GENERAL SOIL MAP (STATSGO2). AVAILABLE ONLINE AT HTTPS://SDMDATAACCESS.SC.EGOV.USDA.GOV. ACCESSED 10/27/2017.

0 4 8
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-3

\\corparcgis\Data\ArcGis\Data\GIS\PROJECTS_ENV Z:\GISProjects_ENV\SCE\SCE_TLLR\ArcGIS_Desktop\PEA_Figures\IC\Figure4-6-3_SoilUnits_IC.mxd 1/23/2019 adavis
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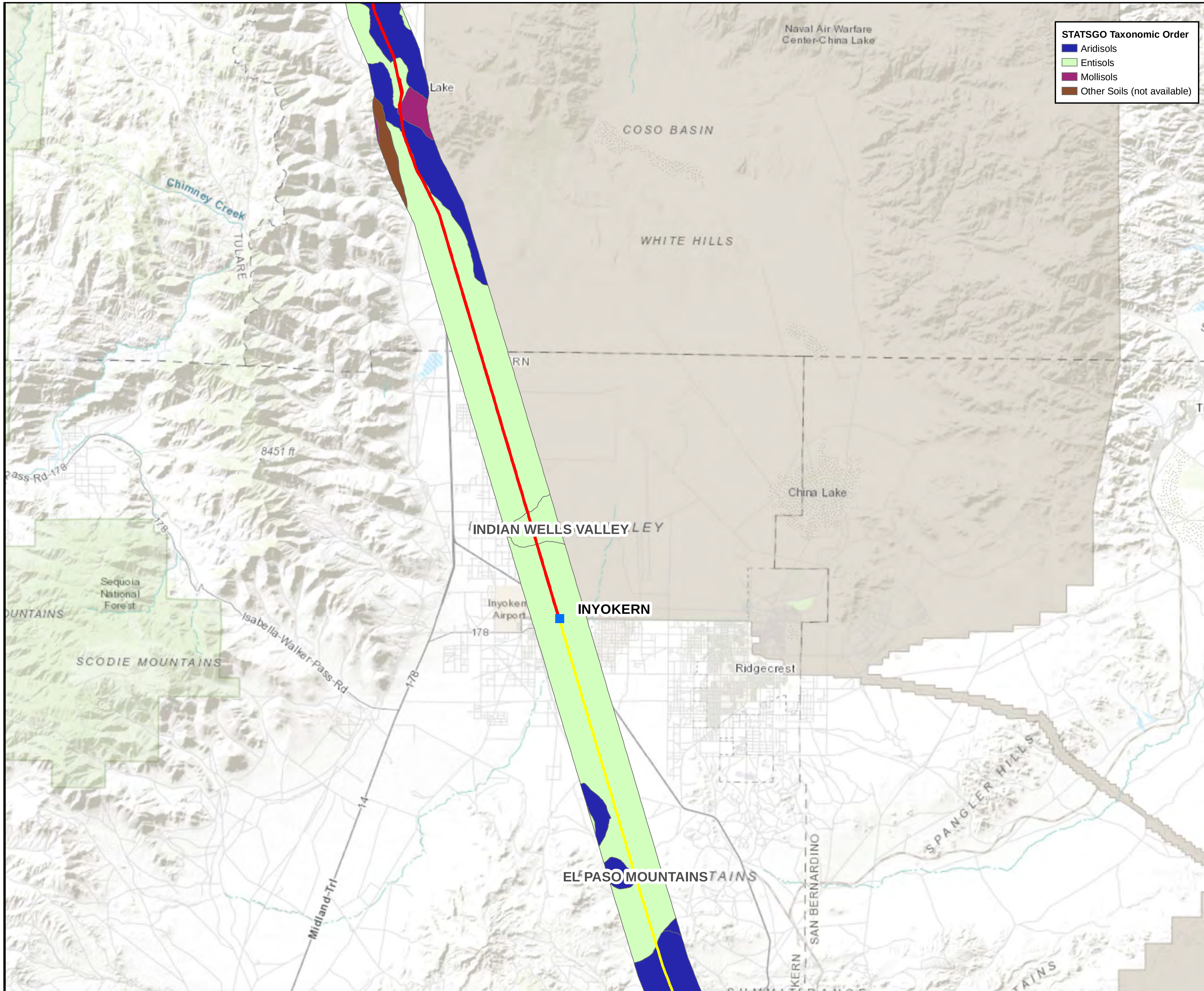

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Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2

SOURCE:
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SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. U.S. GENERAL SOIL MAP (STATSGO2). AVAILABLE ONLINE AT HTTPS://SDMDATAACCESS.SC.EGOV.USDA.GOV. ACCESSED 10/27/2017.

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0 4 8
Miles

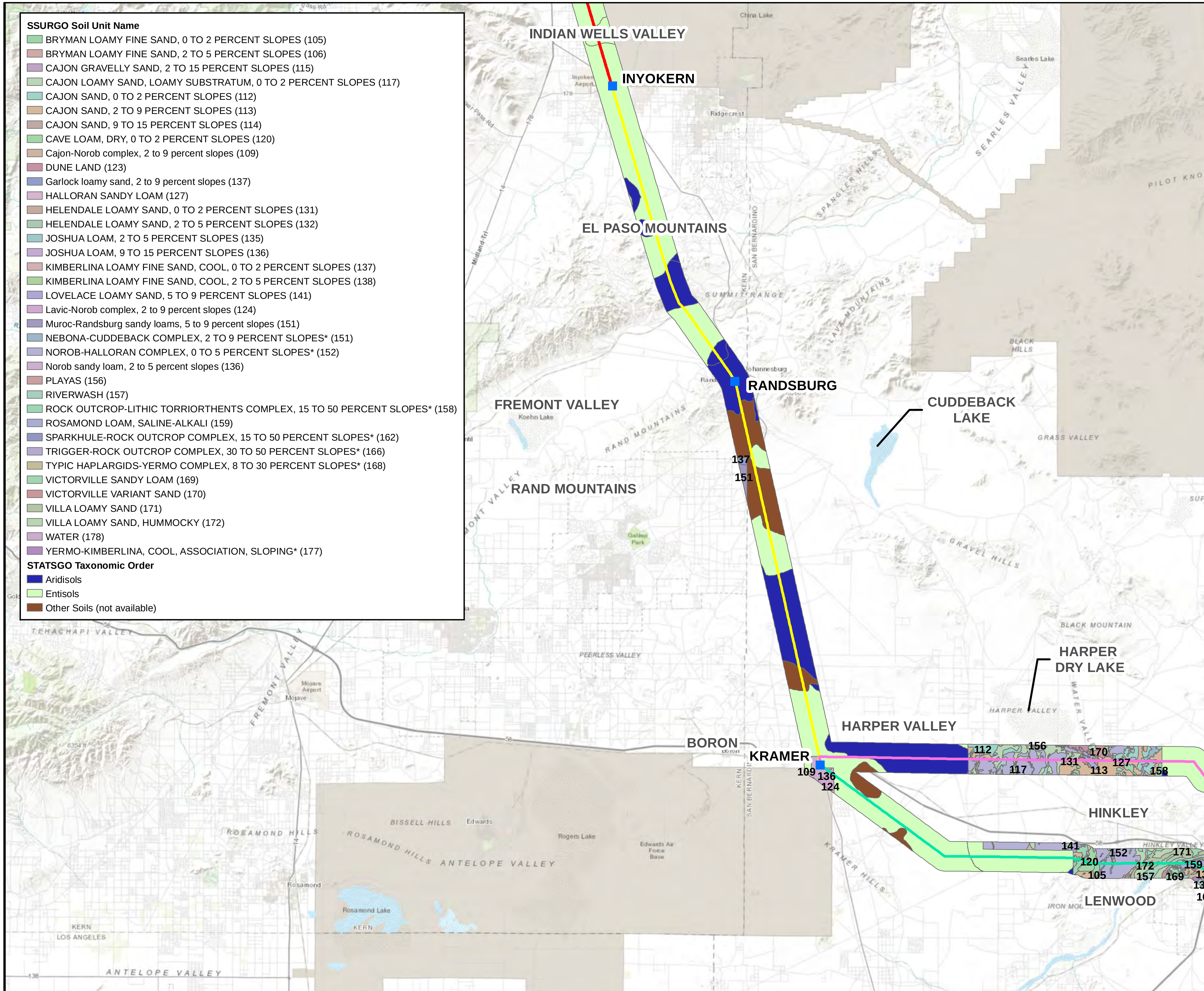
IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-3



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Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S

SOURCE:
SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL SURVEY GEOGRAPHIC (SSURGO) DATABASE. AVAILABLE ONLINE AT HTTPS://SDMDATAACCESS.SC.EGOV.USDA.GOV. ACCESSED 10/27/2017.
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0 7.5 15
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-3

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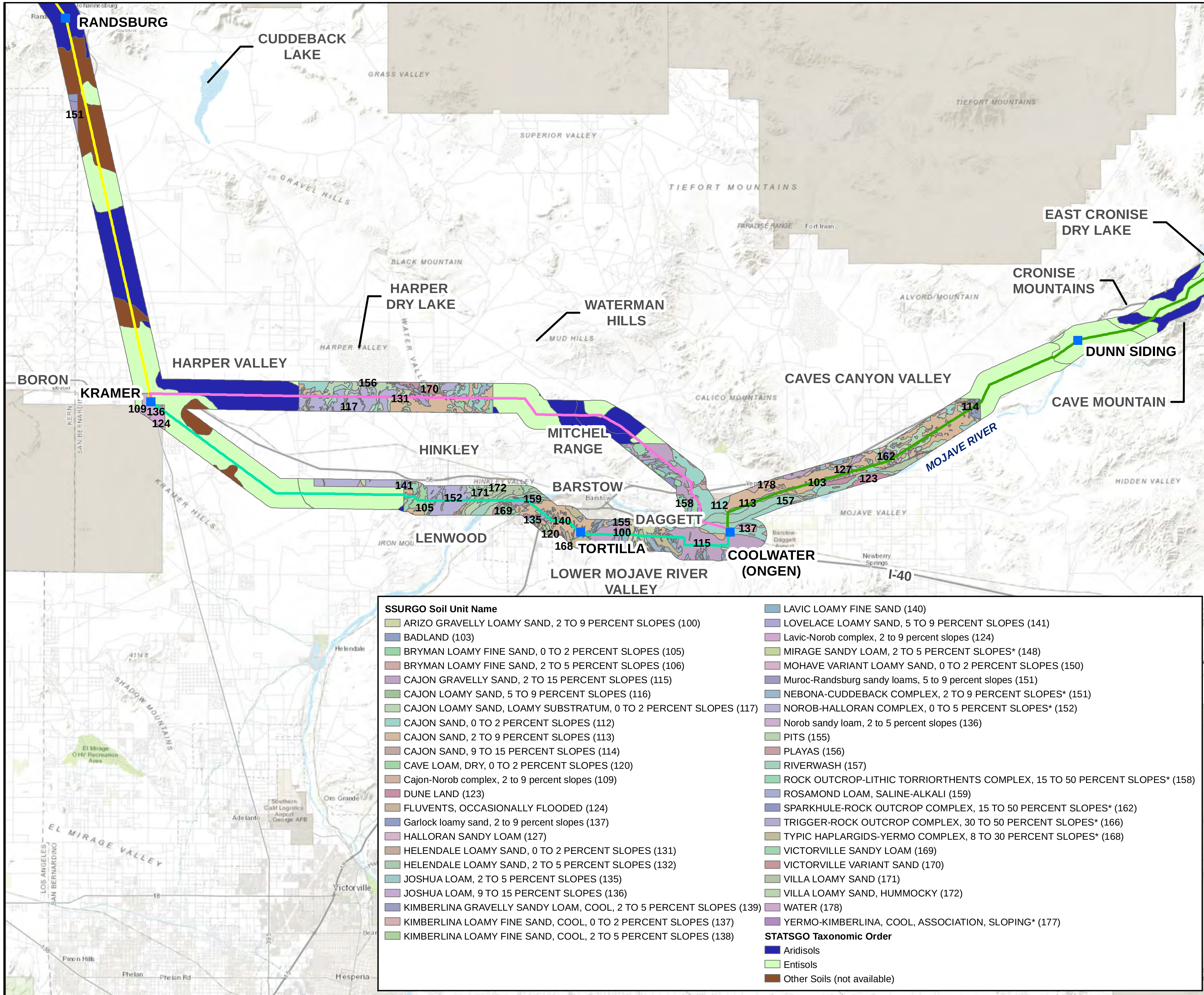

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N

Legend

- SUBSTATION
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- SEGMENT 4

SOURCE:
SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL SURVEY GEOGRAPHIC (SSURGO) DATABASE. AVAILABLE ONLINE AT HTTPS://SDMDATAACCESS.SC.EGOV.USDA.GOV. ACCESSED 10/27/2017.
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0 7.5 15
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-3

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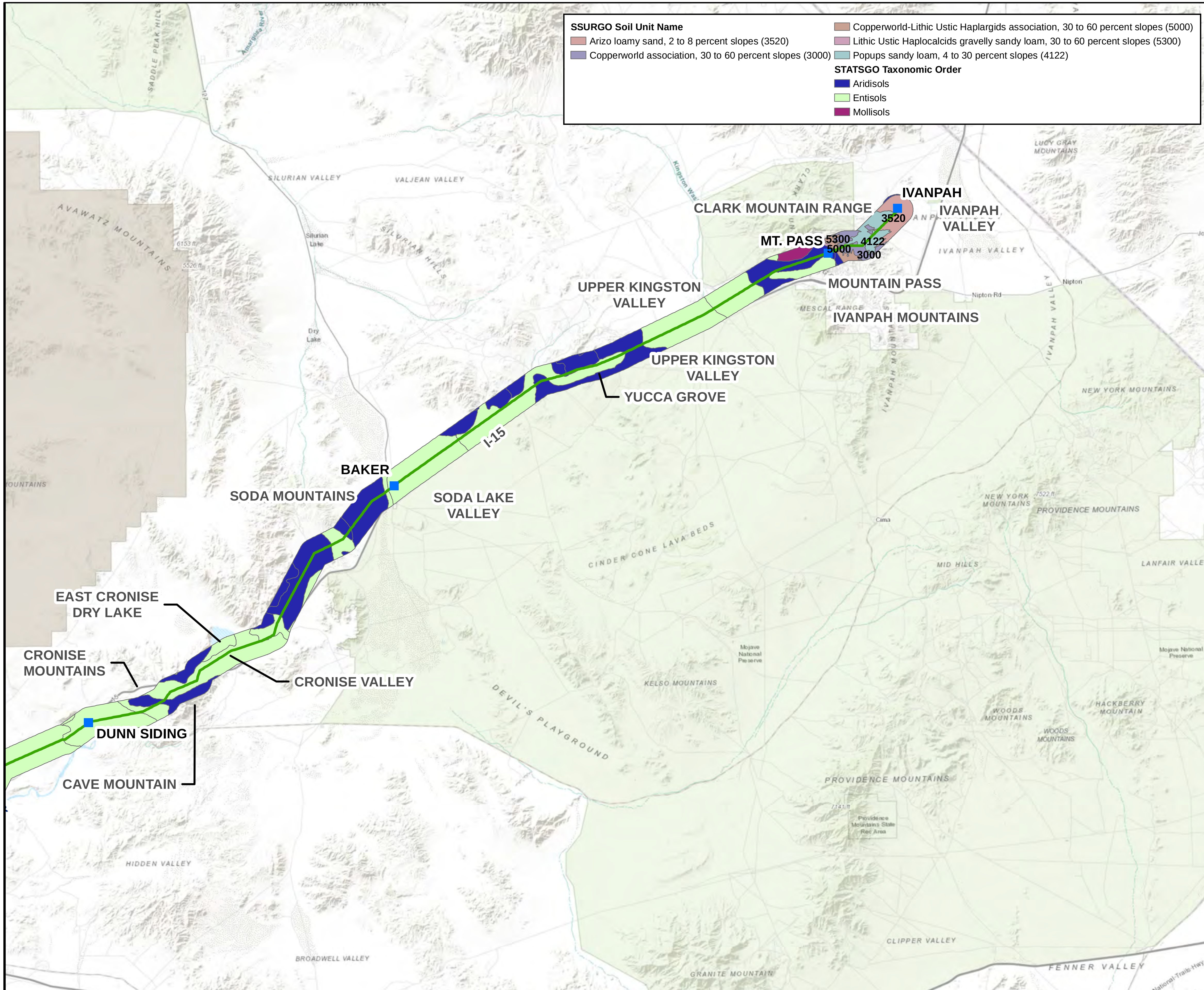

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Legend

SUBSTATION

SEGMENT 4

SOURCE:
SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL SURVEY GEOGRAPHIC (SSURGO) DATABASE. AVAILABLE ONLINE AT HTTPS://SDMDATAACCESS.SC.EGOV.USDA.GOV. ACCESSED 10/27/2017.
SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. U.S. GENERAL SOIL MAP (STATSGO2). AVAILABLE ONLINE AT HTTPS://SDMDATAACCESS.SC.EGOV.USDA.GOV. ACCESSED 10/27/2017.

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0 7.5 15
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

SOIL UNITS MAP

FIGURESET:
4.7-3

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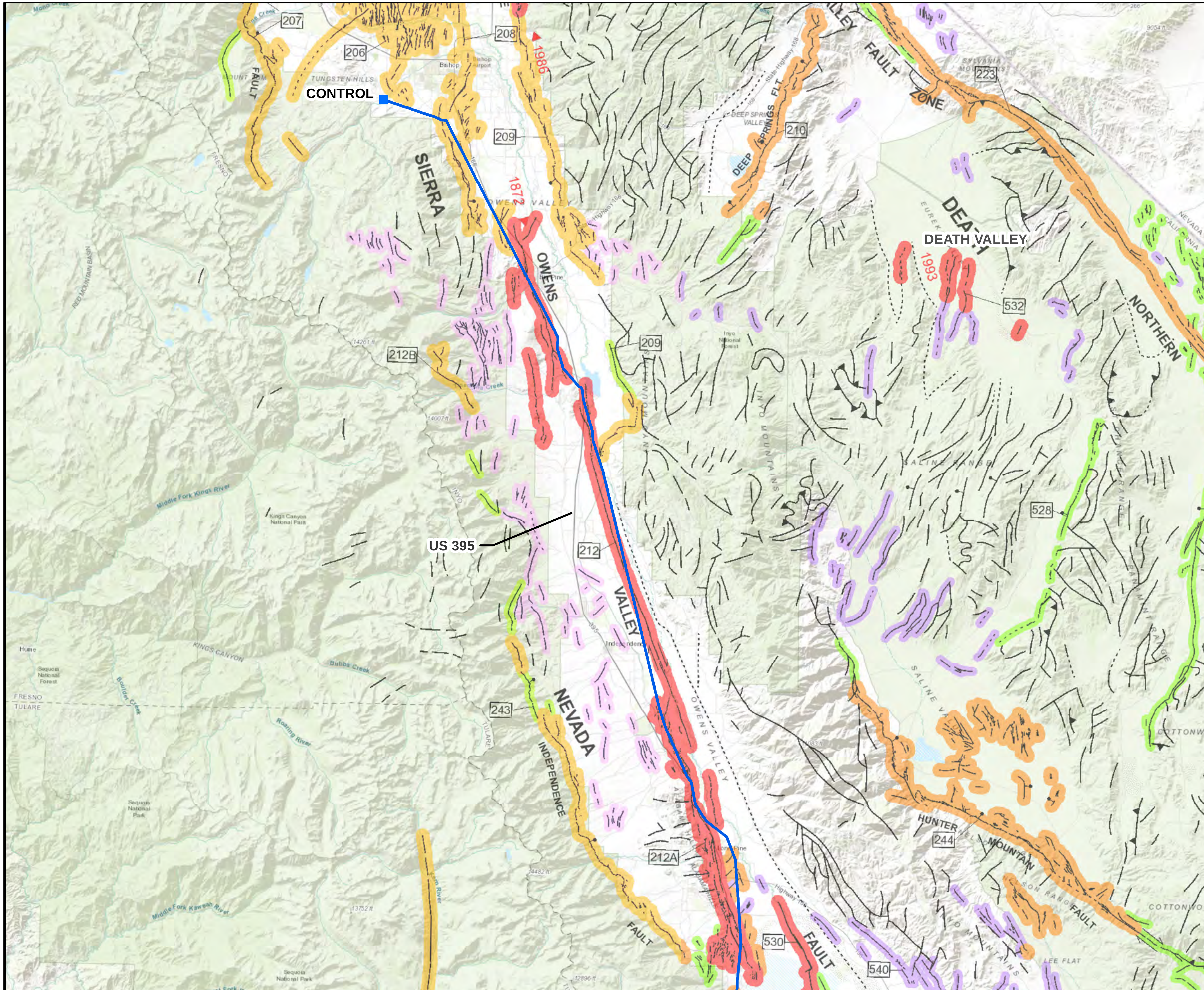

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Legend

- SUBSTATION
- SEGMENT 1

FAULT

- HISTORICAL FAULT
- HOLOCENE FAULT
- LATE QUATERNARY FAULT
- QUATERNARY FAULT
- PRE-QUATERNARY FAULT

Source: CGS 2017b

Note: Boxed numbers indicate references in CGS (2010).

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0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

FAULT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-4

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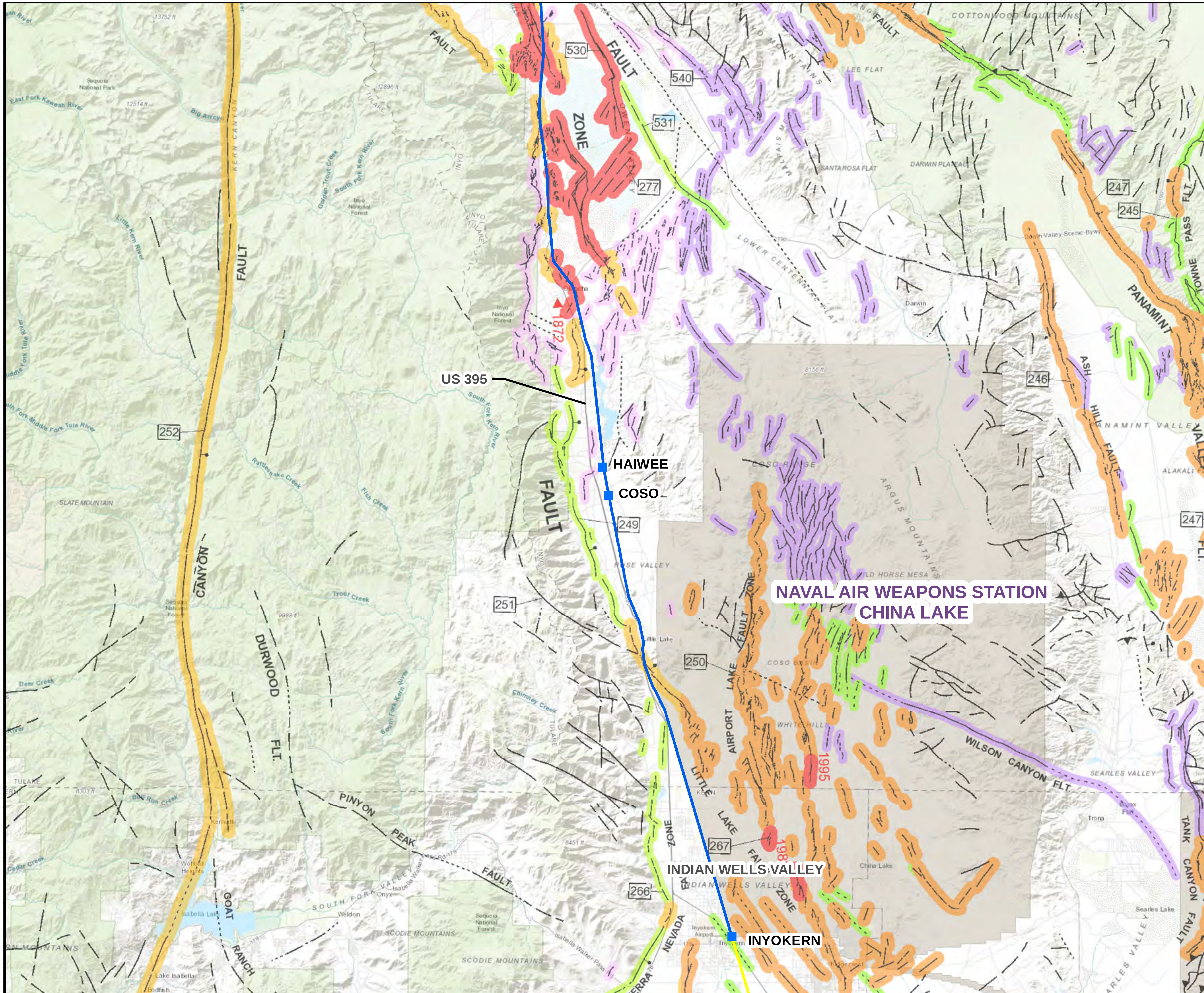

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N

Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2

FAULT

- HISTORICAL FAULT
- HOLOCENE FAULT
- LATE QUATERNARY FAULT
- QUATERNARY FAULT
- PRE-QUATERNARY FAULT

Source: CGS 2017b

Note: Boxed numbers indicate references in CGS (2010).

0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

FAULT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-4

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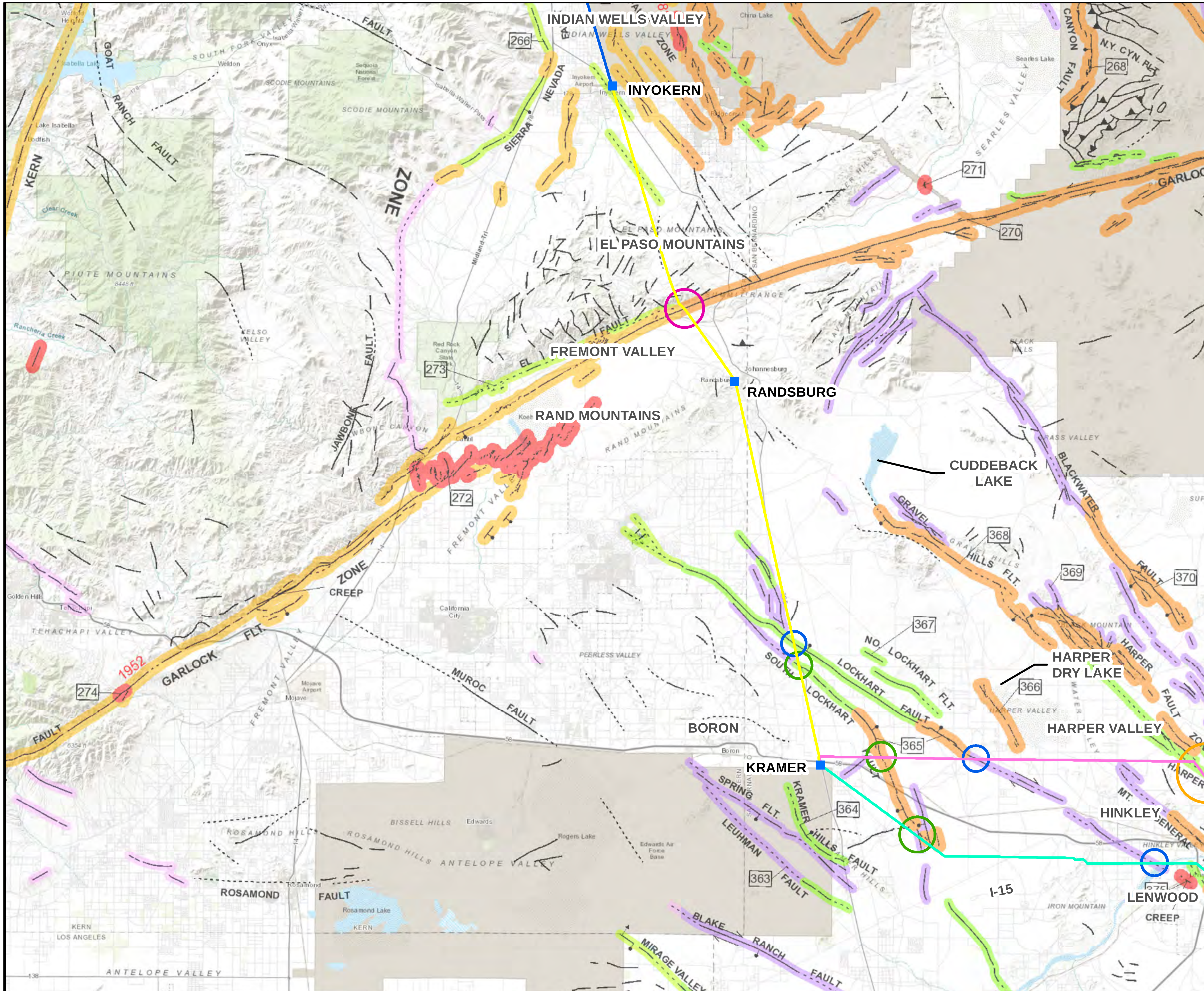

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N

Legend

SUBSTATION
SEGMENT 1
SEGMENT 2
SEGMENT 3N
SEGMENT 3S

FAULT
HISTORICAL FAULT
HOLOCENE FAULT
LATE QUATERNARY FAULT
QUATERNARY FAULT
PRE-QUATERNARY FAULT

HOLOCENE FAULT ZONES
HARPER LAKE FAULT
SOUTH LOCKHART FAULT
LOCKHART FAULT
CARLOCK FAULT

Source: CGS 2017b

Note: Boxed numbers indicate references in CGS (2010).

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0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

FAULT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-4

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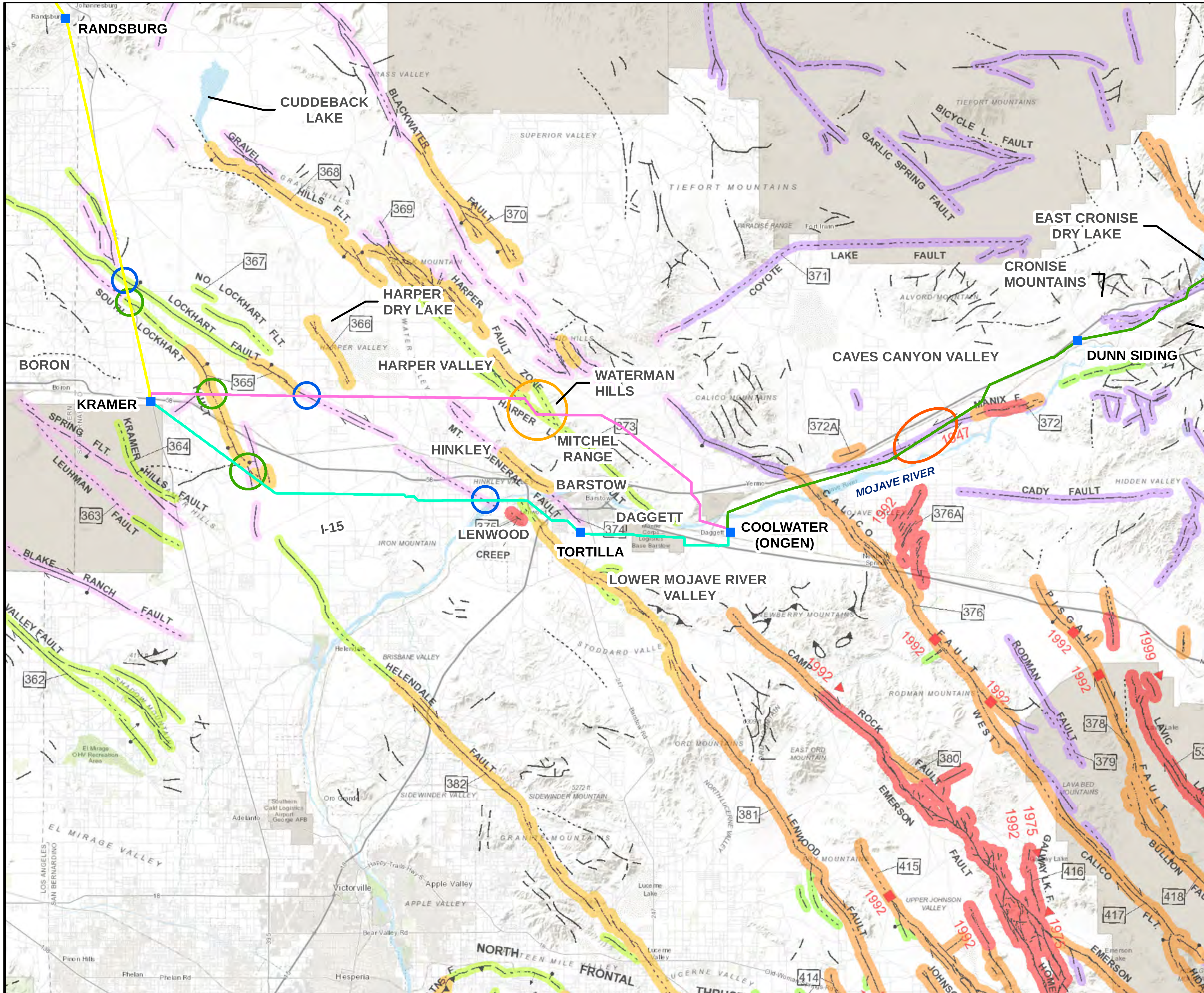

Legend

- SUBSTATION
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- SEGMENT 4

FAULT

- HISTORICAL FAULT
- HOLOCENE FAULT
- LATE QUATERNARY FAULT
- QUATERNARY FAULT
- PRE-QUATERNARY FAULT

HOLOCENE FAULT ZONES

- HARPER LAKE FAULT
- MANIX FAULT
- SOUTH LOCKHART FAULT
- LOCKHART FAULT

Source: CGS 2017b

Note: Boxed numbers indicate references in CGS (2010).

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0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

SOUTHERN CALIFORNIA EDISON
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IVANPAH-CONTROL PROJECT

FAULT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-4

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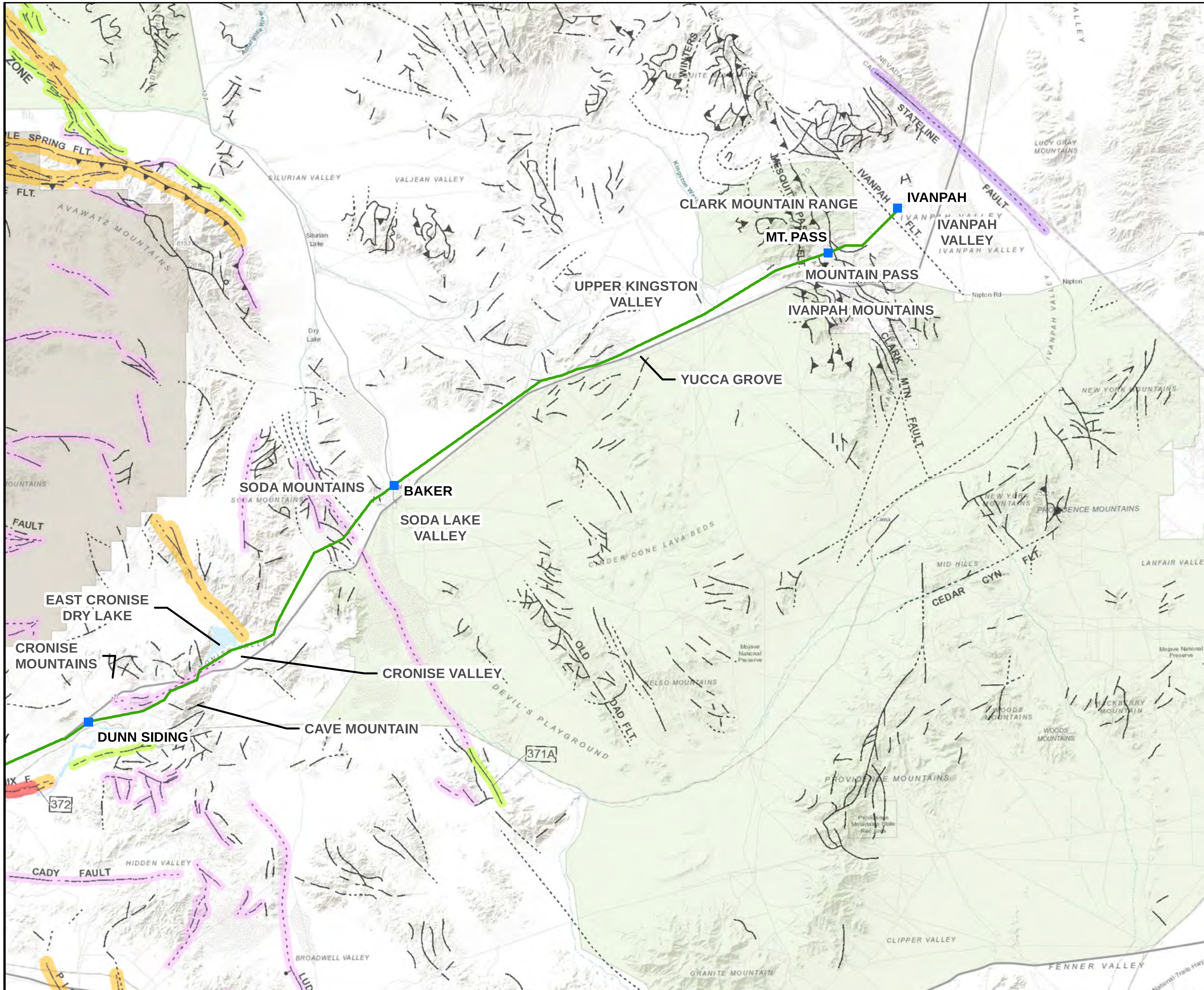

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Legend

- SUBSTATION
- SEGMENT 4

FAULT

- HISTORICAL FAULT
- HOLOCENE FAULT
- LATE QUATERNARY FAULT
- QUATERNARY FAULT
- PRE-QUATERNARY FAULT

Source: CGS 2017b

Note: Boxed numbers indicate references in CGS (2010).

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0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

FAULT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-4

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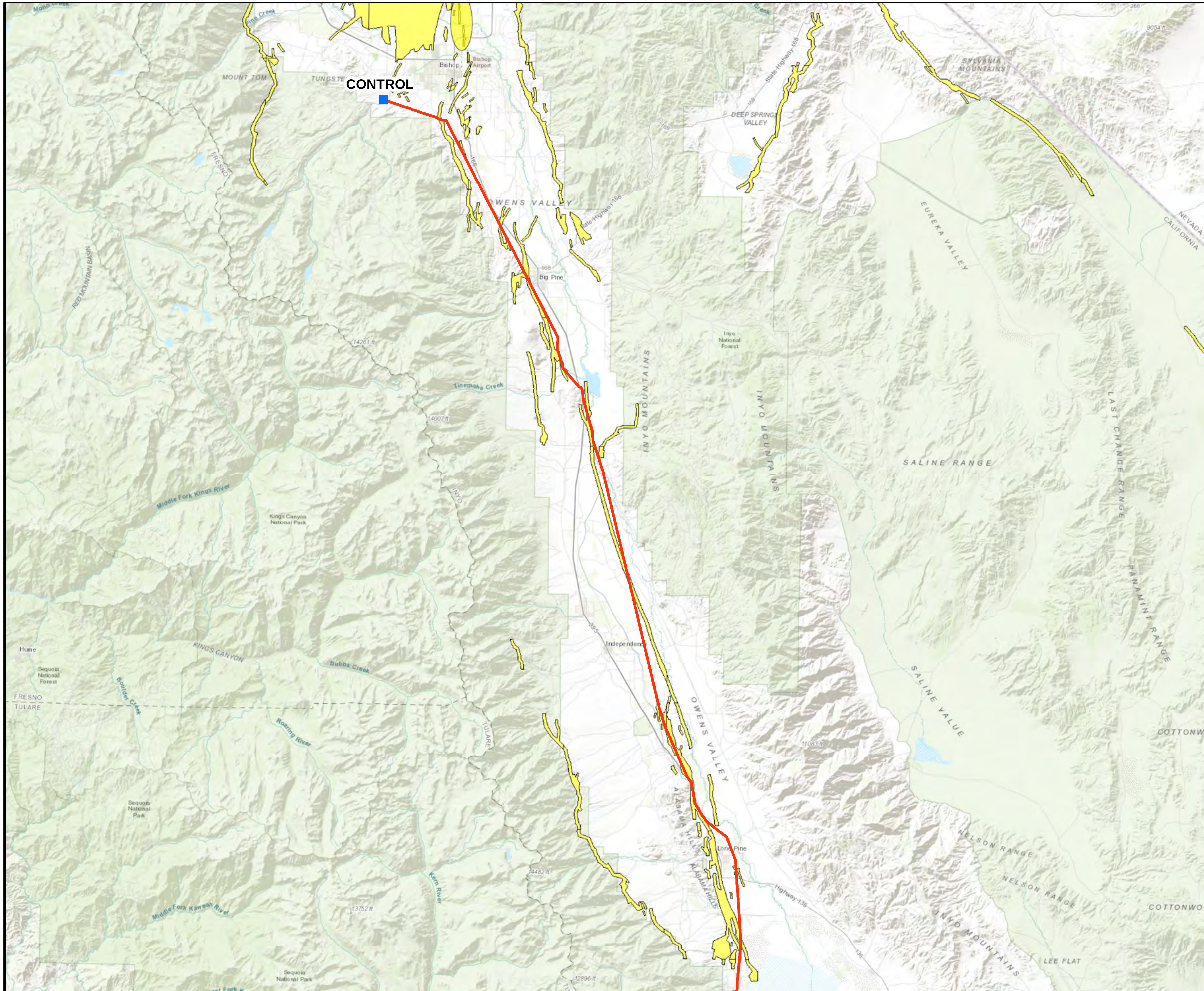

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Legend

- SUBSTATION
- SEGMENT 1
- HOLOCENE FAULT TRACES
- ALQUIST-PRIOLO ZONES

Source: CGS, 2017a

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0 6 12

Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

ALQUIST-PRIOLO SPECIAL STUDIES ZONES MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-5

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Coordinate System: NAD 1983 UTM Zone 11N

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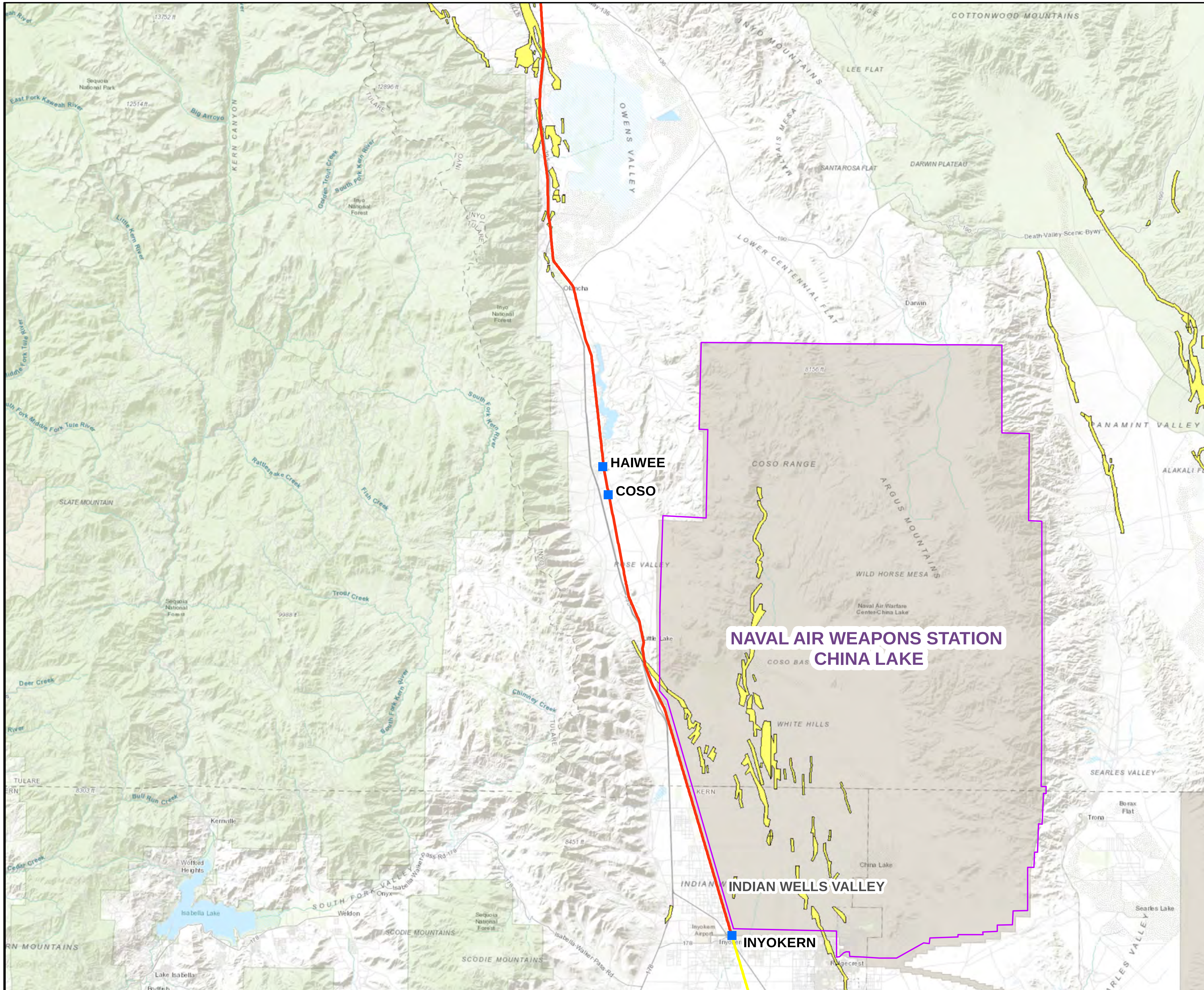

Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- HOLOCENE FAULT TRACES
- NAVAL AIR WEAPONS STATION CHINA LAKE
- ALQUIST-PRIOLO ZONES

Source: CGS, 2017a

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0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

ALQUIST-PRIOLO SPECIAL STUDIES ZONES MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-5

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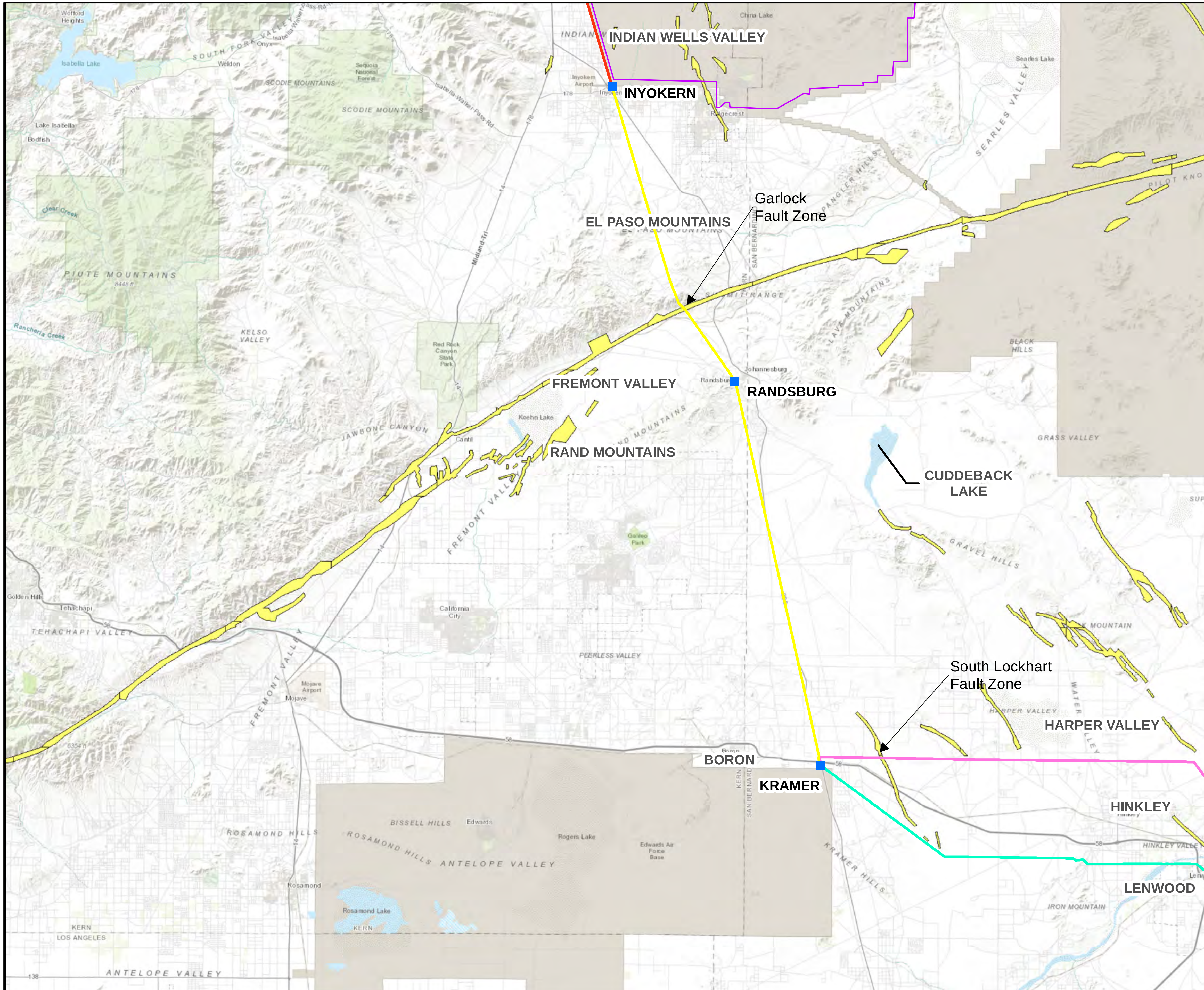

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N

Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- HOLOCENE FAULT TRACES
- NAVAL AIR WEAPONS STATION CHINA LAKE
- ALQUIST-PRIOLO ZONES

Source: CGS, 2017a

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0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

ALQUIST-PRIOLO SPECIAL STUDIES ZONES MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-5

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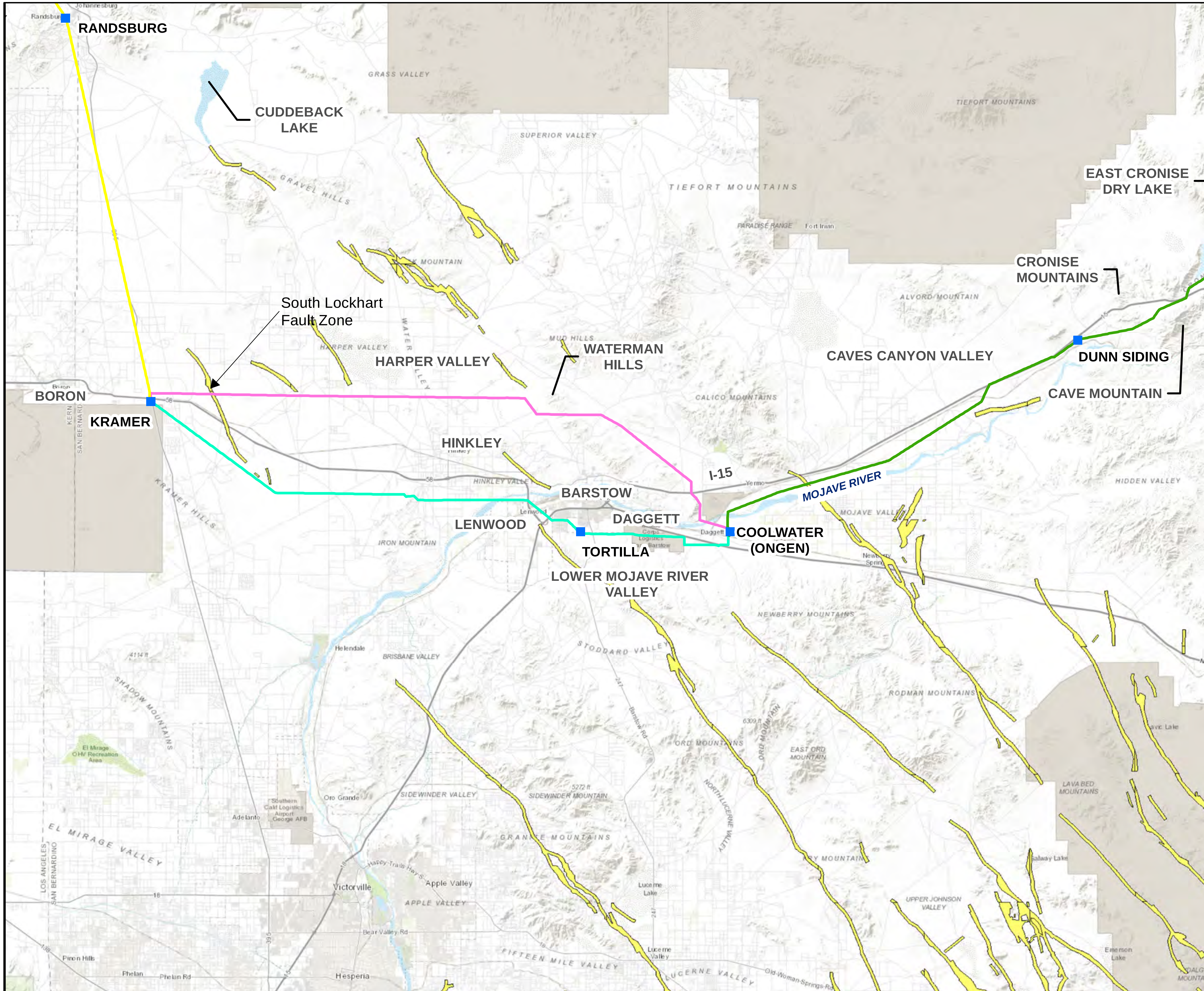

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Legend

- SUBSTATION
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- SEGMENT 4
- HOLOCENE FAULT TRACES
- ALQUIST-PRIOLO ZONES

Source: CGS, 2017a

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0 6 12

Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

ALQUIST-PRIOLO SPECIAL STUDIES ZONES MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-5

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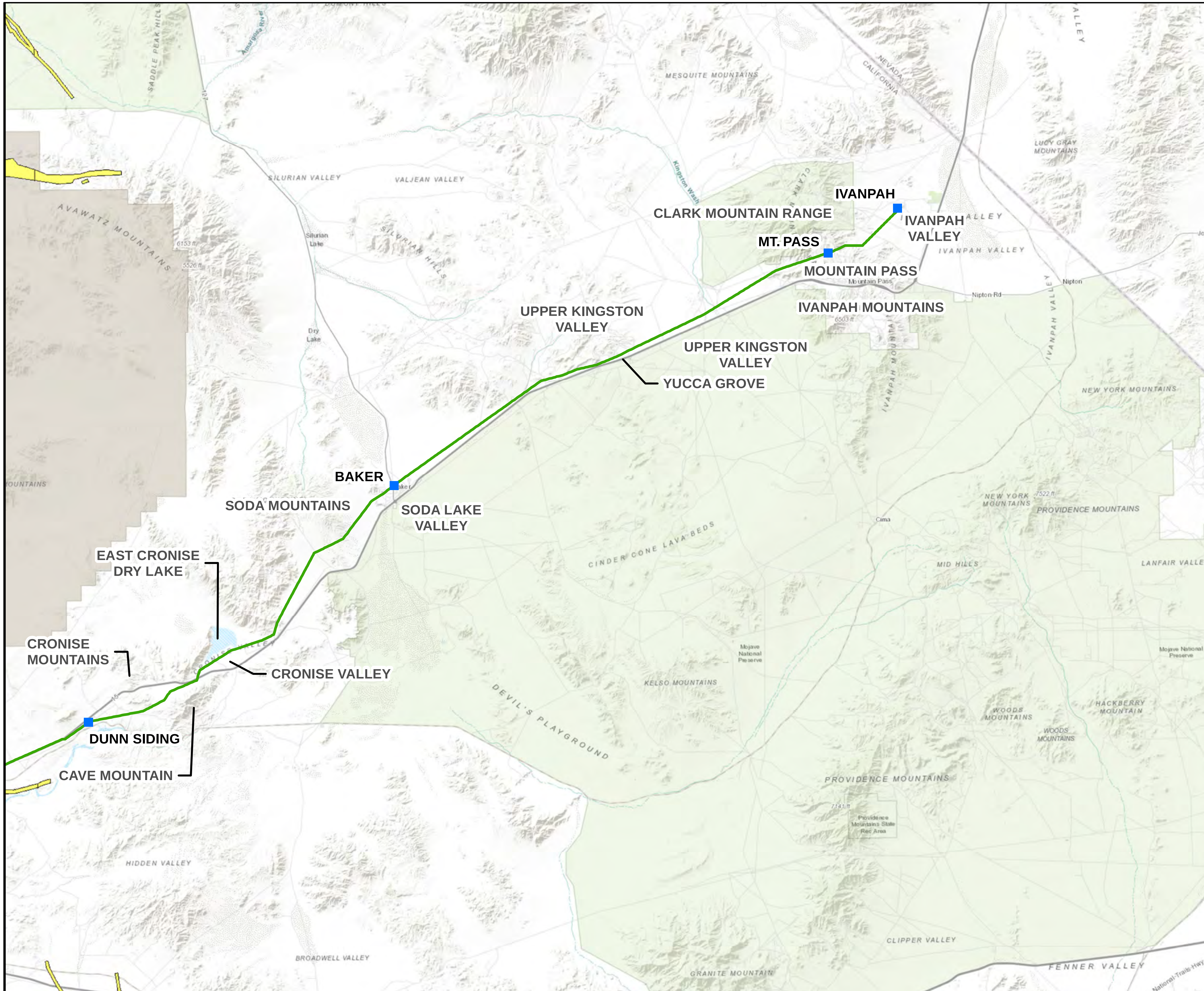

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Legend

SUBSTATION

SEGMENT 4

HOLOCENE FAULT TRACES

ALQUIST-PRIOLO ZONES

Source: CGS, 2017a

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0 6 12

Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

ALQUIST-PRIOLO SPECIAL STUDIES ZONES MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:

4.7-5

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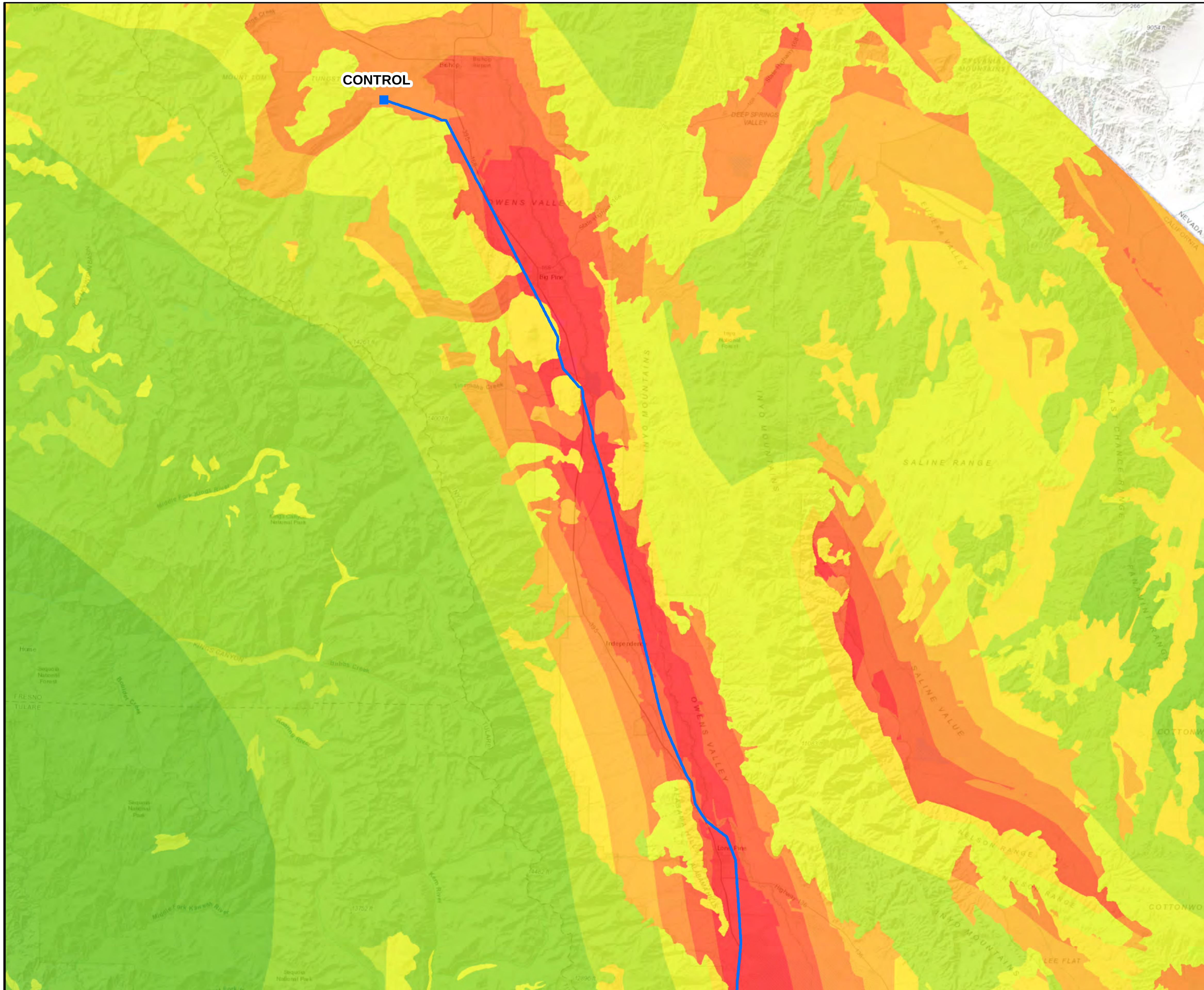

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N

Legend

- SUBSTATION
- SEGMENT 1

EARTHQUAKE SHAKING POTENTIAL, EXPRESSED AS PERCENT OF GRAVITY (G)

- 90 - 100%
- 80 - 90%
- 70 - 80%
- 60 - 70%
- 50 - 60%
- 40 - 50%
- 30 - 40%

NOTES:
1. SHAKING POTENTIAL VALUES REFLECT EXPECTED INTERMEDIATE PERIOD (1.0 SECOND) GROUND MOTIONS WITH 2% EXCEEDANCE PROBABILITY IN 50 YEARS.
2. RED = HIGHER SHAKING POTENTIAL, GREEN = LOWER SHAKING POTENTIAL
3. BASED ON BRANUM ET AL. (2016) AND CGS (2017C).

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

EARTHQUAKE SHAKING POTENTIAL MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-6

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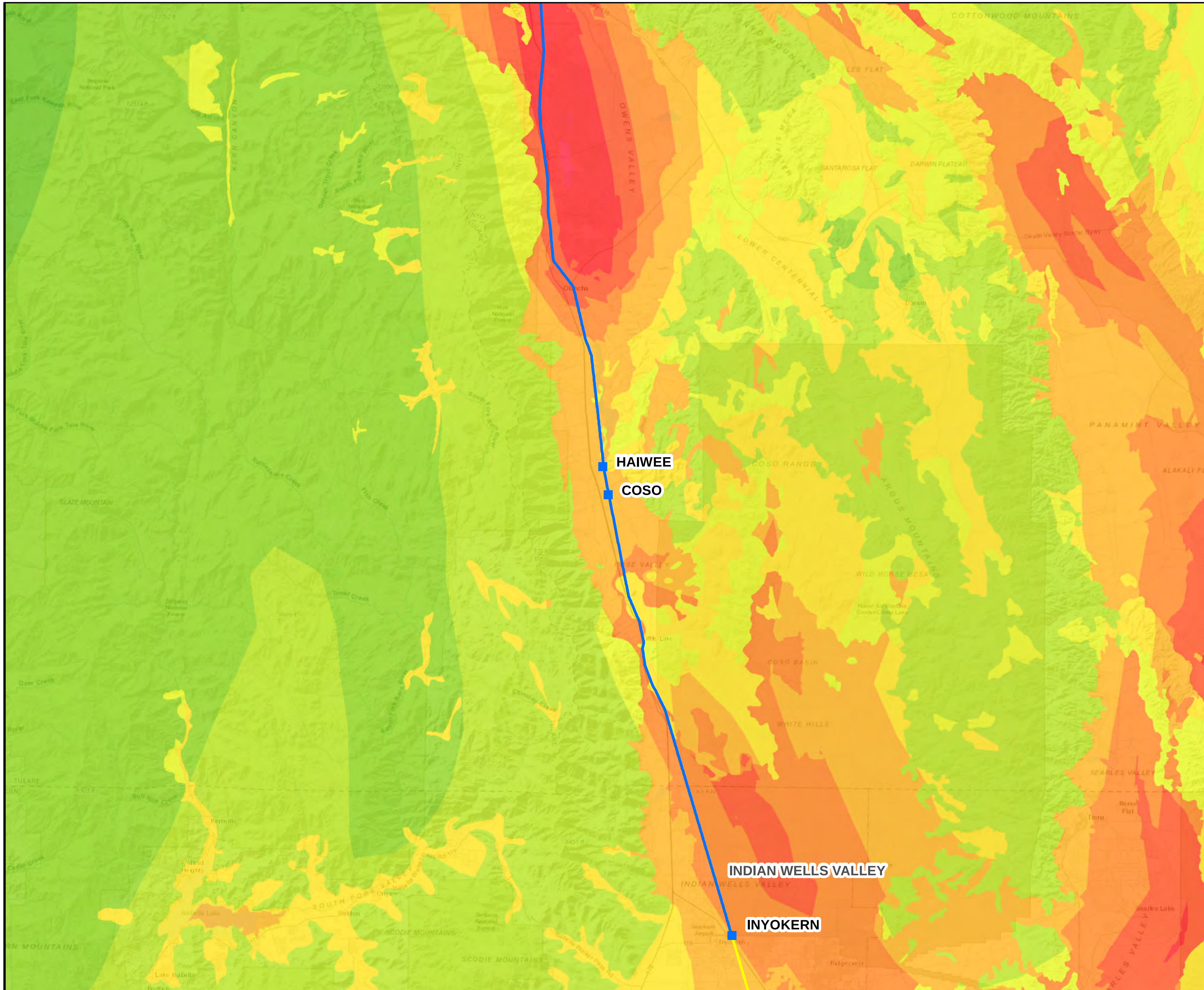
Coordinate System: NAD 1983 UTM Zone 11N



SOUTHERN CALIFORNIA EDISON
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N

Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2

EARTHQUAKE SHAKING POTENTIAL, EXPRESSED AS PERCENT OF GRAVITY (G)

- 90 - 100%
- 80 - 90%
- 70 - 80%
- 60 - 70%
- 50 - 60%
- 40 - 50%
- 30 - 40%

NOTES:
1. SHAKING POTENTIAL VALUES REFLECT EXPECTED INTERMEDIATE PERIOD (1.0 SECOND) GROUND MOTIONS WITH 2% EXCEEDANCE PROBABILITY IN 50 YEARS.
2. RED = HIGHER SHAKING POTENTIAL, GREEN = LOWER SHAKING POTENTIAL
3. BASED ON BRANUM ET AL. (2016) AND CGS (2017C).

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Miles

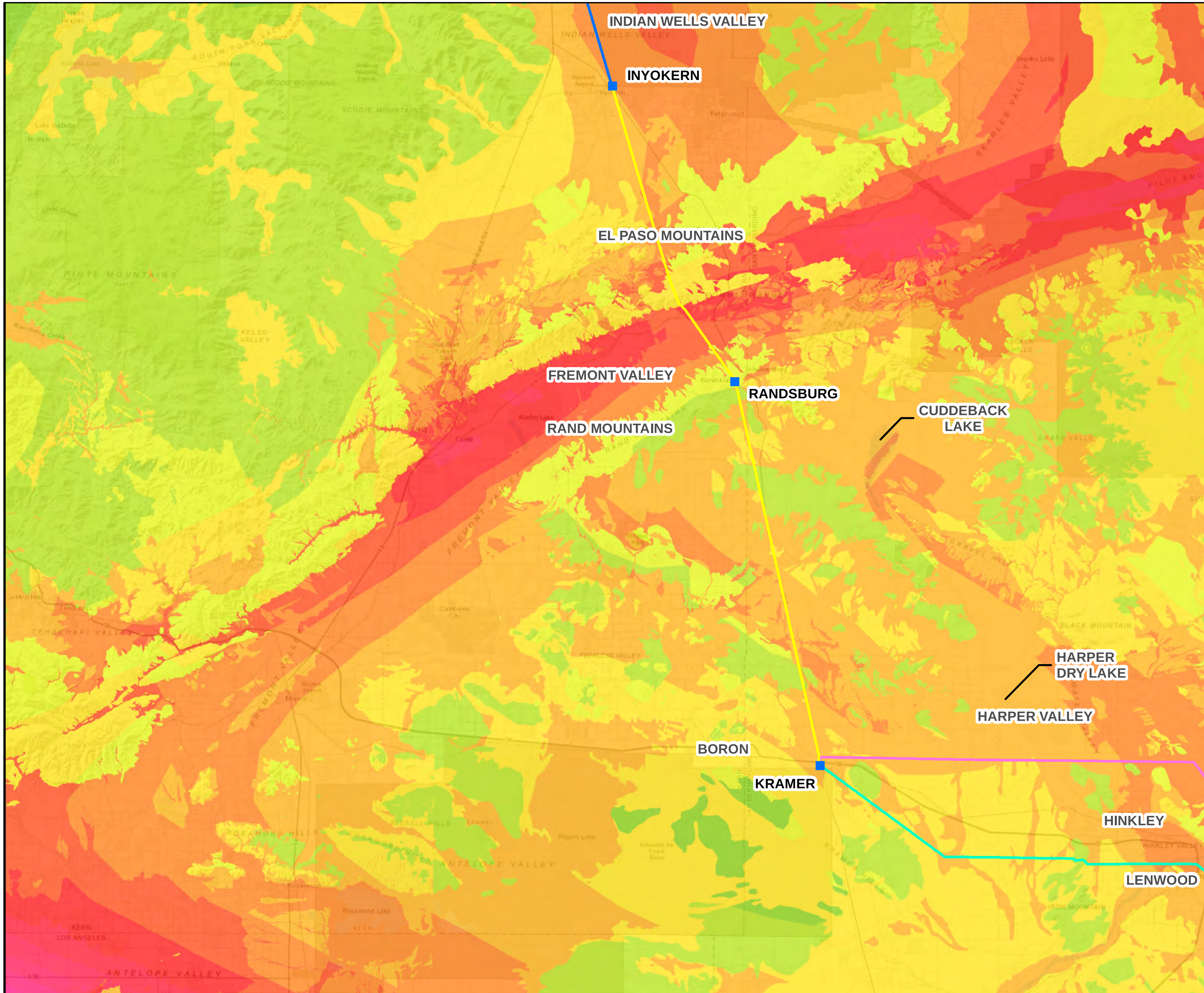
IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

EARTHQUAKE SHAKING POTENTIAL MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-6



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N

Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S

EARTHQUAKE SHAKING POTENTIAL,
EXPRESSED AS PERCENT OF GRAVITY (G)

- 90 - 100%
- 80 - 90%
- 70 - 80%
- 60 - 70%
- 50 - 60%
- 40 - 50%
- 30 - 40%

NOTES:
1. SHAKING POTENTIAL VALUES REFLECT EXPECTED INTERMEDIATE PERIOD (1.0 SECOND) GROUND MOTIONS WITH 2% EXCEEDANCE PROBABILITY IN 50 YEARS.
2. RED = HIGHER SHAKING POTENTIAL, GREEN = LOWER SHAKING POTENTIAL
3. BASED ON BRANUM ET AL. (2016) AND CGS (2017C).

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IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

EARTHQUAKE SHAKING POTENTIAL MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-6

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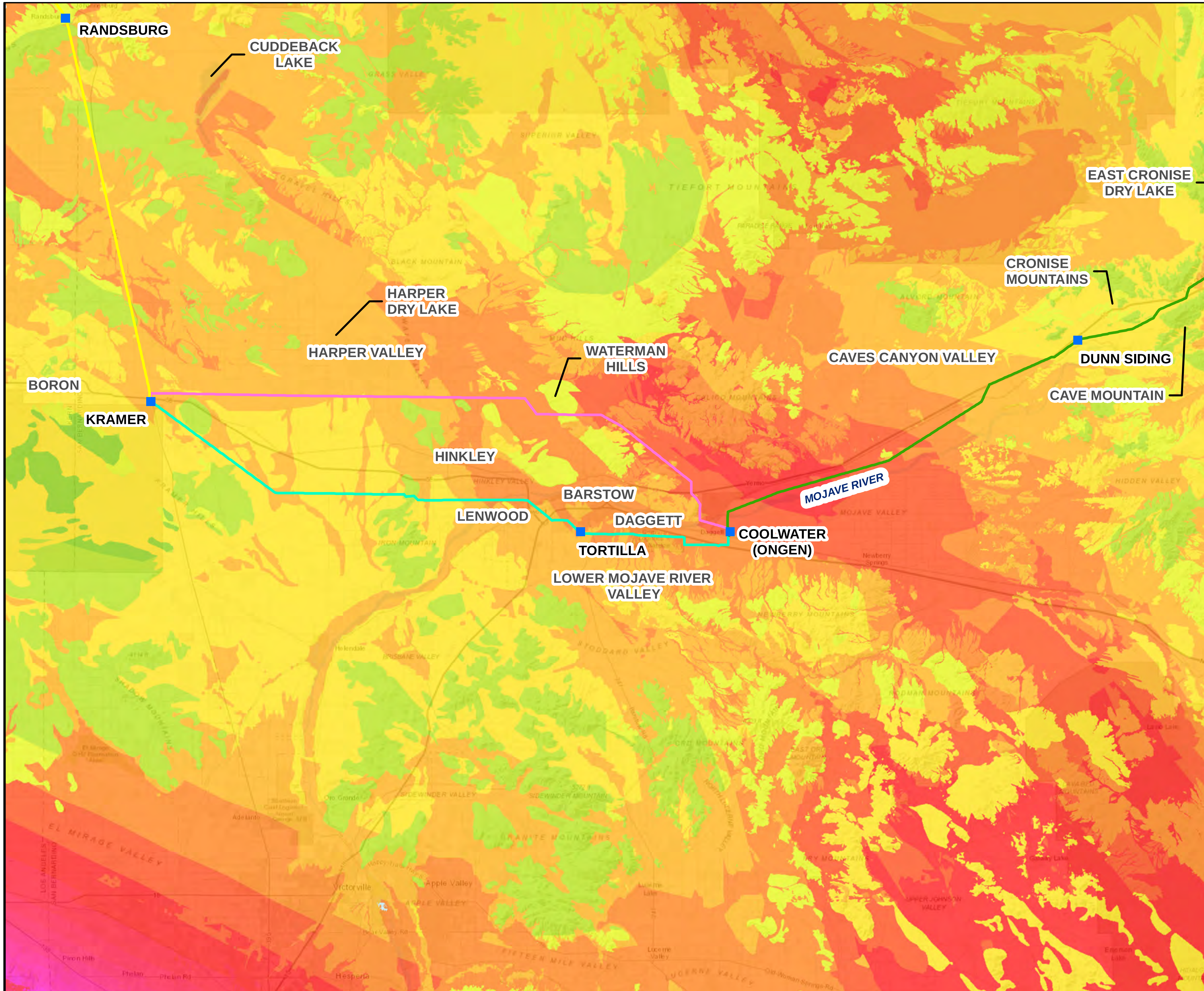
Coordinate System: NAD 1983 UTM Zone 11N



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Legend

- SUBSTATION
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- SEGMENT 4

EARTHQUAKE SHAKING POTENTIAL, EXPRESSED AS PERCENT OF GRAVITY (G)

- 90 - 100%
- 80 - 90%
- 70 - 80%
- 60 - 70%
- 50 - 60%
- 40 - 50%
- 30 - 40%

NOTES:
1. SHAKING POTENTIAL VALUES REFLECT EXPECTED INTERMEDIATE PERIOD (1.0 SECOND) GROUND MOTIONS WITH 2% EXCEEDANCE PROBABILITY IN 50 YEARS.
2. RED = HIGHER SHAKING POTENTIAL, GREEN = LOWER SHAKING POTENTIAL
3. BASED ON BRANUM ET AL. (2016) AND CGS (2017C).

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

EARTHQUAKE SHAKING POTENTIAL MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-6

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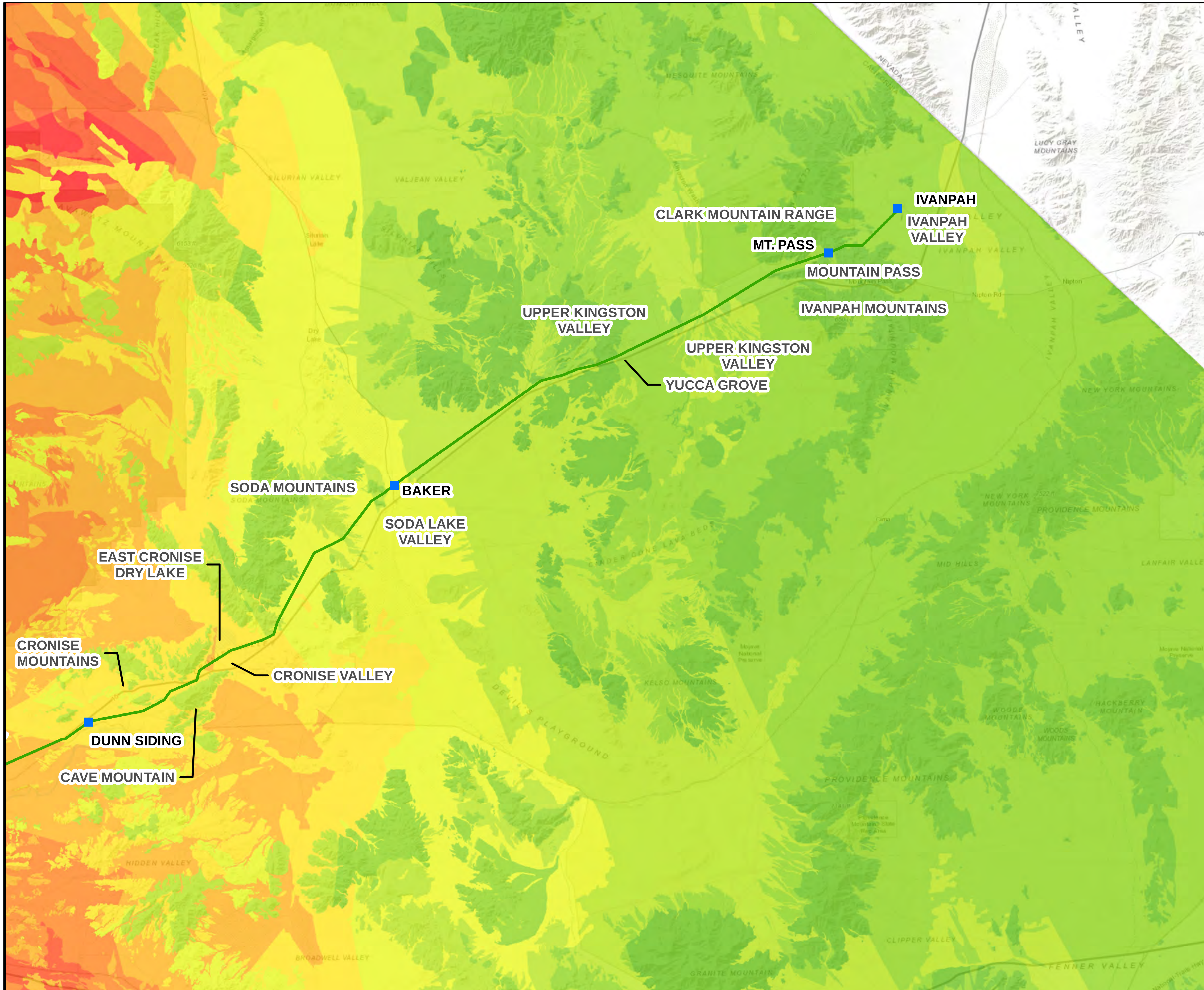
Coordinate System: NAD 1983 UTM Zone 11N



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Legend

- SUBSTATION
- SEGMENT 4

EARTHQUAKE SHAKING POTENTIAL, EXPRESSED AS PERCENT OF GRAVITY (G)

- 90 - 100%
- 80 - 90%
- 70 - 80%
- 60 - 70%
- 50 - 60%
- 40 - 50%
- 30 - 40%

NOTES:
1. SHAKING POTENTIAL VALUES REFLECT EXPECTED INTERMEDIATE PERIOD (1.0 SECOND) GROUND MOTIONS WITH 2% EXCEEDANCE PROBABILITY IN 50 YEARS.
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3. BASED ON BRANUM ET AL. (2016) AND CGS (2017C).

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0 6 12
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IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

EARTHQUAKE SHAKING POTENTIAL MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-6

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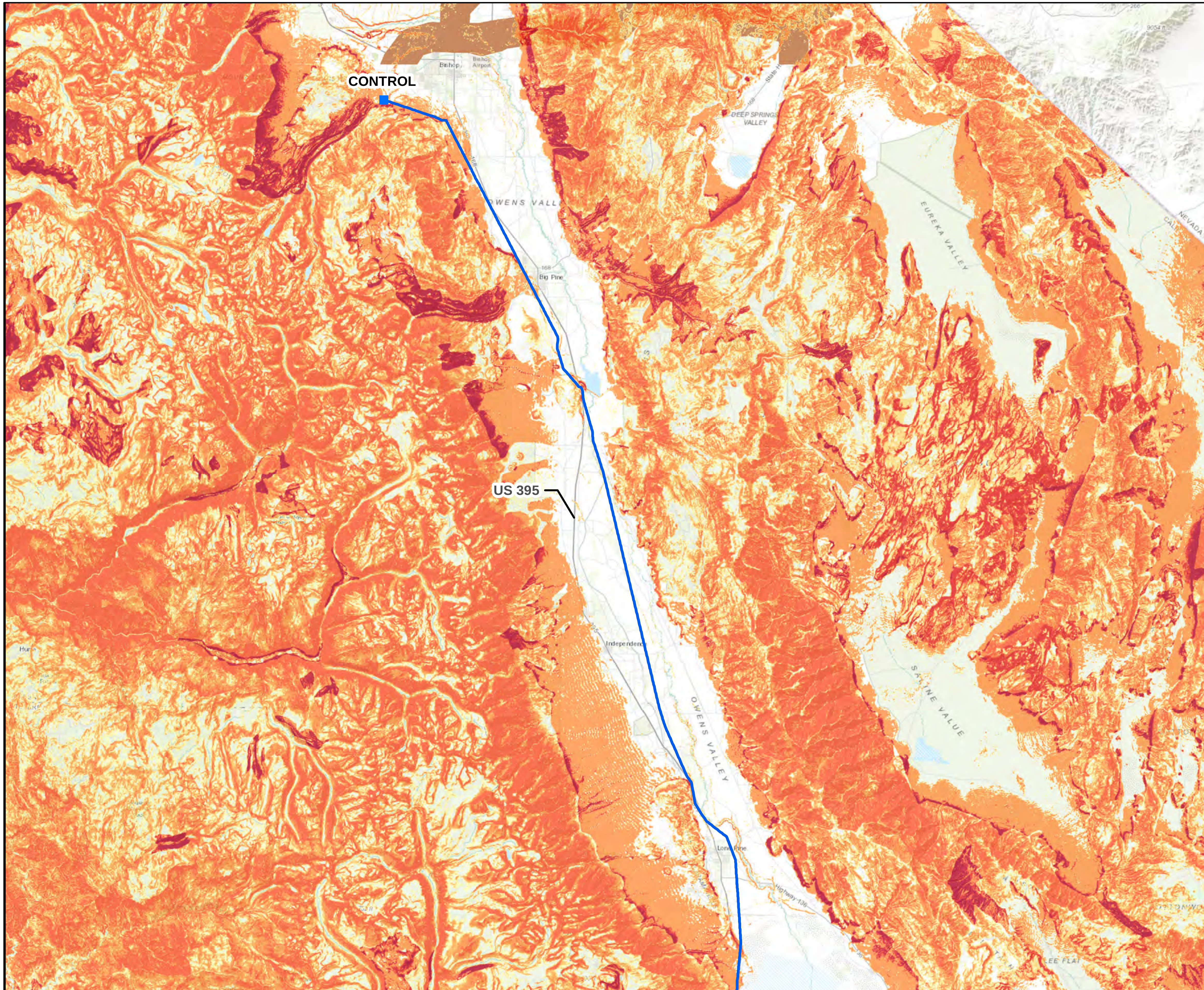
Coordinate System: NAD 1983 UTM Zone 11N



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N

Legend

SUBSTATION

SEGMENT 1

GREATER LANDSLIDE SUSCEPTIBILITY

LOWER LANDSLIDE SUSCEPTIBILITY

NOTES:
1. LANDSLIDE SUSCEPTIBILITY REFLECTS ROCK STRENGTH AND SLOPE CLASS.
2. BASED ON WILLS ET AL. (2011) AND CGS (2017D)

Page 1 of 5

0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

LANDSLIDE SUSCEPTIBILITY MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-7

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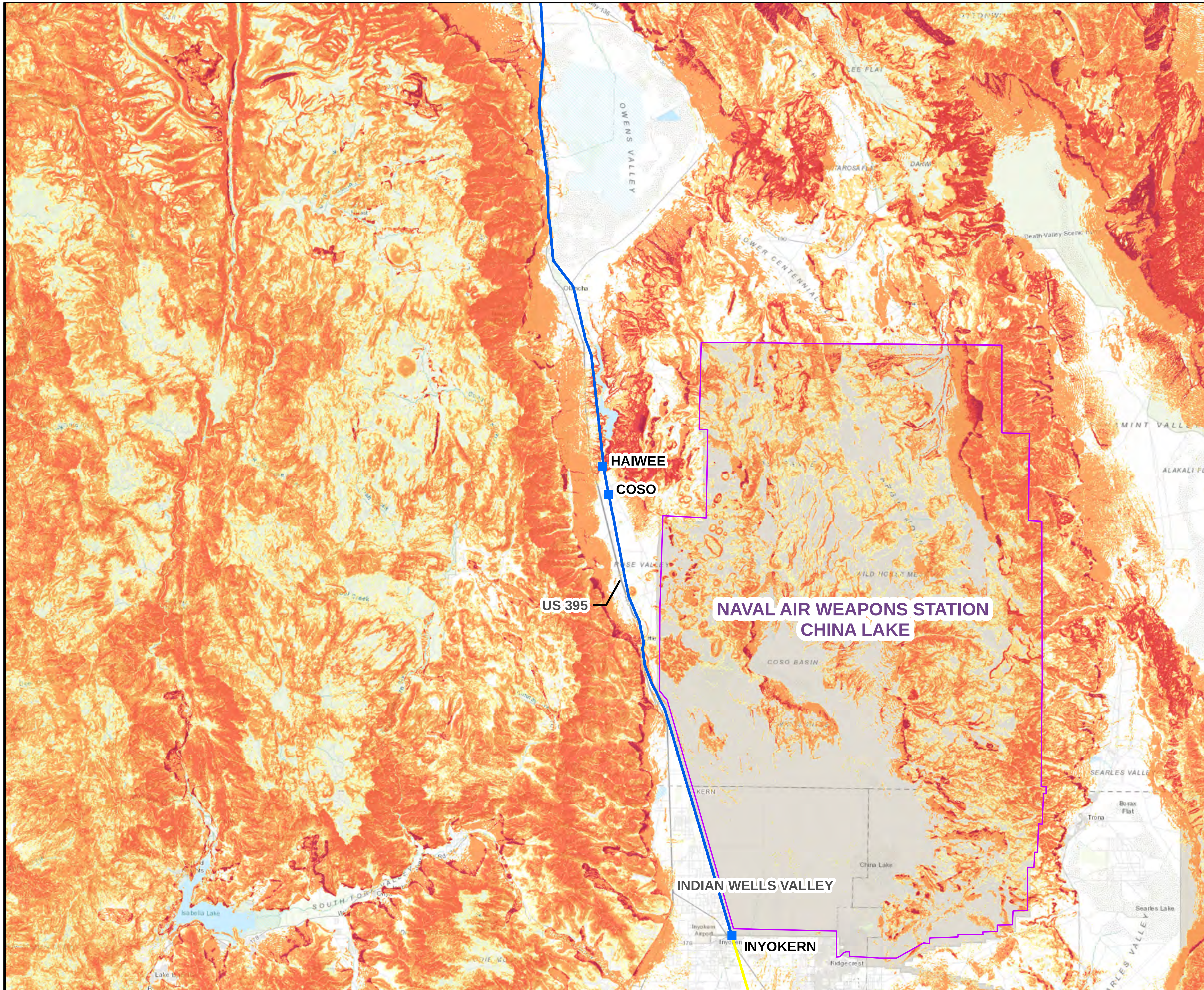
Coordinate System: NAD 1983 UTM Zone 11N



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Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- GREATER LANDSLIDE SUSCEPTIBILITY
- LOWER LANDSLIDE SUSCEPTIBILITY

NOTES:
1. LANDSLIDE SUSCEPTIBILITY REFLECTS ROCK STRENGTH AND SLOPE CLASS.
2. BASED ON WILLS ET AL. (2011) AND CGS (2017D)

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Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

LANDSLIDE SUSCEPTIBILITY MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-7

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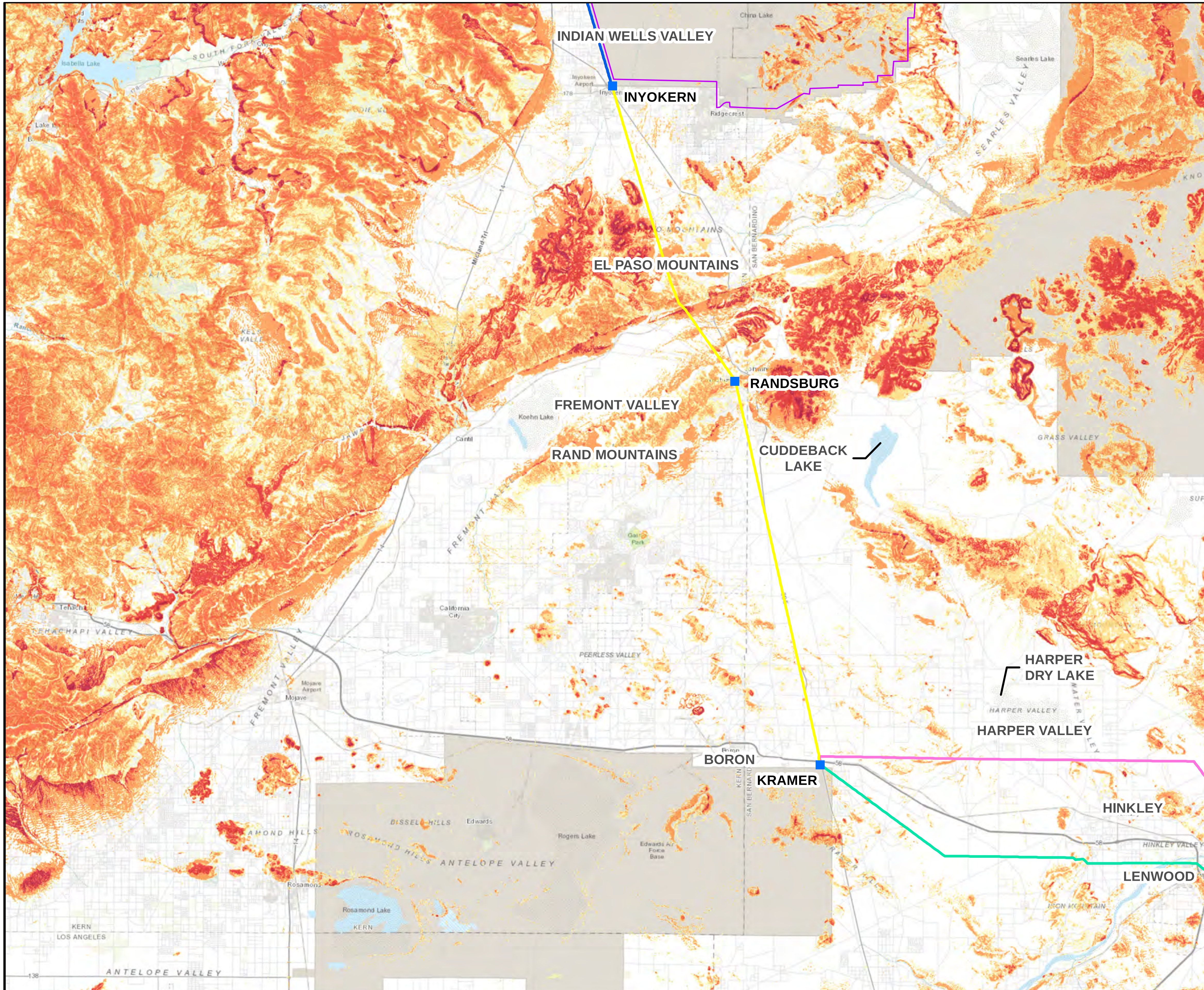

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Legend

- SUBSTATION
- SEGMENT 1
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- GREATER LANDSLIDE SUSCEPTIBILITY
- LOWER LANDSLIDE SUSCEPTIBILITY

NOTES:
1. LANDSLIDE SUSCEPTIBILITY REFLECTS ROCK STRENGTH AND SLOPE CLASS.
2. BASED ON WILLS ET AL. (2011) AND CGS (2017D)

0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

LANDSLIDE SUSCEPTIBILITY MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-7

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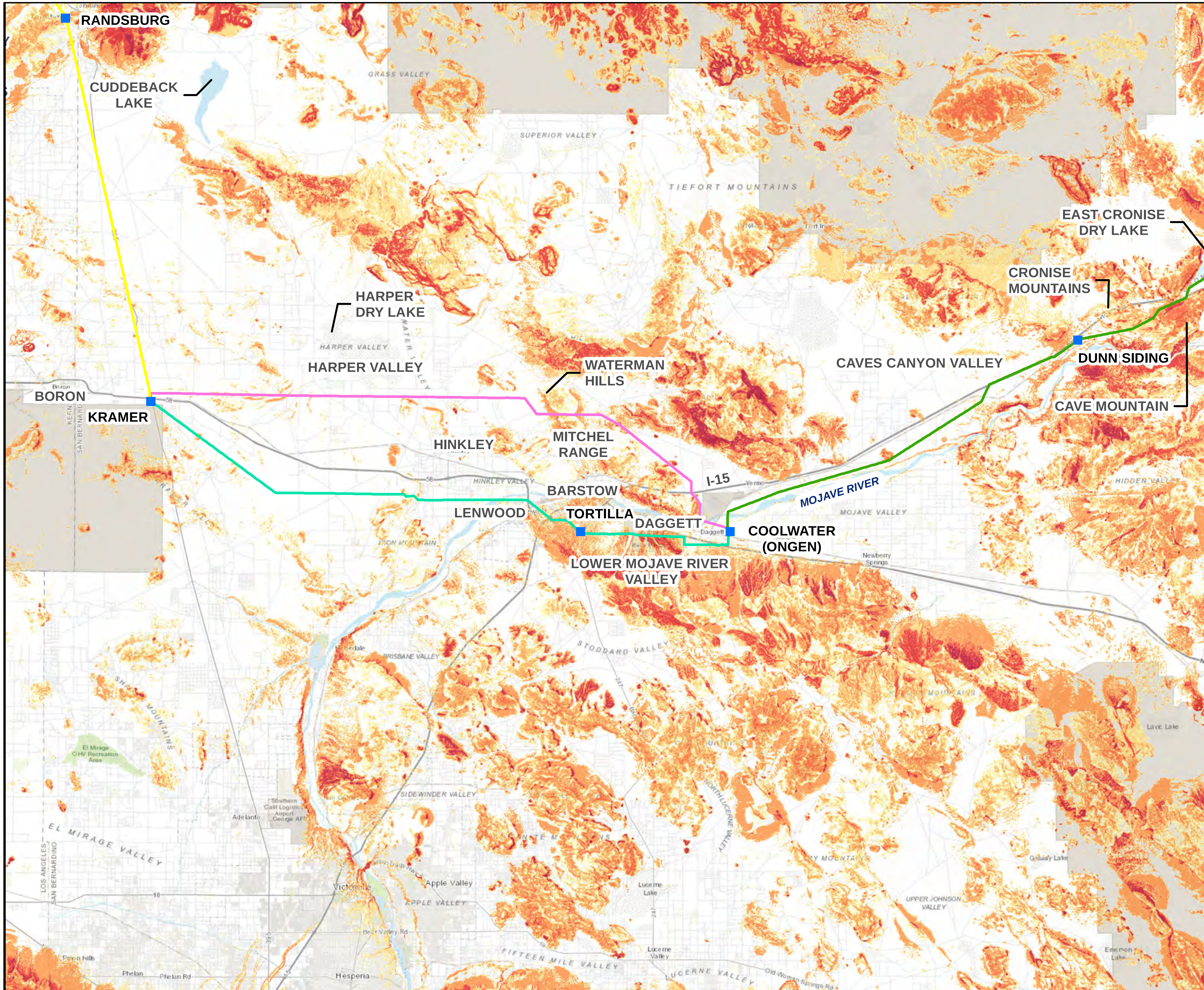

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Legend

- SUBSTATION
- SEGMENT 2
- SEGMENT 3N
- SEGMENT 3S
- SEGMENT 4
- GREATER LANDSLIDE SUSCEPTIBILITY
- LOWER LANDSLIDE SUSCEPTIBILITY

NOTES:
1. LANDSLIDE SUSCEPTIBILITY REFLECTS ROCK STRENGTH AND SLOPE CLASS.
2. BASED ON WILLS ET AL. (2011) AND CGS (2017D)

Page 4 of 5

0 6 12
Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

LANDSLIDE SUSCEPTIBILITY MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET:
4.7-7

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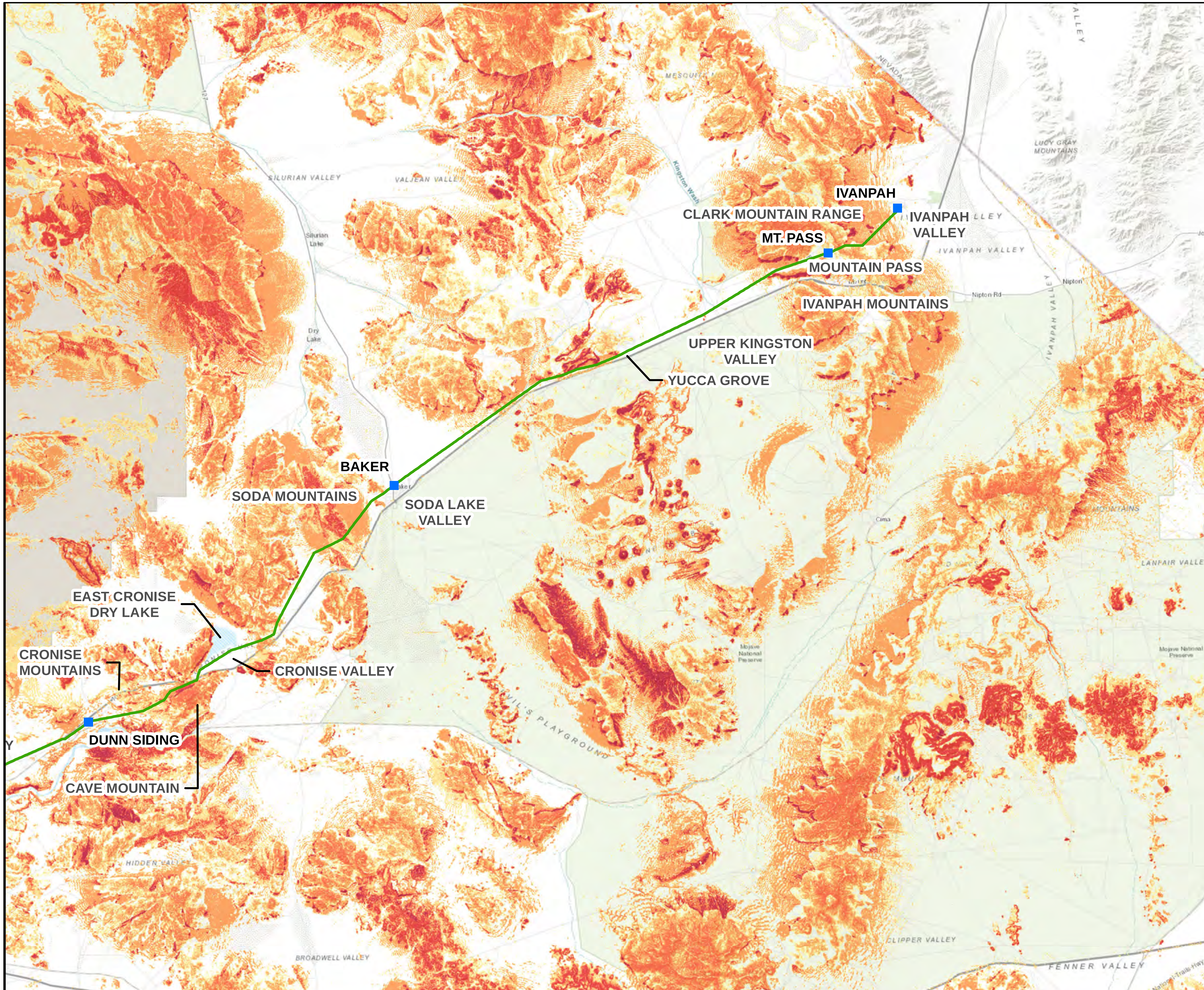

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N

Legend

- SUBSTATION
- SEGMENT 4
- GREATER LANDSLIDE SUSCEPTIBILITY
- LOWER LANDSLIDE SUSCEPTIBILITY

NOTES:
1. LANDSLIDE SUSCEPTIBILITY REFLECTS ROCK STRENGTH AND SLOPE CLASS.
2. BASED ON WILLS ET AL. (2011) AND CGS (2017D)

Page 5 of 5

0 6 12

Miles

IMAGERY SOURCE: ESRI ONLINE NATIONAL GEOGRAPHIC AND WORLD IMAGERY 2015

IVANPAH-CONTROL PROJECT

LANDSLIDE SUSCEPTIBILITY MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURESET: 4.7-7

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Coordinate System: NAD 1983 UTM Zone 11N

4.8 Greenhouse Gas Emissions

This section describes the greenhouse gas (GHG) regulations that are applicable to electrical transmission projects and evaluates the potential impacts from construction and operation of the Full-Rebuild Concept and its Alternatives.

4.8.1 Environmental Setting

The IC Project Alignment is located within the Great Basin Valleys Air Basin and Mojave Desert Air Basin, which are under the jurisdictions of the Great Basin Unified Air Pollution Control District (GBUAPCD), the Eastern Kern Air Pollution Control District (EKAPCD), and the Mojave Desert Air Quality Management District (MDAQMD).

GHGs refer to gases that trap heat in the atmosphere, causing a greenhouse effect. GHGs include, but are not limited to, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF_6). Atmospheric concentrations of the two most important directly-emitted, long-lived GHGs, CO_2 and CH_4, are currently well above the range of atmospheric concentrations that occurred over the last 650,000 years. (Pew Center 2008) According to the Intergovernmental Panel on Climate Change (IPCC), increased atmospheric levels of CO_2 are correlated with rising temperatures; concentrations of CO_2 have increased by 31 percent above pre-industrial levels since the year 1750. Climate models show that temperatures would probably increase by 1.4 degrees Celsius (°C) to 5.8°C by the year 2100. (IPCC 2007)

Global warming potential (GWP) estimates how much a given mass of a GHG contributes to climate change. The term enables comparison of the warming effects of different gases. GWP uses a relative scale that compares the warming effect of the gas in question with that of the same mass of CO_2. The CO_2 equivalent (CO_2e) is a measure used to compare the effect of emissions of various GHGs based on their GWP, when projected over a specified time period (generally 100 years). CO_2e is commonly expressed as metric tons (MT) of CO_2 equivalents ($MTCO_2e$) or million metric tons (MMT) of CO_2 equivalents ($MMTCO_2e$). The CO_2e for a gas is obtained by multiplying the mass of the gas (in tons) by its GWP.

4.8.2 Regulatory Setting

Federal, state, and local regulations were reviewed for applicability to the IC Project.

4.8.2.1 Federal

4.8.2.1.1 Federal Mandatory Reporting of Greenhouse Gases (Section 40 Code of Federal Regulations [C.F.R.] Part 98

The Federal Clean Air Act (CAA) requires the U.S. Environmental Protection Agency (EPA) to define national standards to protect U.S. public health and welfare. The CAA does not currently regulate GHG emissions from construction activities specifically; however, GHGs are pollutants that can be regulated in the future under the CAA. There are currently no federal regulations that set ambient air quality standards for GHGs.

4.8.2.2 State

4.8.2.2.1 Global Warming Solutions Act of 2006 (Assembly Bill (AB) 32)

The California Global Warming Solutions Act of 2006 (AB 32) charges the California Air Resources Board (CARB) with the responsibility of monitoring and regulating sources of GHG emissions in order to reduce those emissions. CARB established a scoping plan in December 2008 for achieving reductions in GHG emissions and has established and implemented regulations for reducing those emissions by the year 2020.

4.8.2.2.2 California Mandatory Greenhouse Gas Reporting Regulation (17 California Code of Regulations §§ 95100 - 95133)

Pursuant to AB 32, CARB adopted the Mandatory Greenhouse Gas Reporting Regulation. The facilities required to annually report their GHG emissions include electricity-generating facilities, electricity retail providers and power marketers, oil refineries, hydrogen plants, cement plants, cogeneration facilities, and industrial sources that emit over 25,000 $MTCO_2e$ from stationary source combustion. In particular, retail providers of electricity are required to report fugitive emissions of SF_6 related to transmission and distribution systems, substations, and circuit breakers located in California that the retail provider or marketer is responsible for maintaining in proper working order. SCE complies with these requirements.

4.8.2.3 Local

The California Public Utilities Commission (CPUC) has sole and exclusive state jurisdiction over the siting and design of the IC Project. Pursuant to CPUC General Order 131-D (GO 131-D), Section XIV.B, "Local jurisdictions acting pursuant to local authority are preempted from regulating electric power line projects, distribution lines, substations, or electric facilities constructed by public utilities subject to the CPUC's jurisdiction. However, in locating such projects, the public utilities shall consult with local agencies regarding land use matters." Consequently, public utilities are directed to consider local regulations and consult with local agencies, but the counties' and cities' regulations are not applicable as the counties and cities do not have jurisdiction over the IC Project. The IC Project, however, must comply with applicable local air district regulations.

4.8.2.3.1 Eastern Kern Air Pollution Control District

The EKAPCD has adopted an addendum to their EKAPCD CEQA Guidelines, titled *Addressing GHG Emission Impacts for Stationary Source Projects When Serving as the Lead CEQA Agency*. This addendum establishes a significance threshold of 25,000 $MTCO_2e$ per year.

4.8.2.3.2 Great Basin Unified Air Pollution Control District

The GBUAPCD has not formally adopted recommendations or official guidance to evaluate the significance of GHG emissions for projects.

4.8.2.3.3 Mojave Desert Air Quality Management District

The MDAQMD has established 100,000 tons of CO_2e per annum or 548,000 pounds per day as the District's significant emissions thresholds for greenhouse gases.

4.8.3 Significance Criteria

The significance criteria for assessing the impacts from GHG emissions are derived from the California Environmental Quality Act (CEQA) Environmental Checklist. According to the CEQA Checklist, a project causes a potentially significant impact if it would:

- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment
- Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions

4.8.4 Impact Analysis

4.8.4.1 Would the Project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

4.8.4.1.1 Construction and Operations

Less than Significant Impact. GHG emissions would be generated from operation of heavy equipment, support vehicles and helicopters. The most common GHGs associated with fuel combustion are CO_2, CH_4, and N_2O. Annual GHG emissions were estimated for construction activities using the CalEEMod model for both on-road and off-road sources. Helicopter emissions were estimated based on the Swiss Federal Office of Civil Aviation (FOCA) Guidance on the Determination of Helicopter Emissions. (FOCA 2015)

Construction activities would result in emissions of GHG over the construction period. Construction activities would result in exhaust emissions from vehicular traffic, as well as from construction equipment and machinery. Over the construction period, approximately 83,020 $MTCO_2e$ would be emitted. GHG construction emissions from future activities amortized over 30 years is approximately 2,767 $MTCO_2e$.

As explained in Section 4.3, operational emissions would not differ in scope or scale from activities currently conducted. Thus, the estimated annual emission of GHGs from the operation of the Full-Rebuild Concept is 0 $MTCO_2e$.[12] Combined, the 2,767 $MTCO_2e$ emissions associated with construction and operations would be well below the 25,000 $MTCO_2e$ threshold of significance established by the EKAPCD, which is the more stringent of the two quantified thresholds. Therefore, the Full-Rebuild Concept would not generate, either directly or indirectly, GHG emissions that would have a significant impact on the environment, and impacts would be less than significant.

4.8.4.2 Would the Project conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

4.8.4.2.1 Construction

No Impact. Construction of the Full-Rebuild Concept would be consistent with applicable policies, plans, and regulations for reducing GHG emissions. The Full-Rebuild Concept would incorporate best management practices and other standard SCE practices, such as reducing the idle time of construction vehicles, that are consistent with the requirements and intentions of the federal and state plans, polices, and regulations. Construction activities would not be expected to consume a substantial amount of energy that would result in a conflict with policies that serve to reduce GHG emissions through a reduction in energy consumption. As presented above, GHG construction emissions from activities amortized over 30 years would be approximately 2,767 $MTCO_2e$. GHG emissions would fall well below the most-stringent numerical threshold of significance in the area of the Full-Rebuild Concept. Therefore, the Full-Rebuild Concept would not conflict with any applicable plan, policy, or regulation, and no impact would occur under this criterion.

[12] The installation of ACCC conductor will improve the operational efficiency of the circuits included in the Full-Rebuild Concept by reducing electrical impedance and associated line losses. Reduced line losses will result in a greater percentage of the electricity generated being delivered, which may allow the combustion of a smaller volume of carbon-based fuels per unit of electricity generated, and thus some reduction of GHG emitted by generators served by these circuits. The potential reduction of GHG emissions associated with the generation of electricity has not been quantified as the Full-Rebuild Concept's construction and O&M-related GHG emissions are below the most-stringent numerical threshold of significance.

4.8.4.2.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.8.5 Applicant Proposed Measures

Because no significant impacts to GHG emissions would occur as a result of the Full-Rebuild Concept, no avoidance or minimization measures are proposed.

4.8.6 Alternatives

Alternatives to the Full-Rebuild Concept are addressed in Section 5.2, Description of Project Alternatives and Impact Analysis.

4.8.7 References

EKAPCD. 2012. Addendum to CEQA Guidelines. Addressing GHG Emission Impacts for Stationary Source Projects When Serving as Lead CEQA Agency. Available at http://www.kernair.org/Documents/CEQA/EKAPCD%20CEQA%20GHG%20Policy%20Adopted%203-8-12.pdf

Mojave Desert Air Quality Management District. 2016. California Environmental Quality Act (CEQA) And Federal Conformity Guidelines. Available at http://mdaqmd.ca.gov/home/showdocument?id=192.

4.9 Hazards and Hazardous Materials

This section describes the hazards and hazardous materials along the IC Project Alignment and associated with construction and operation of the Full-Rebuild Concept, as well as the potential impacts and alternatives.

4.9.1 Environmental Setting

4.9.1.1 Hazardous Materials and Waste

As described in Section 3.1.2 and Section 4.11.1, the existing land use along the IC Project Alignment is primarily open space, with scattered residential uses. Widely-dispersed industrial uses are found in the eastern portions of Segment 4 (mining and solar electric generating facilities). Institutional uses, primarily military facilities, are located adjacent to Segments 1, 2, 3S and 4 and adjacent to Inyokern Substation and Coolwater Substation. Portions of the IC Project Alignment are located on lands managed by the Bureau of Land Management, Bureau of Indian Affairs, China Lake Naval Air Weapons Station, Edwards Air Force Base, and Marine Corps Logistics Base-Barstow, and California State Lands Commission. Past land uses along the IC Project Alignment included primarily open space, with military uses, hardrock mining, mineral prospecting and processing, and agriculture found along the alignment.

State and federal databases were reviewed to identify hazardous materials and hazardous waste facilities including federal Superfund sites, State Response sites, Voluntary Cleanup sites, School Cleanup sites, Permitted Operating sites, Corrective Action sites, and Tiered Permit sites within or adjacent to the IC Project Alignment.

No records were found that indicate Superfund sites are present within or immediately adjacent to the IC Project Alignment. Records pertaining to facilities reporting to the USEPA's Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) database were not found within 0.5 mile of the IC Project Alignment. The results of these database reviews are presented in Table 4.9-1 below and shown on Figure 4.9-1.

Table 4.9-1: Hazardous Material and Waste Sites within 0.5 Miles of the IC Project Alignment

Project Segment	Source Database	Facility Name	Location	Type	Distance (miles/direction)
1	Geotracker	China Lake Naval Air Weapons Station - Site 60 - B2 Spotting Tower 3 Quonset Hut	35.796, -117.848	Military Cleanup Site	0.1 / E
1	Geotracker	Lone Pine Class III Landfill	36.594, -118.035	Land Disposal Site	0.2 / W
1	Geotracker	Big Pine County Yard	37.148, -118.289	Leaking UST (Closed)	0.4 / NE
1	Geotracker	PPG Industries	36,476, -118.033	Leaking UST (Cleanup)	0.2 / E
1	Geotracker	Sawmill Class III Landfill	35.846, -117.873	Land Disposal Site	0.2 / W
1	Envirostor	Jorgensen Reduction Plant	37.283, -118.382	Formerly Used Defense Site	0
1	Envirostor	Olancha Airfield	36.284, -118.000	Formerly Used Defense Site	0.4 / W

Table 4.9-1: Hazardous Material and Waste Sites within 0.5 Miles of the IC Project Alignment

Project Segment	Source Database	Facility Name	Location	Type	Distance (miles/direction)
1	RCRAInfo	A and R Anchor Big Pine Reservation	37.152, -118.283	Small Quantity Generator	0.5 / NE
2	Enviromapper	Luz Solar Partners VI through VII	35.024, -117.552,	Hazardous Waste Generating Facility	> 0.1 / W
3N	Envirostor	Oriental Mill Site	34.874, -116.891	Suspected Contaminant Site (heavy metals)	> 0.1 / SW
3N	Envirostor	Waterloo Mill Site	34.876, -116.891	Suspected Contaminant Site (heavy metals)	> 0.1 / W
3N	Geotracker	Fort Irwin Road Land Treatment Facility	34.975, -117.002	Contaminated Soil Disposal Site (Capped)	0
3N, 3S, 4	USEPA TRI	Reliant Energy Coolwater Electric Generating Station	34.863, -116.853	Handling of dioxin/ dioxin-like compounds	0
3S	USEPA TRI	Airco Industrial Gases	34.858, -116.855	Industrial Gas Manufacturing	> 0.1 / E
4	Envirostor	Reliant Energy Coolwater LLC	34.863, -116.853	Hazardous Waste Management Unit (Clean closed)	> 0.5 / E

4.9.1.2 Airports, Airstrips, and Heliports

Public airports, public use airports, private airstrips within two miles of the IC Project Alignment, and airports with land use plans in which the IC Project Alignment is located, are presented in Table 4.9-2 below and shown in Figureset 4.9-2.

Table 4.9-2: Airports and Airstrips

Project Segment	Facility	Location	Type	Distance from Project Alignment (miles/direction)
1	Lone Pine/Death Valley Airport*	36.590, -118.047, Lone Pine	Public Airport	0.4 / W
1	Independence Airport	36.810, -118.203, Independence	Public Airport	1.0 / NW
1	Inyokern Airport*	35.662, -117.825, Inyokern	Public Airport	1.1 / W
2	Inyokern Airport*	35.662, -117.825, Inyokern	Public Airport	1.6 / NW
4	Harvard Airstrip	34.962, -116.675	Private Airstrip	1.8 / NW
4	Baker Airport*	35.286, -116.081, Baker	Public Airport	0.3 / N

* Airport with land use plan in which the IC Project Alignment is located.

4.9.1.2.1 Military Installations

Two military aviation installations—the China Lake Naval Air Weapons Station (CLNAWS) and Edwards Air Force Base—are located adjacent to Segments 1 and 2, respectively. Each installation has unique flying operations, and their primary missions are to test military aircraft and weapon system (Kern County 2012). The IC Project Alignment is approximately 5 miles from the nearest runway at the China Lake Naval Air Weapons Station. A portion of Segment 3N is routed through the formerly-used Victorville Precision Bombing Range N-1.

4.9.1.3 Emergency Response

The California Emergency Management Agency (Cal/EMA) established a Standard Emergency Management System (SEMS) to harmonize incident command, mutual aid agreements, roles, responsibilities, and training. Kern County, Inyo County, San Bernardino County, and the City of Barstow each have developed and implemented emergency response plans. No designated evacuation routes are crossed by the IC Project Alignment or identified in the area.

4.9.1.3.1 Inyo County

Per Inyo County Code Section 2.56.080, the Inyo County Disaster Council is responsible for development of a county emergency plan. The Inyo County Director of Emergency Services is empowered to request a local emergency proclamation or proclaim a local emergency when the Board of Supervisors is not in session. All officers and employees of the county and enrolled volunteers constitute its emergency organization.

4.9.1.3.2 Kern County

Kern County Fire Department (KCFD) maintains and implements a SEMS-based Emergency Operations Plan (EOP). The EOP is administered by the KCFD Office of Emergency Services which is responsible for coordinating local incident response. The EOP contains specific guidance for hazardous materials incident response. (KCFD 2008)

4.9.1.3.3 San Bernardino County

SBCFD maintains and implements a SEMS-based EOP. The Office of Emergency Services administers the EOP and coordinates with several cities and towns, special districts, state and federal agencies, and non-governmental organizations (NGOs). (SBCFD 2013)

4.9.1.3.4 City of Barstow

The City of Barstow maintains and implements a SEMS-based EOP. The EOP contains Annexes describing plans for hazardous materials releases, airplane crashes, and wildfires. (City of Barstow 2015)

4.9.1.4 Wildland Fires

Fire departments and services located along the IC Project Alignment are presented in Section 4.15.1.1, Fire Protection.

Within California, fire hazard severity zones are designated by the California Department of Forestry and Fire Protection (CALFIRE). Fire hazard severity zone levels range from moderate to very high. Fire hazard severity zones are administered by the federal, state, or local government that is financially responsible for preventing and suppressing wildfires in a given area, and are categorized into the following three groups:

- Federal Responsibility Areas: The federal government is financially responsible for wildfire suppression
- State Responsibility Areas: The state is financially responsible for wildfire suppression
- Local Responsibility Areas: Cities or counties are financially responsible for wildfire suppression

The existing subtransmission lines and substations associated with the Full-Rebuild Concept are located within all three responsibility areas. The majority of the IC Project Alignment is located within the CAL FIRE moderate fire hazard severity zone. The majority of the remainder of the IC Project Alignment is located within the CAL FIRE high and very high fire hazard severity zones; some portions of the IC Project Alignment are located in areas designated as non-wildland/non-urban land. Tabular information on the miles of IC Project Alignment located within these zones is presented in Table 4.9-3 below, and shown graphically on Figure 4.9-3, Fire Hazard Severity Zones. CPUC Fire-Threat Map data is also presented in Figure 4.9-3. Figureset 4.9-4, Wildland-Urban Interface, illustrates the wildland-urban interfaces along the IC Project Alignment.

Table 4.9-3: Miles of IC Project Alignment within Designated Fire Hazard Severity Zones

Project Segment		Distance (miles)	SRA	LRA	FRA	URA
1	Very High	—	—	—	—	—
	High	81.3	61	2.6	17.2	0.5
	Moderate	42.2	0.9	18.4	22.9	—
	Unzoned	2.8	—	2.2	0.6	—
2	Very High	—	—	—	—	—
	High	—	—	—	—	—
	Moderate	46.5	—	22.3	24.2	1.9
	Unzoned	—	—	—	—	—
3N	Very High	—	—	—	—	—
	High	—	—	—	—	—
	Moderate	42.1	—	20.4	12	9.7
	Unzoned	2.2	—	2.1	—	0.1
3S	Very High	—	—	—	—	—
	High	—	—	—	—	—
	Moderate	41.50	—	20.1	7	14.4
	Unzoned	2	—	2	—	—
4	Very High	—	—	—	—	—
	High	—	—	—	—	—
	Moderate	93.4	—	29	59.7	4.7
	Unzoned	—	—	—	—	—

Abbreviations:
FRA: Federal Responsibility Area SRA: State Responsibility Area;
LRA: Local Responsibility Area; URA: Unspecified Responsibility Area
Source: CALFIRE 2018

4.9.1.5 Schools

No school buildings are located within 0.25 miles of the IC Project Alignment in Segments 1, 2, 3N, or 3S. In Segment 4, four school buildings are located within 0.25 mile of the IC Project Alignment: Baker Elementary, Baker Junior High School, Baker High School, and Baker Valley Day School. All four are found in a single cluster in the community of Baker at 72100 School House Lane, approximately 0.25 mile south of the IC Project Alignment.

4.9.2 Regulatory Setting

Federal, state, and local regulations were reviewed for applicability to the IC Project.

4.9.2.1 Federal

4.9.2.1.1 Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) of 1980 (42 U.S.C. § 9601 et seq.)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a federal Superfund to clean up uncontrolled or abandoned hazardous-waste sites, as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through CERCLA, EPA has the power to seek out those parties responsible for any release and ensure their cooperation in the cleanup.

4.9.2.1.2 The Superfund Amendments and Reauthorization Act of 1986 Title III (40 CFR § 68.110 et seq.)

The Superfund Amendments and Reauthorization Act (SARA) amended CERCLA and established a nationwide emergency planning and response program, and imposed reporting requirements for businesses that store, handle, or produce significant quantities of extremely hazardous materials. The act requires states to implement a comprehensive system to inform local agencies and the public when a significant quantity of such materials is stored or handled at a facility. Additionally, SARA identifies requirements for planning, reporting, and notification concerning hazardous materials.

4.9.2.1.3 Clean Water Act (33 U.S.C. Section 1251 et seq.)

The CWA is the principal federal statute protecting navigable waters and adjoining shorelines from pollution. The law was enacted with the intent of restoring and maintaining the chemical, physical, and biological integrity of the waters of the United States. Since its enactment, the CWA has formed the foundation for regulations detailing specific requirements for pollution prevention and response measures. The United States EPA implements provisions of the CWA through a variety of regulations, including the National Contingency Plan and the Oil Pollution and Prevention Regulations. Implementation of the CWA is the responsibility of each state.

4.9.2.1.4 Clean Air Act

The Clean Air Act (CAA) provides measures aimed at preventing the accidental release of hazardous materials into the atmosphere. Regulations implementing the CAA and governing hazardous materials emissions are provided in Title 40, Part 68 of the CFR. Implementation of these regulations is intended to prevent the accidental release of hazardous materials into the environment.

4.9.2.1.5 Resource Conservation and Recovery Act (42 U.S.C. §6901 et seq.)

The Resource Conservation and Recovery Act (RCRA) regulates hazardous waste from the time that waste is generated, through to its management, storage, transport, and treatment, until its final disposal. The EPA has authorized the Department of Toxic Substances Control (DTSC) in California and the NDEP to administer their respective RCRA programs.

4.9.2.1.6 U.S. Department of Transportation

The USDOT has the regulatory responsibility for the safe transportation of hazardous materials under the Hazardous Materials Transportation Act (HMTA), as amended and codified in 49 U.S.C. 5101 et seq.

4.9.2.1.7 Code of Federal Regulations Title 14

All airports and navigable airspace not administered by the DoD are under the jurisdiction of the Federal Aviation Administration (FAA). Title 14, Part 77 of the CFR establishes the standards and required notification for objects affecting navigable airspace. In general, construction projects exceeding 200 feet in height—or those extending at a ratio greater than 100 to 1 (horizontal to vertical) from a public or military airport runway more than 3,200 feet long, out to a horizontal distance of 20,000 feet—are considered potential obstructions and require FAA notification. In addition, construction projects extending at a ratio greater than 50 to 1 (horizontal to vertical) from a public or military airport runway measuring 3,200 feet or less, out to a horizontal distance of 10,000 feet, are considered potential obstructions and require FAA notification. Title 14, Part 133 of the CFR also requires an operating plan to be developed in coordination with and approved by the local FAA Flight Standards District Office that has jurisdiction over when helicopter use would be required.

4.9.2.1.8 Occupational Safety and Health Administration (29 CFR 1900-1910)

Established under the OSHA Act of 1970, OSHA regulates workplace safety and health. The agency's mission is to prevent work-related injuries, illnesses, and deaths.

4.9.2.1.9 Hazard Management and Resource Restoration Program

The Hazard Management and Resource Restoration (HMRR) program is administered by the BLM. Its mission is to protect lives, resources, and property, and to improve the health of landscapes and watersheds by: (1) minimizing the environmental contamination on public lands, (2) reducing and eliminating risk associated with physical and environmental hazards, (3) restoring resources impacted by oil discharges and hazardous release, and (4) administering CERCLA assessments.

4.9.2.2 State

4.9.2.2.1 California Environmental Protection Agency

The California Environmental Protection Agency (Cal/EPA) is the California state agency responsible for developing, implementing, and enforcing the state's environmental protection laws that ensure clean air, clean water, clean soil, safe pesticides, and waste recycling and reduction. Cal/EPA oversees the DTSC and State Water Resources Control Board (SWRCB). Cal/EPA has implementation authority for the Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program) per CCR Title 27, Division 1, Subdivision 4, Chapter 1.

4.9.2.2.2 California Emergency Management Agency

The California Emergency Management Agency (Cal/EMA) was formed January 1, 2009, as the result of a merger between the Governor's Office of Emergency Services (OES) and the Office of Homeland Security (OHS). The Hazardous Materials Unit of the Cal/EMA is responsible for hazmat emergency planning and response, spill release and notification, and hazmat enforcement of the Unified Program.

4.9.2.2.3 Department of Toxic Substances Control

Under Government Code Section 65962.5(a), the DTSC is required to compile and update as appropriate, but at least annually, and submit to the Secretary for Environmental Protection a list of all of the following: 1) All hazardous waste facilities subject to corrective action pursuant to Section 25187.5 of the Health and Safety Code. 2) All land designated as hazardous waste property or border zone property pursuant to Article 11 (commencing with Section 25220) of Chapter 6.5 of Division 20 of the Health and Safety Code.

4.9.2.2.4 Division of California Occupational Safety and Health, Department of Industrial Relations

The Division of California Occupational Safety and Health protects workers and the public from safety hazards (CCR Title 8).

4.9.2.2.5 California State Hazard Mitigation Plan

The 2018 California State Hazard Mitigation Plan (SHMP) represents the state's primary hazard mitigation guidance document. The 2018 SHMP continues to build upon the state's commitment to reduce or eliminate potential risks and impacts of natural and human-caused disasters to help communities with their mitigation and disaster resiliency efforts. The 2018 plan includes: an updated statewide risk assessment, disaster history, and statistics; recent mitigation progress, success stories, and best practices; updated state hazard mitigation goals, objectives, and strategies; and updated climate mitigation progress and adaptation strategies. FEMA approved California's 2018 SHMP on September 28, 2018.

4.9.2.2.6 California Public Utilities Commission General Order 95

General Order 95 (GO 95) contains requirements and specifications for overhead electrical line construction. These requirements are intended to ensure safety to workers engaged in the construction, O&M, and use of electrical facilities. The regulations are also intended to ensure the general reliability of the state's utility infrastructure and services. Rule 35 of GO 95 establishes minimum clearances between line conductors and nearby vegetation for fire prevention purposes. These minimum clearances must be maintained through tree trimming prior to construction and throughout O&M of utility facilities.

4.9.2.2.7 California Public Utilities Commission General Order 166

The purpose of the standards contained in GO 166 is to ensure that jurisdictional electric utilities are prepared for emergencies and disasters in order to minimize damage and inconvenience to the public which may occur as a result of electric system failures, major outages, or hazards posed by damage to electric distribution facilities. The standards require, among others, that each jurisdictional electric utility prepare an emergency response plan and update the plan annually; conduct annual emergency training and exercises using the utilities emergency response plan; and coordinate emergency plans with state and local public safety agencies.

4.9.2.2.8 Public Resources Code §§ 4292-4293

Public Resources Code (PRC) Section 4292 require a 10-foot clearance of any tree branches or ground vegetation from around the base of power poles carrying more than 110 kV. The firebreak clearances required by PRC Section 4292 are applicable within an imaginary cylindrical space surrounding each pole or tower on which a switch, fuse, transformer or lightning arrester is attached and surrounding each dead-end or corner pole. PRC Section 4293 presents guidelines for line clearance including a minimum of 10 feet of vegetation clearance from any conductor operating at 110 kV or higher.

4.9.2.2.9 Health and Safety Code § 13009

Health and Safety Code Section 13009 permits the California Department of Forestry and Fire Protection (CALFIRE) to file civil actions to recover fire suppression costs from a party who causes a fire (1) negligently, or (2) in violation of a law or an order to correct a fire hazard. CAL FIRE established a Civil Cost Recovery (CCR) Program to satisfy the statute's intent to assign financial responsibility to culpable parties and to prevent fires through deterrence.

4.9.2.3 Local

The California Public Utilities Commission (CPUC) has sole and exclusive state jurisdiction over the siting and design of the IC Project. Pursuant to CPUC General Order 131-D (GO 131-D), Section XIV.B, "Local jurisdictions acting pursuant to local authority are preempted from regulating electric power line projects, distribution lines, substations, or electric facilities constructed by public utilities subject to the CPUC's jurisdiction. However, in locating such projects, the public utilities shall consult with local agencies regarding land use matters." Consequently, public utilities are directed to consider local regulations and consult with local agencies, but the counties' and cities' regulations are not applicable as the counties and cities do not have jurisdiction over the IC Project. Accordingly, the following discussion of local land use regulations is provided for informational purposes only.

4.9.2.3.1 Certified Unified Program Agency

The CUPA is the agency certified by the DTSC to conduct the Unified Program. The program consists of hazardous waste generator and on-site treatment programs, aboveground and underground storage tank programs, Hazardous Materials Management, Business Plans, and Inventory Statements, and the Risk Management and Prevention Program.

4.9.2.3.2 Inyo County Environmental Health Department

The Inyo County Environmental Health Department, Hazardous Materials Program, is the CUPA responsible for administering the hazardous materials program within Inyo County.

4.9.2.3.3 Kern County Environmental Health Services Division

The Kern County Environmental Health Services Division is the CUPA responsible for administering the hazardous materials program within the Kern County.

4.9.2.3.4 San Bernardino County Fire Department

The San Bernardino County Fire Department, Hazardous Materials Division, is the CUPA responsible for administering the hazardous materials program within San Bernardino County.

4.9.2.3.5 Inyo County and City of Bishop Multi-Jurisdictional Hazard Mitigation Plan

The Inyo County and City of Bishop Multi-Jurisdictional Hazard Mitigation Plan (ICCB 2016) establishes a strategy for Inyo County to reduce hazard impacts. The Plan focuses on hazard mitigation in reducing the impacts of disasters by identifying effective and feasible actions to reduce the risks posed by potential hazards. The Plan develops mitigation actions to strengthen community resilience, which helps ensure coordinated and consistent hazard mitigation activities across Inyo County. The County and the City have developed this Plan to be consistent with current standards and regulations, ensuring that the understanding of hazards facing the communities reflects best available science and current conditions. The Plan is also consistent with Federal Emergency Management Agency (FEMA) requirements.

4.9.2.3.6 Kern Multi Jurisdiction Hazard Mitigation Plan

Kern County and several participating jurisdictions prepared in 2012 a Comprehensive Update to the Multi Jurisdiction Hazard Mitigation Plan (MHMP), originally approved by the Federal Emergency Management Agency (FEMA) in 2006. The purpose of this plan is to guide hazard mitigation planning to better protect the people and property of the County from the effects of hazard events. The plan demonstrates the commitment of each participating jurisdiction to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources.

4.9.2.3.7 San Bernardino County Multi-Jurisdictional Hazard Mitigation Plan

The purpose of the Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) is to demonstrate the plan for reducing and/or eliminating risk in the unincorporated area of the County and within areas overseen or managed by the Flood Control District, Fire District and Special Districts Department. The MJHMP process encourages communities within the unincorporated county to develop goals and projects that will reduce risk and build a more disaster resilient community by analyzing potential hazards.

4.9.3 Significance Criteria

4.9.3.1 California Environmental Quality Act (CEQA)

The significance criteria for assessing the impacts to hazards and hazardous materials come from the California Environmental Quality Act (CEQA) Environmental Checklist. According to the CEQA Checklist, a project causes a potentially significant impact if it would:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment
- Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school
- Be located on a site that is included on a list of hazardous material sites, compiled pursuant to Government Code Section 65962.5, and as a result would create a significant hazard to the public or the environment
- For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, the Proposed Project would result in a safety hazard for people residing or working in the Proposed Project area
- For a project within the vicinity of a private airstrip, the Proposed Project would result in a safety hazard for people residing or working in the Proposed Project area
- Would the project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?
- Would the project expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

4.9.4 Impact Analysis

4.9.4.1 Would the project create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

4.9.4.1.1 Construction

Less than Significant Impact with Mitigation. No acutely hazardous materials would be used or stored on location during construction of the Full-Rebuild Concept. Construction of the Full-Rebuild Concept would require the use of gasoline, diesel fuel, oil, solvents, and lubricants associated with vehicles and construction activities. Hazardous materials management would include compliance with a project-specific SWPPP and a spill prevention, control, and countermeasures (SPCC) Plan, if necessary, and implementation of best management practices (BMPs) related to fueling and the handling, use and storage of hazardous materials. All transport of hazardous materials would comply with applicable laws, rules, and regulations, and would use applicable BMPs, including the acquisition of required shipping papers, package marking, labeling, transport vehicle placarding, training, and registrations. SCE crews and/or SCE's construction contractor would implement proper hazardous materials management activities, which would include preparation and implementation of plan(s) such as a hazardous materials management plan for the Full-Rebuild Concept, before field construction activities begin that would outline the proper procedures for the handling, use, storage, and disposal of hazardous materials.

An inadvertent release could also occur from the use of hazardous materials during construction within temporary storage sites, while transporting hazardous materials to and from work areas, or during refueling and servicing of equipment. However, a Full-Rebuild Concept-specific Hazardous Materials Management Plan (HMMP), as specified in APM HAZ-1, would be prepared and implemented throughout construction of the Full-Rebuild Concept. The plan would include safety information regarding the transport, use, and disposal of hazardous materials. In addition, all transport, use, and disposal of hazardous materials would be in compliance with applicable laws, rules, and regulations.

Depending on the type, condition, and original chemical treatment, any wood poles removed would be returned to a staging yard and either reused by SCE, returned to the manufacturer, disposed of in a Class I hazardous waste landfill, or in a RWQCB-approved Class III landfill or equivalent facility.

All hazardous materials would be transported, used, and disposed of in accordance with applicable rules, regulations, and SCE standard protocols designed to protect the environment, workers, and the public. Implementation of APM HAZ-1 would result in less than significant impacts.

4.9.4.1.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.9.4.2 Would the project create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

4.9.4.2.1 Construction

Less than Significant Impact. Construction of the Full-Rebuild Concept would require the limited use of hazardous materials, such as fuels, lubricants, and cleaning solvents. As described in Chapter 3, fuel storage and refueling of vehicles helicopters may occur in designated areas during construction activities. A small volume of fuels, lubricants, and solvents with low toxicity are anticipated to be used during the construction of the Full-Rebuild Concept. All hazardous materials would be stored, handled, and used in accordance with applicable regulations, and safety data sheets (SDS) would be available. The most likely incidents involving these hazardous materials are associated with minor spills or drips.

A site-specific construction SWPPP would be prepared and followed, as applicable, to ensure quick response to minor spills and minimal impacts to the environment. The SWPPP would identify the locations for storing hazardous materials during construction, as well as protective measures, notification, and cleanup requirements for any incidental spills or other potential releases of hazardous materials.

In the event of a release of hazardous materials, such as minor spills and drips from construction equipment and refueling, SCE would use the SWPPP as guidance for appropriate handling and response. In addition, implementation of the WEAP as described in Chapter 3 would provide site personnel with instruction on the SWPPP and site-specific BMPs, when applicable.

During construction, the potential exists that subsurface utilities (e.g., a natural gas line) or structures (e.g., an underground storage tank) might be encountered and damaged, resulting in a release of a hazardous material. During construction, screening activities would include contacting DigAlert, conducting visual observations, and using buried line locating equipment. In addition, SCE would develop and implement an HMMP per APM HAZ-1 to further reduce the risk of hazards to the public, workers, and the environment.

A low potential exists for contaminated soil to be encountered during excavation or other ground-disturbing activities. SCE would develop and implement a Soil Management Plan per APM HAZ-2. The Plan would direct that, if encountered, contaminated soil would be segregated, sampled, and tested to determine appropriate treatment and disposal options. If the soil is classified as hazardous, it would be properly managed on location and transported in accordance with the U.S. Department of Transportation regulations using a Uniform Hazardous Waste Manifest to a Class I Landfill or other appropriate soil treatment or recycling facility. Similarly, there is a low potential for encountering contaminated groundwater during excavation or other ground-disturbing activities. No contaminated groundwater underlying Full-Rebuild Concept construction work areas was identified during the review of Envirostor and Geotracker data. If, however, potentially-contaminated groundwater is encountered, then groundwater samples would be collected and tested to determine appropriate treatment and disposal. Hazardous materials would be transported, used, and disposed of in accordance with applicable rules, regulations, and SCE standard protocols designed to protect the environment, workers, and the public. Further, SCE does not believe there is a reasonable risk of impacts associated with unexploded ordnance or heavy metal contamination within the boundaries of the Victorville Precision Bombing Range N-1 along Segment 3N): transmission lines, including the IC Project subtransmission line, have been built through the Range with no currently-known legacy hazards at the locations where these lines were installed. In addition, given the sparse population in the area, there is no reasonably foreseeable situation where a member of the public would be exposed to unexploded ordnance or materials hazards associated with construction within the Range.

Based on small quantities of hazardous materials to be used during construction, implementation of project-related training and procedures, and absence of known contaminated sites in locations where the Full-Rebuild Concept would be constructed, less than significant impacts are anticipated during construction of the Full-Rebuild Concept. Implementation of APMs HAZ-1 and HAZ-2 would further reduce these less than significant impacts.

4.9.4.2.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.9.4.3 Would the project emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

4.9.4.3.1 Construction

Less than Significant Impact. Four schools in the community of Baker are located within 0.25 miles of the IC Project Alignment. Hazardous materials to be used during the construction of the Full-Rebuild Concept would consist of low-toxicity materials including gasoline, diesel fuel, oil, solvents, and lubricants associated with the construction equipment and vehicles and construction activities. The low-toxicity materials would be used at all Full-Rebuild Concept construction sites. All hazardous materials would be stored, handled, and used in accordance with applicable regulations. No acutely hazardous materials (as defined in Tit. 22 Cal. Code Regs. § 66260.10) would be used or stored on location during construction activities.

Due to the low toxicity of materials associated with the Full-Rebuild Concept, and implementation of a construction SWPPP that would include good housekeeping, spill containment and response measures, and waste management BMPs, impacts would be less than significant. Implementation of APM HAZ-1 would further reduce these less than significant impacts.

4.9.4.3.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.9.4.4 Would the project be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

4.9.4.4.1 Construction

Less than Significant Impact with Mitigation. The Full-Rebuild Concept would be constructed in part on a site that is currently identified on a list compiled pursuant to Government Code Section 65962.5. The SCE Coolwater Generating Station was the site of a release to soil that has been remediated; in 2014, DTSC deemed no further action was needed at this location and the site was approved for unrestricted land use. (DTSC 2014)

In addition, a short (~0.25 mile long) portion of Segment 1 traverses, or is immediately adjacent to, the Jorgensen Reduction Plant site, a tungsten ore processing plant which operated from the early 1940s to the mid-1950s. DTSC records indicate evaluation is needed associated with the historical operation of this facility. Components of the Full-Rebuild Concept may be constructed within the affected area of this facility. SCE would develop and implement a Soil Management Plan as described in APM HAZ-2 to ensure the appropriate identification, sampling, management, and disposal of potentially contaminated soils. If the soil is classified as hazardous, the soil would be properly profiled, manifested, and transported to a Class I landfill or other appropriate soil treatment or recycling facility. Given implementation of these protocols and APM HAZ-2, less than significant impacts are anticipated from construction of the Full-Rebuild Concept.

4.9.4.4.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.9.4.5 For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Proposed Project result in a safety hazard for people residing or working in the Proposed Project area?

4.9.4.5.1 Construction

Less than Significant Impact. Portions of the IC Project Alignment in Segment 1 traverse areas addressed in the Inyo County Airport Hazard Overlay District and Kern County Airport Land Use Compatibility Plan. In Segments 2 and 4, respectively, the IC Project Alignment is within two miles of, and crosses the plane of imaginary surfaces or airport land use plan buffers at, Inyokern Airport and Baker Airport.

While the Full-Rebuild Concept would be constructed within two miles of public airports, the existing subtransmission infrastructure would be replaced in or immediately adjacent to the existing alignment. Prior to construction, SCE would submit the required Notice of Proposed Construction or Alteration to the FAA pursuant to Title 14 CFR, Section 77.9 for any replacement structures or alterations that require noticing.

Further, SCE would coordinate with local airports regarding helicopter operations and flight plans during project construction. Therefore, the impact would be less than significant.

4.9.4.5.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.9.4.6 For a project within the vicinity of a private airstrip, would the Proposed Project result in a safety hazard for people residing or working in the Proposed Project area?

4.9.4.6.1 Construction

No Impact. The IC Project Alignment is not located in the vicinity of a private airstrip; therefore, no impacts would occur under this criterion.

4.9.4.6.2 Operations

No Impact. The IC Project Alignment is not located in the vicinity of a private airstrip; therefore, no impacts would occur under this criterion.

4.9.4.7 Would the project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

4.9.4.7.1 Construction

Less than Significant Impact. As discussed in Section 4.17, construction of the Full-Rebuild Concept would not be expected to significantly impact traffic circulation or increase demands on existing emergency response services during temporary construction activities, and would not significantly impact emergency access in the area or increase the demand for existing emergency response services. Although it is not anticipated that construction activities would result in the blockage of any roadways that could be used in the case of an emergency, in the event that any construction-related activity may result in such a blockage or closure, SCE would implement APM TRA-1, which calls for coordination with local authorities including emergency responders regarding appropriate procedures. As directed in APM TRA-1, construction activities completed within public street rights-of-way would require the use of a traffic control service, and all lane closures would be conducted in accordance with APM TRA-1. The impacts associated with construction activities would be less than significant under this criterion.

4.9.4.7.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.9.4.8 Would the project expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

4.9.4.8.1 Construction

Less than Significant Impact. As previously discussed, the majority of the Full-Rebuild Concept components are located within the CAL FIRE moderate fire hazard severity zone. Some Full-Rebuild Concept components are located within the high and very high fire hazard severity zone, and in areas are designated as non-wildland/non-urban land.

High heat or sparks from vehicles or equipment have the potential to ignite dry vegetation and cause fires. However, Full-Rebuild Concept construction activities would generally be located within existing SCE owned and/or to-be-acquired ROWs where vegetation would be cleared or trimmed. Vehicles and equipment would primarily use existing roads, and would also use an overland travel method in temporary construction areas containing vegetation. In addition, SCE would implement standard fire prevention protocols during construction activities and comply with applicable laws and regulations. In addition, SCE would develop and implement a Fire Prevention and Emergency Response Plan per APM HAZ-3.

In the event that the National Weather Service issues a Red Flag Warning during construction of the Full-Rebuild Concept, additional measures would be implemented to address smoking and fire rules, storage and parking areas, the use of gasoline-powered tools, the use of spark arresters on construction equipment, road closures, the use of a fire guard, fire suppression tools, fire suppression equipment, and training requirements. The portions of the Full-Rebuild Concept located within moderate to very high fire hazard severity zones would generally be grubbed/trimmed of vegetation and graded before the staging of equipment, thereby minimizing the potential for vehicles or equipment to start a fire. As a result of these measures, construction of the Full-Rebuild Concept would have a less than significant impact to the risk of loss, injury, or death involving wildland fires.

Within California, SCE participates with CAL FIRE, the California Governor's OES, and various city and county fire agencies in the Red Flag Fire Prevention Program, and complies with California PRC Sections 4292 and 4293 related to vegetation management in subtransmission line corridors. The portions of the Full-Rebuild Concept located within moderate or high fire hazard severity zones would generally be cleared of vegetation and graded prior to the staging of equipment, minimizing the risk of construction vehicles starting a fire. Based on SCE's participation in the Red Flag Fire Prevention Program and compliance with applicable state and federal laws and regulations during construction, impacts resulting from wildland fire would be less than significant.

4.9.4.8.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.9.5 Applicant Proposed Measures

The following APMs would be implemented to reduce hazards or hazardous materials impacts associated with the Full-Rebuild Concept:

HAZ-1: Prepare a Hazardous Materials Management Plan. SCE will prepare and implement a project specific Hazardous Materials Management Plan (HMMP), during project construction. The plan will outline proper hazardous materials handling, use, storage and disposal requirements, as well as hazardous waste management procedures. This plan will be developed to ensure that all hazardous materials and wastes will be handled and disposed of according to applicable rules and regulations.

The HMMP will address hazardous materials storage, employee training requirements, hazard recognition, fire safety, first aid/emergency medical procedures, hazardous materials release containment/control procedures, hazard communication training, PPE training, and release reporting requirements. If on site refueling is necessary, BMPs shall be implemented in accordance with the project SWPPP.

All construction personnel, including environmental monitors, will be made aware of state and federal emergency response reporting guidelines for accidental spills.

HAZ-2: Prepare a Soil Management Plan. A Soil Management Plan will be developed and implemented for the proposed project. The Soil Management Plan will provide guidance for the proper handling, on-site management, and disposal of impacted soil that may be encountered during construction activities. The Soil Management Plan will direct that during grading or excavation work, the construction contractor shall observe the exposed soil for visual evidence of contamination. If visual contamination indicators are observed during construction, potentially contaminated soil will be segregated, sampled, and tested to determine appropriate treatment and disposal options. Work in the area of the potentially contaminated soil will be stopped until appropriate measures are determined based on the testing results and are taken to protect human health and the environment. If the soil is classified as hazardous, it will be properly managed on location and transported in accordance with the U.S. Department of Transportation regulations using a Uniform Hazardous Waste Manifest to a Class I Landfill or other appropriate soil treatment or recycling facility. If potentially-contaminated groundwater is encountered, then groundwater samples will be collected and tested to determine appropriate treatment and disposal. Hazardous materials will be transported, used, and disposed of in accordance with applicable rules, regulations, and SCE standard protocols designed to protect the environment, workers, and the public.

HAZ-3: Prepare and Implement a Fire Management Plan. A Fire Prevention and Emergency Response Plan would be developed to ensure the health and safety of construction workers, SCE personnel, and the public during Project construction. The Plan shall cover:

- The purpose and applicability of the plan
- Responsibilities and duties
- Procedures for fire reporting, response, prevention, and evacuation routes
- Coordination procedures with federal and local fire officials

- Crew training, including fire safety practices and restrictions
- Method for verification that Plan protocols and requirements are being followed

A Project-specific fire prevention plan for construction of the project shall be prepared by SCE and submitted to CPUC, BLM, CAL FIRE, Inyo, Kern and San Bernardino counties, and local municipal fire agencies for review prior to initiation of construction.

4.9.6 Alternatives

Alternatives to the Full-Rebuild Concept are addressed in Section 5.2, Description of Project Alternatives and Impact Analysis.

4.9.7 References

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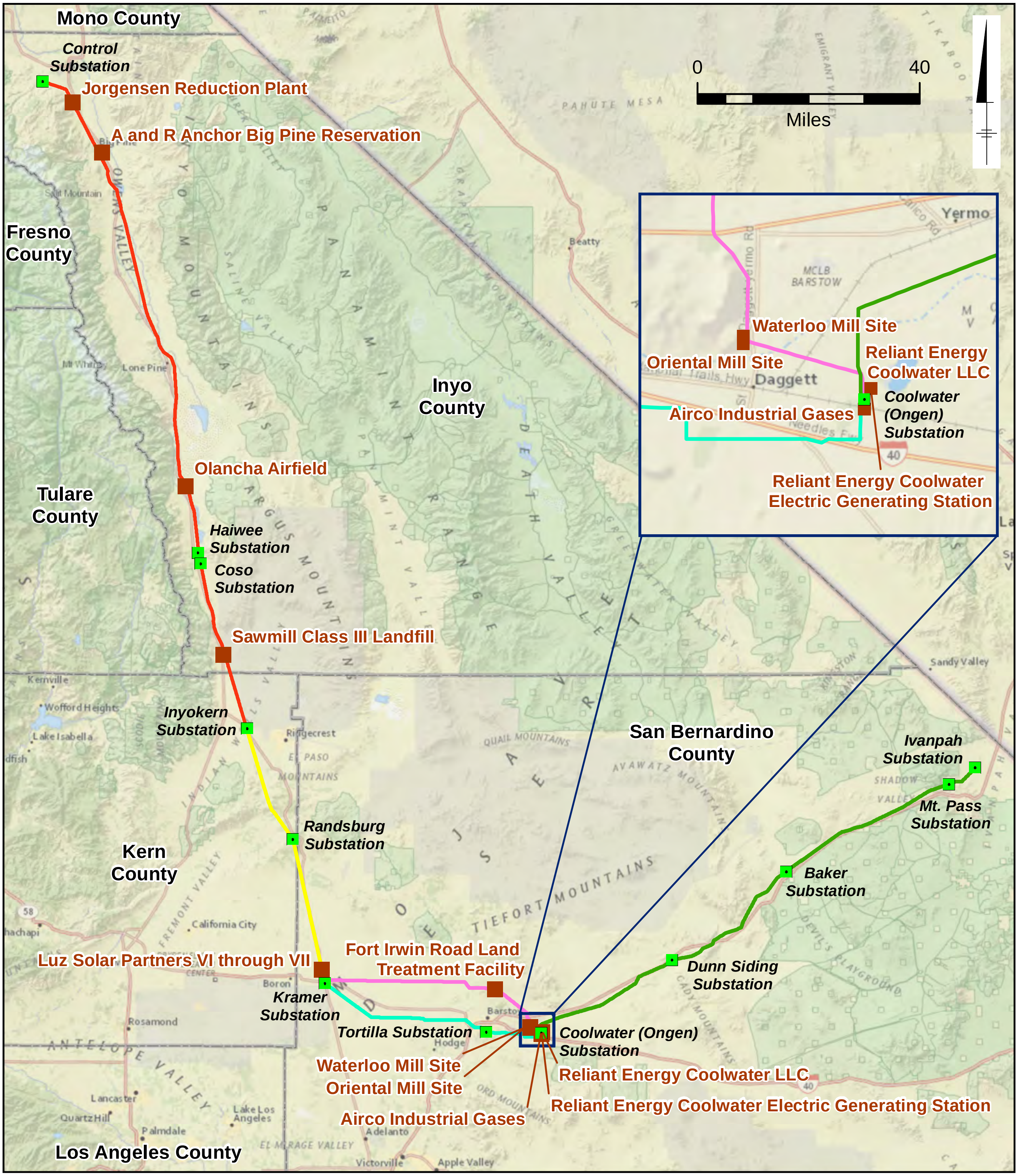

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- Substation
- Hazardous Material and Waste Sites
- County
- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
- Segment 4

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HAZARDOUS MATERIAL AND WASTE SITES WITHIN 0.5 MILES OF THE IC PROJECT ALIGNMENT

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FIGURE: 4.9-1

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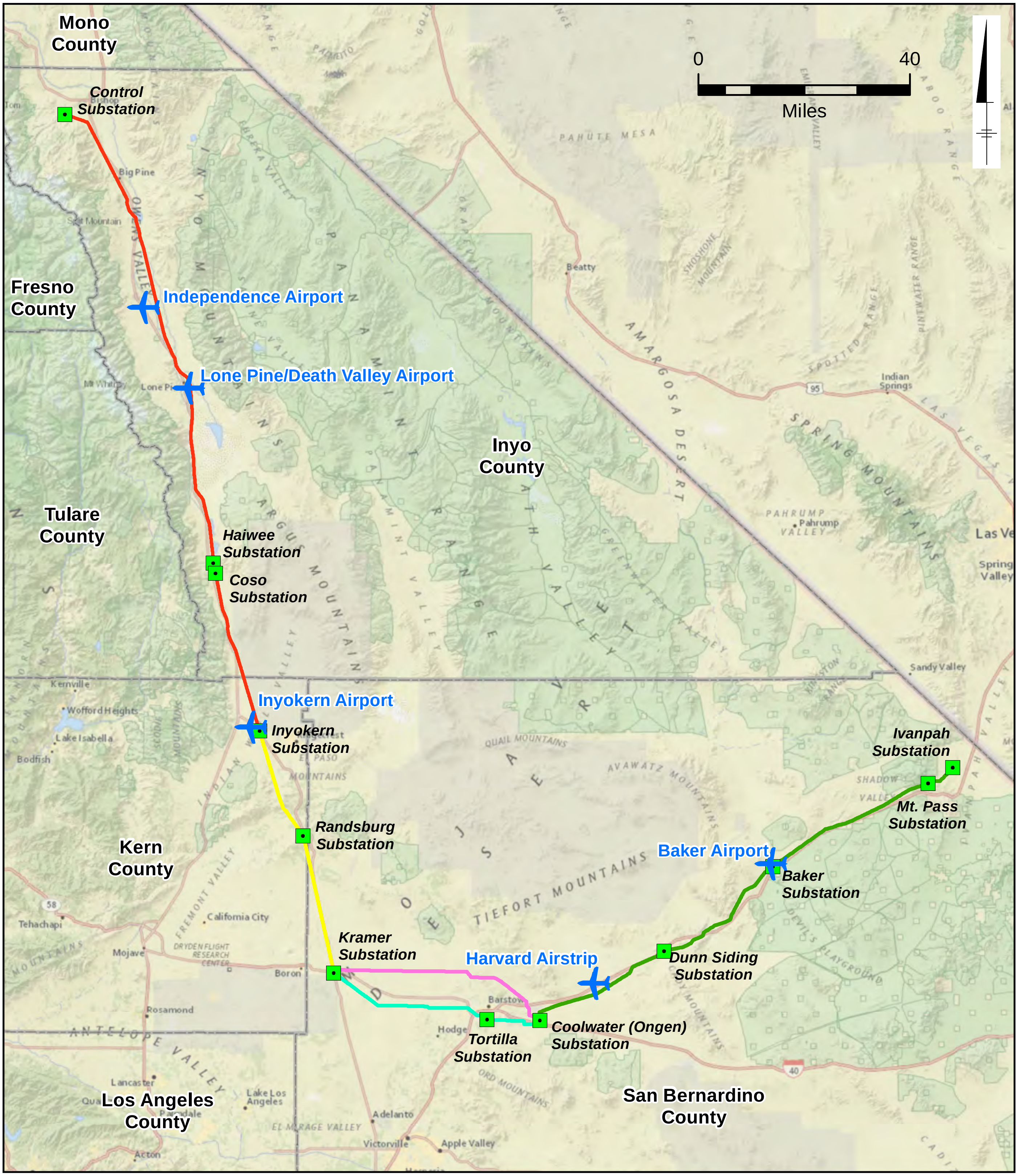

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- Airport and Airstrip
- Substation
- County
- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
- Segment 4

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IVANPAH-CONTROL PROJECT

AIRPORTS AND AIRSTRIPS

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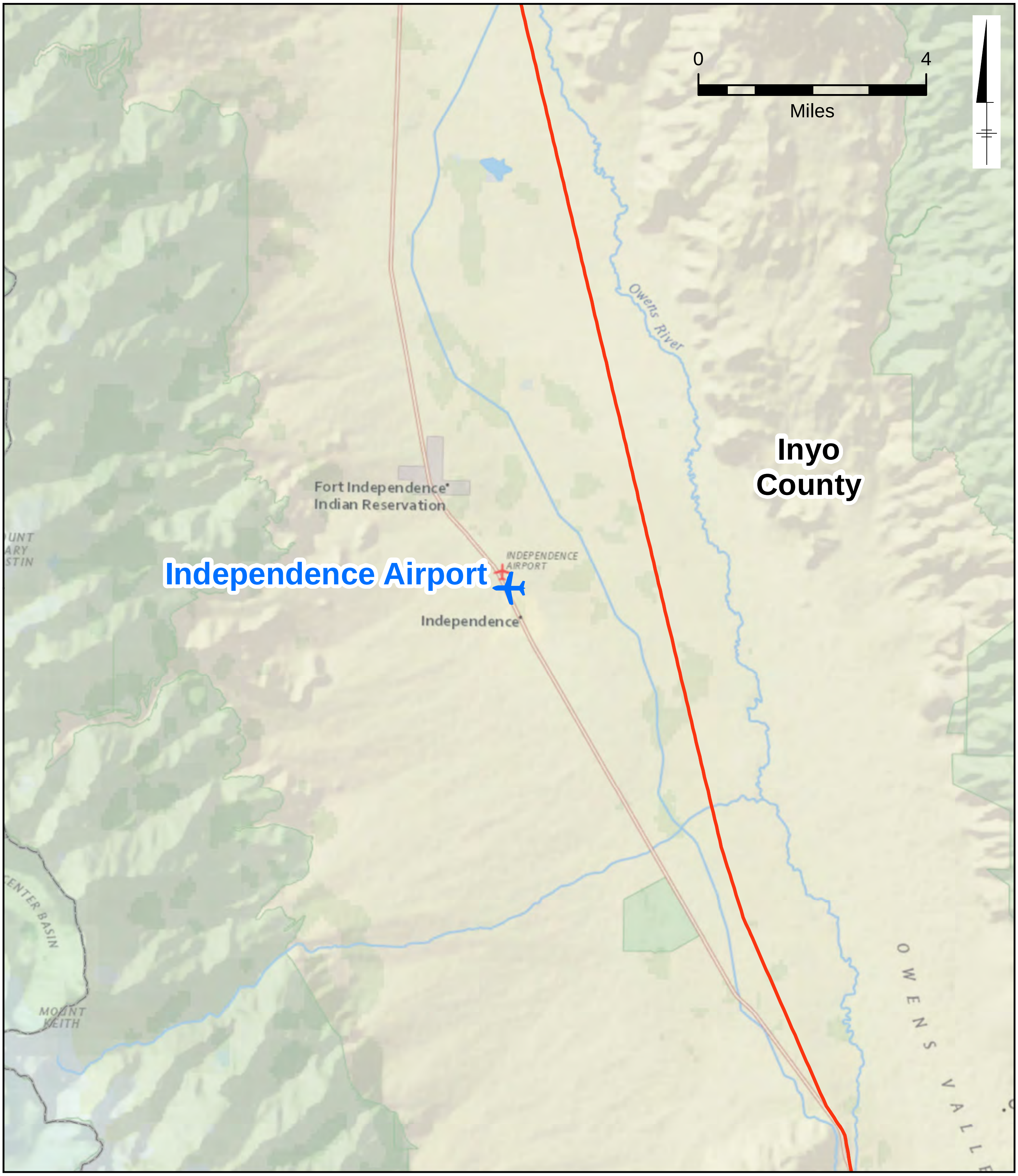
FIGURESET: 4.9-2



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Airport and Airstrip

Substation

County

Segment 1

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AIRPORTS AND AIRSTRIPS

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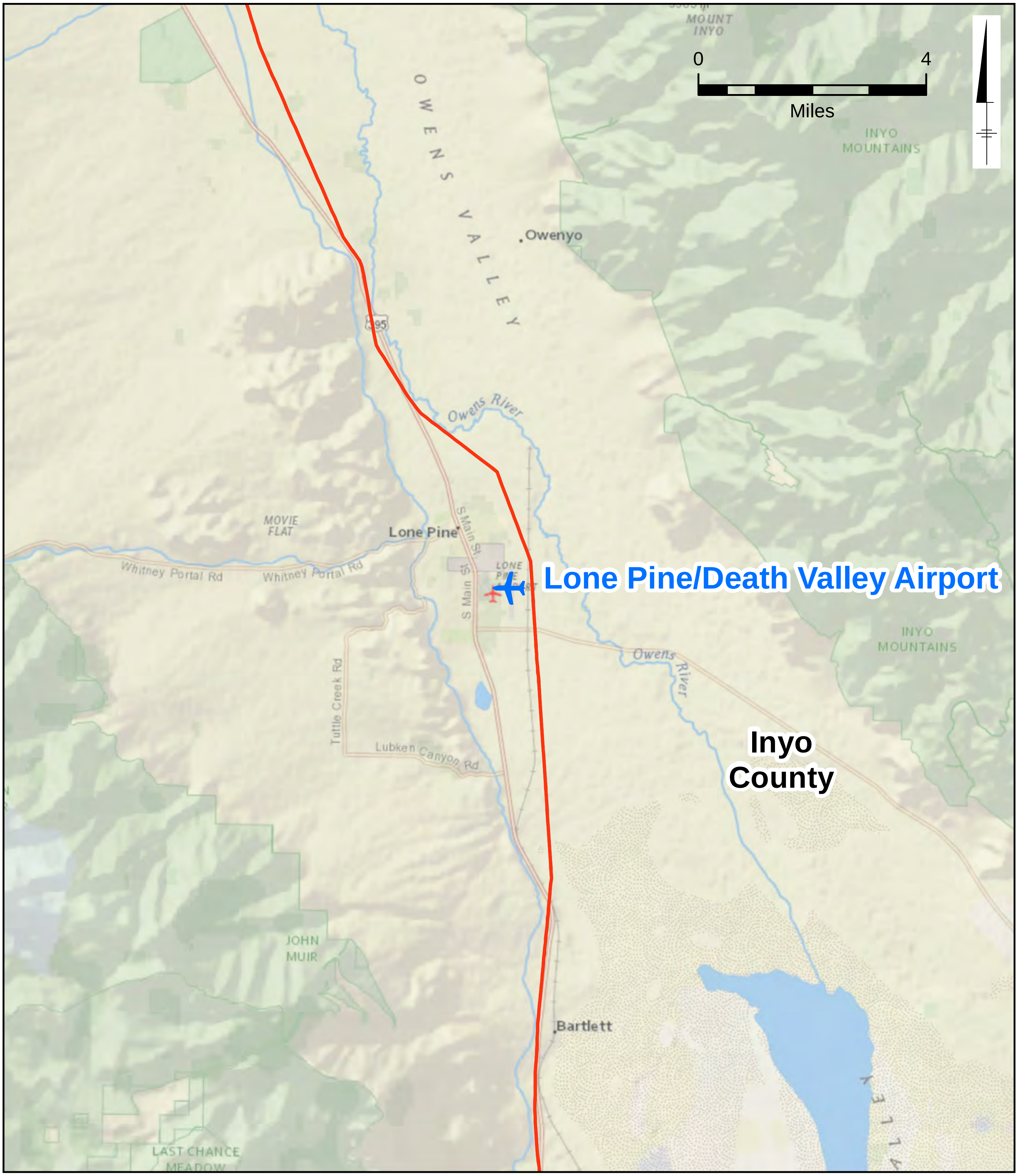

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- Airport and Airstrip
- Substation
- County
- Segment 1

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AIRPORTS AND AIRSTRIPS

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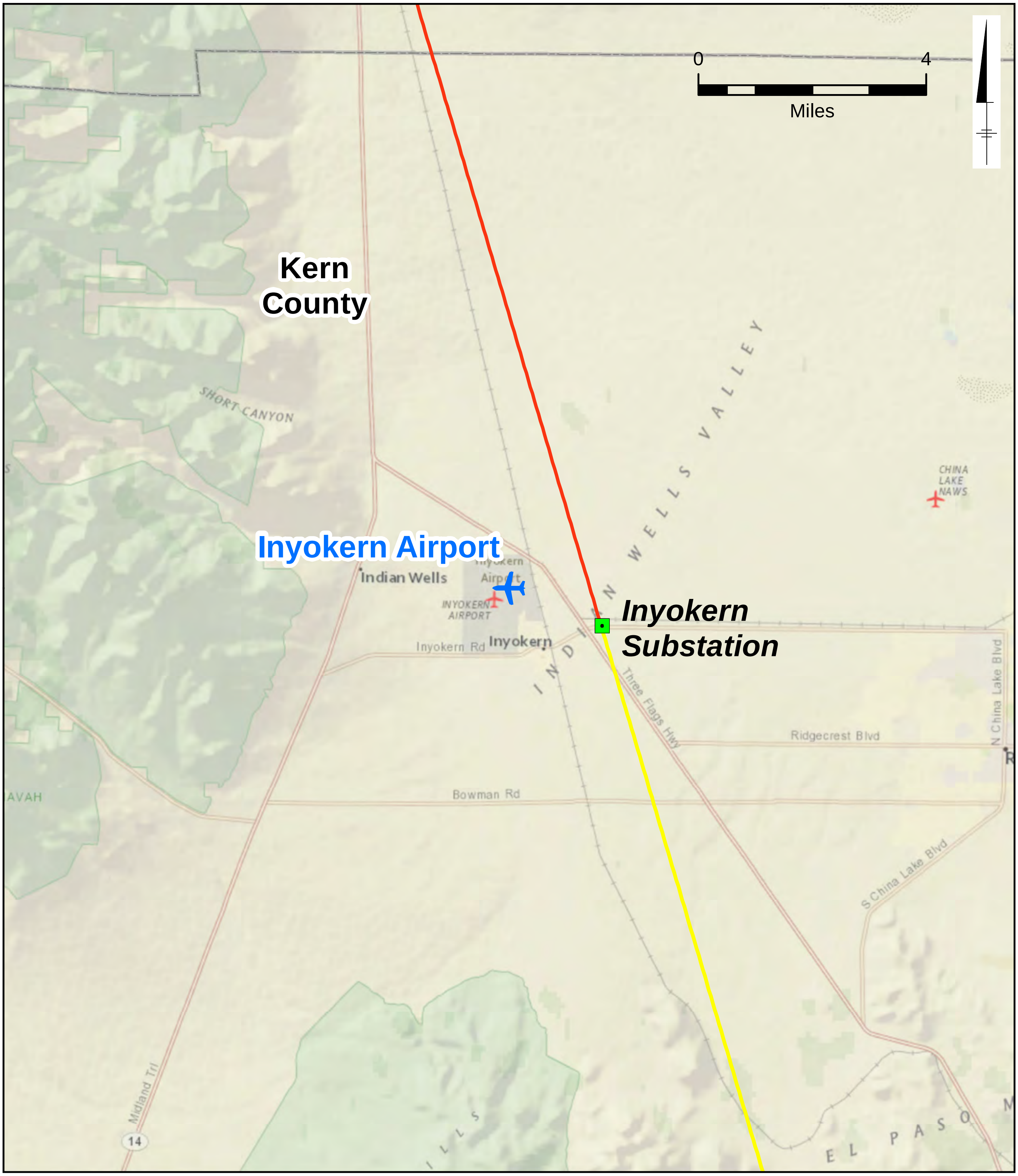

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- Airport and Airstrip
- Substation
- County
- Segment 1
- Segment 2

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IVANPAH-CONTROL PROJECT

AIRPORTS AND AIRSTRIPS

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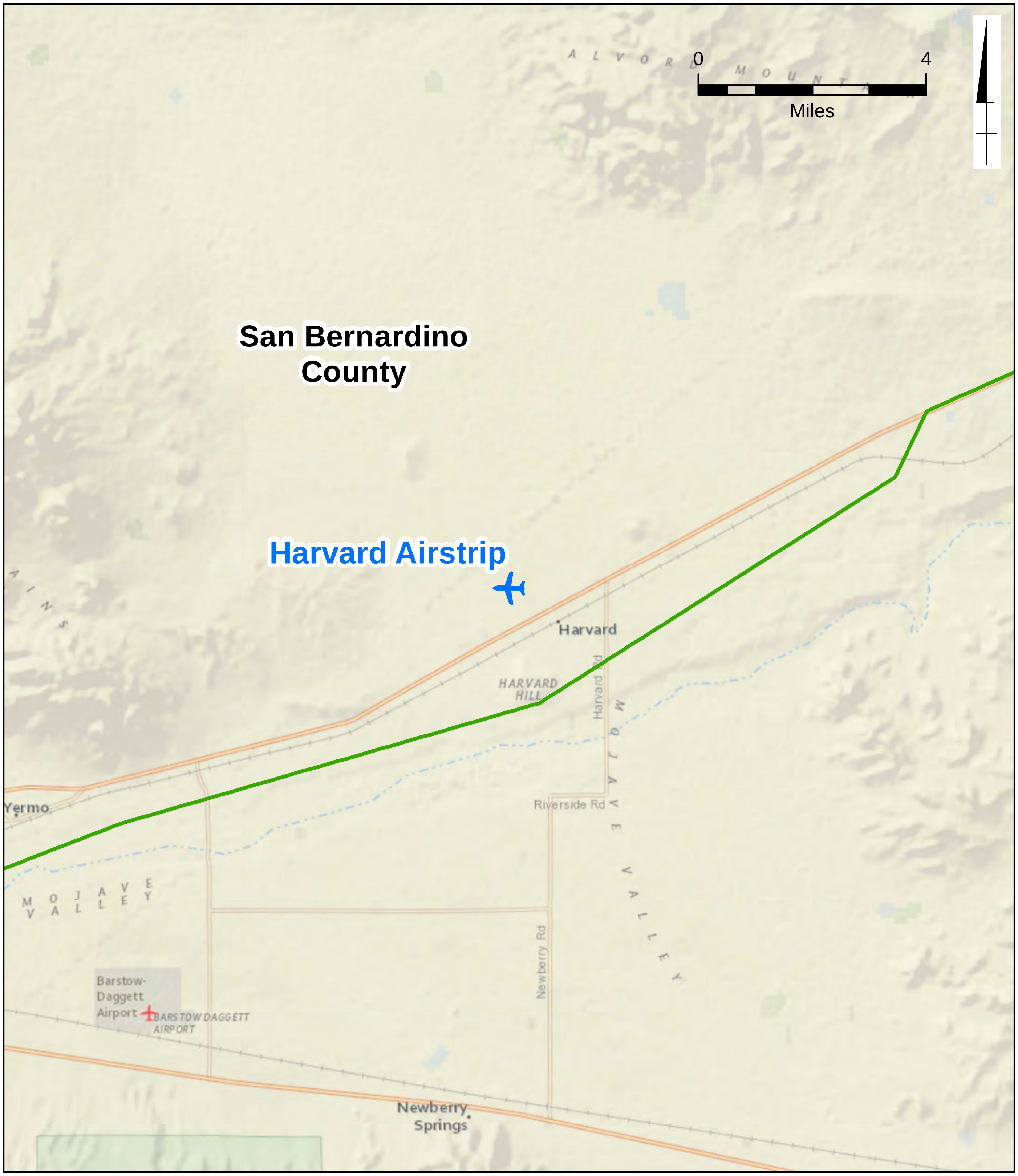

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Airport and Airstrip

Segment 4

Substation

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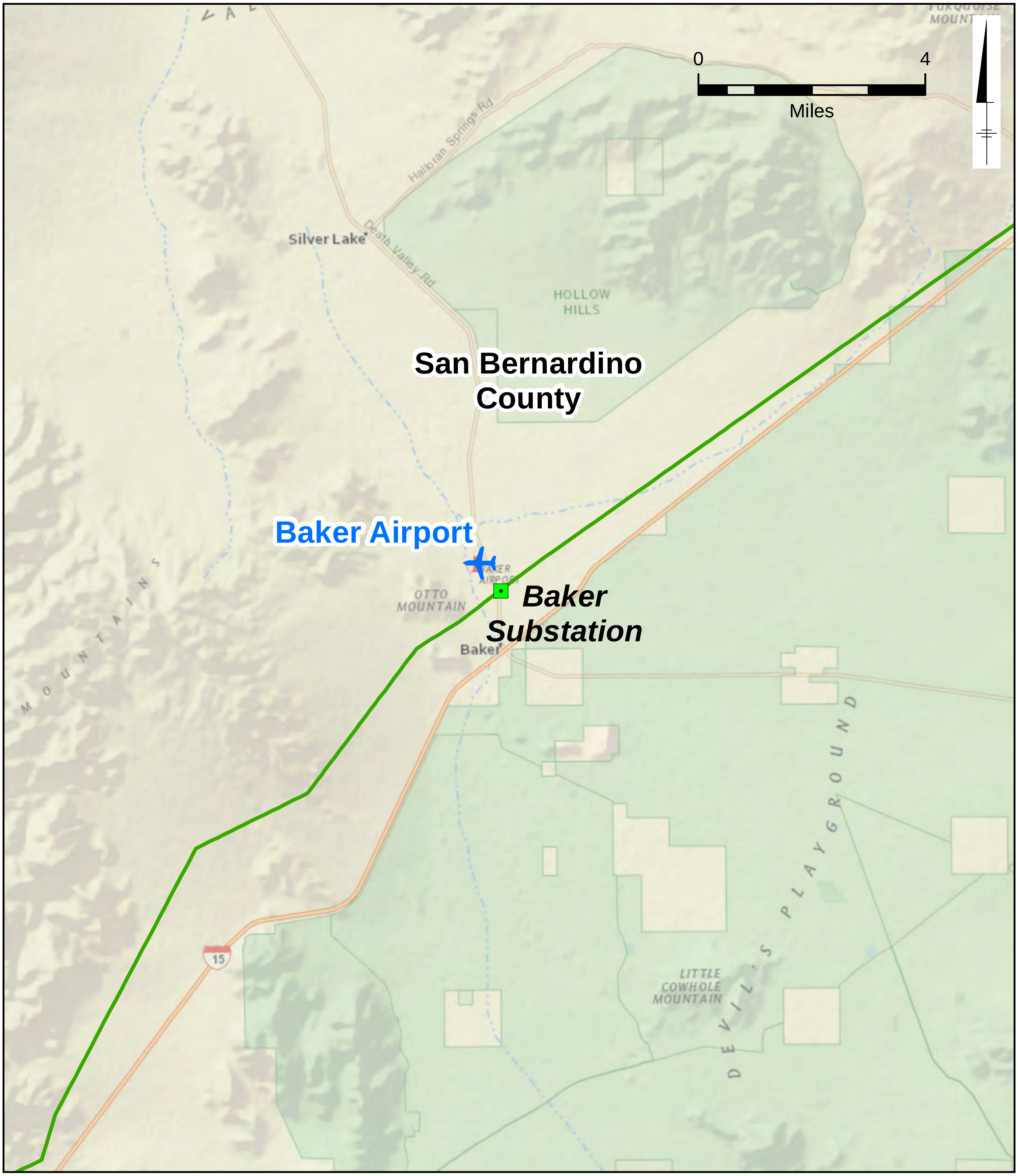

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Airport and Airstrip

Segment 4

Substation

County

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AIRPORTS AND AIRSTRIPS

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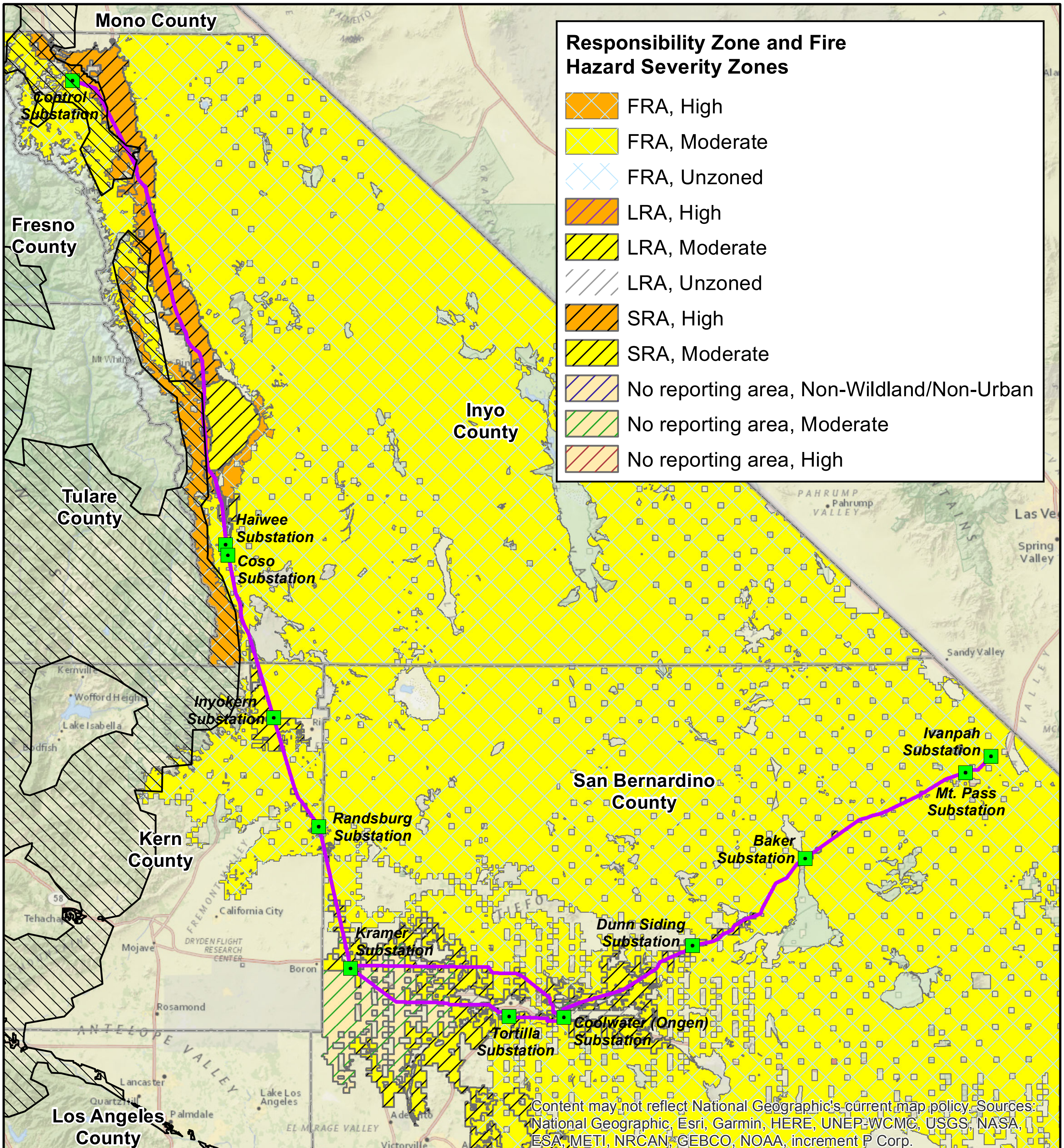

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- Substation
- IC Project Alignment
- Counties
- CPUC Fire Threat Map - Tier 2

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Miles

NOTES:
(1) Fire Hazard Severity Zones source: http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland_zones_maps

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FIRE HAZARD SEVERITY ZONES

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FIGURE
4.9-3

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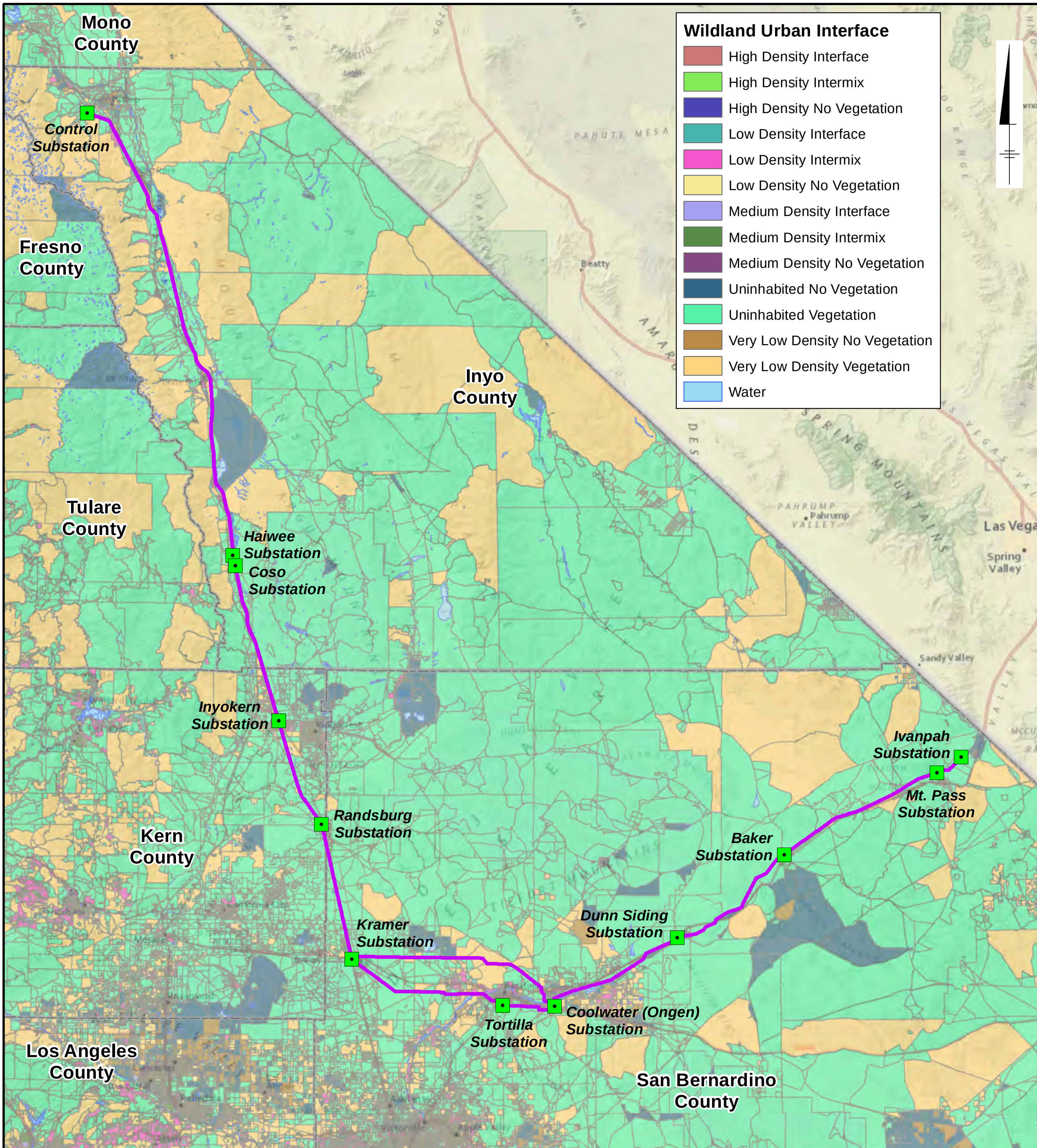

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Substation

IC Project Alignment

County

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NOTES:
(1) Wildland Urban Interface source: USDA Forest Service
https://www.fs.usda.gov/rds/archive/Product/RDS-2015-0012-2

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WILDLAND URBAN INTERFACE

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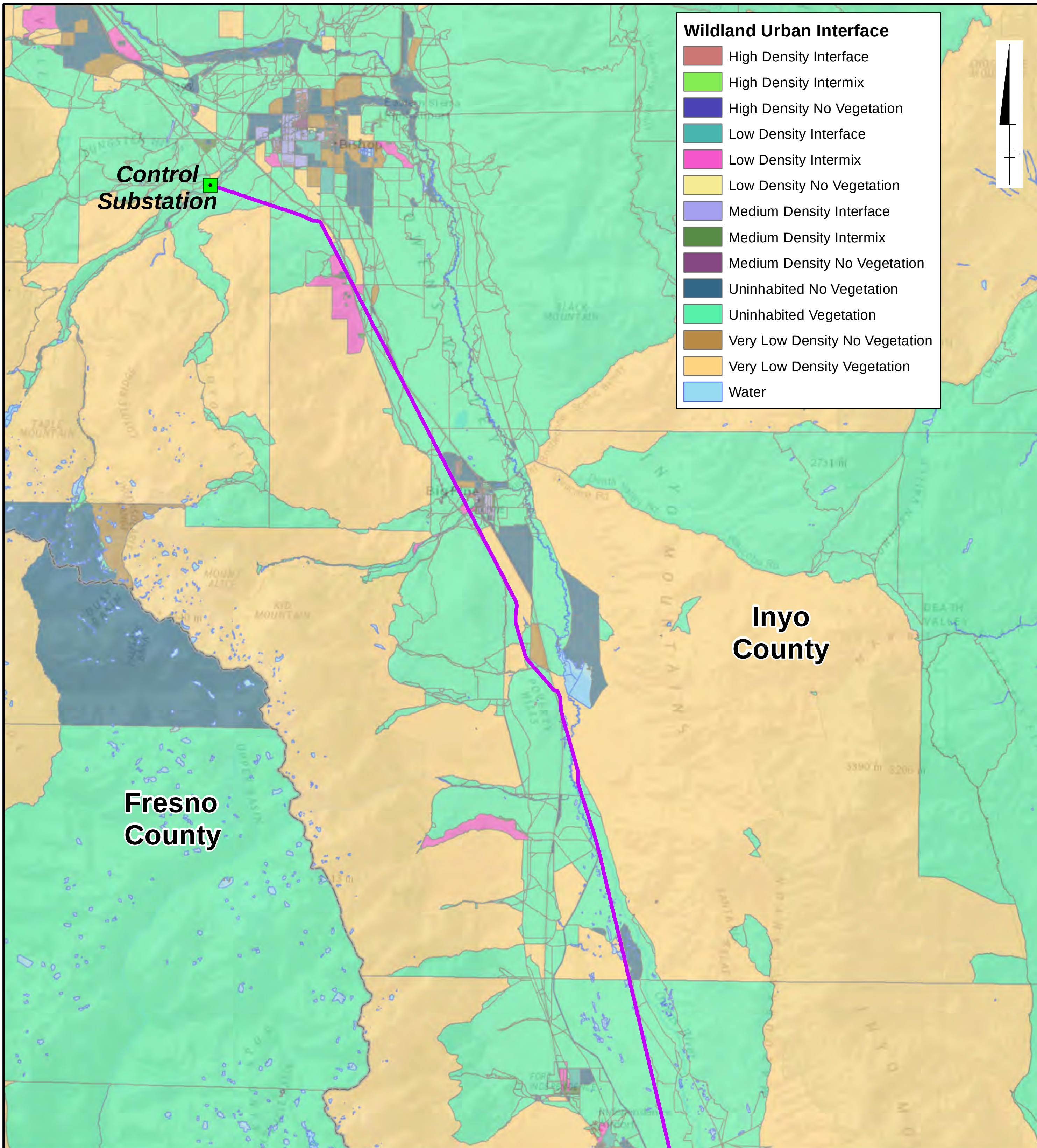

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- Substation
- IC Project Alignment
- County

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NOTES:
(1) Wildland Urban Interface source: USDA Forest Service
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IVANPAH-CONTROL PROJECT

WILDLAND URBAN INTERFACE

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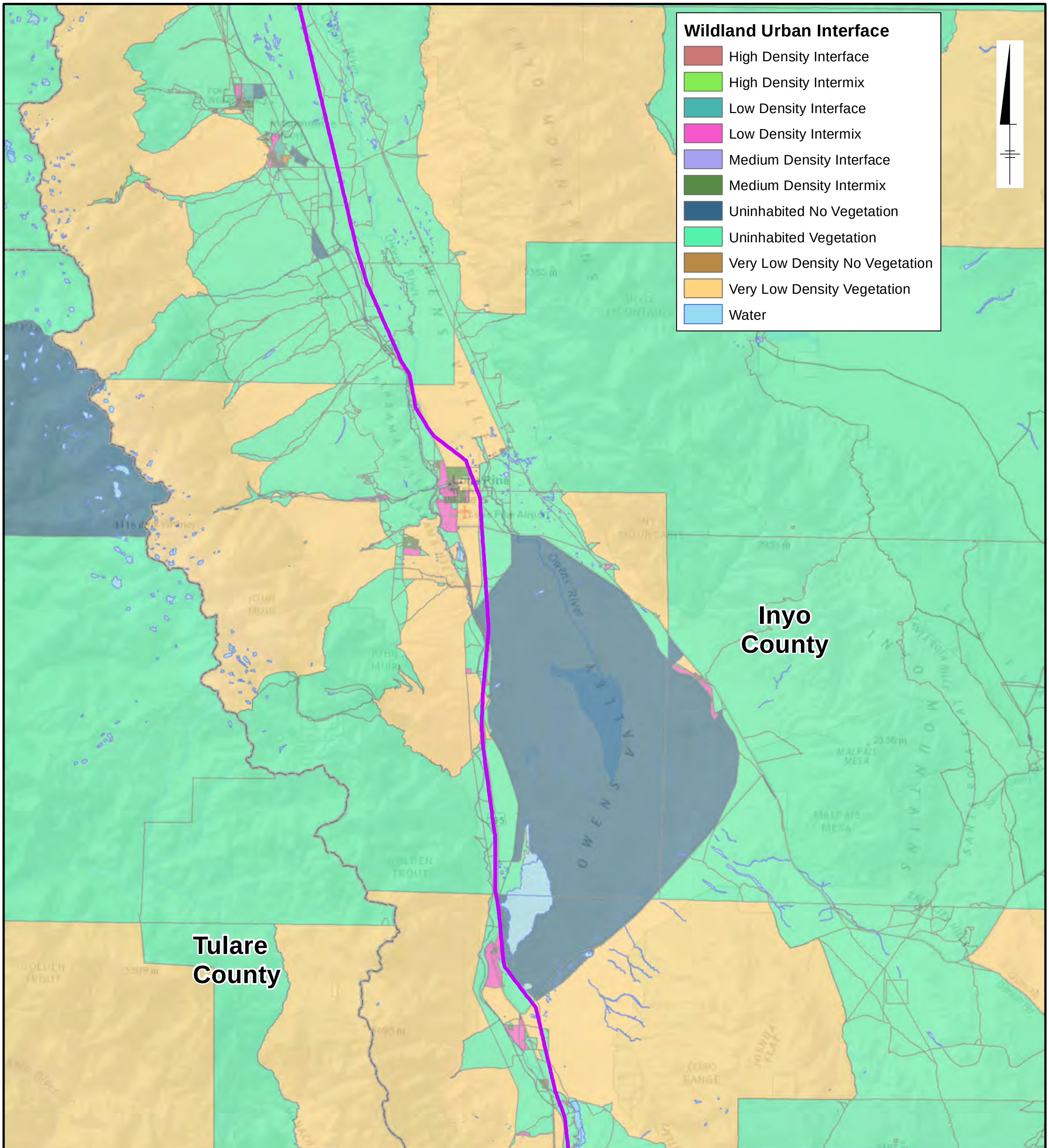

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- Substation
- IC Project Alignment
- County

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Miles

NOTES:
(1) Wildland Urban Interface source: USDA Forest Service
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IVANPAH-CONTROL PROJECT

WILDLAND URBAN INTERFACE

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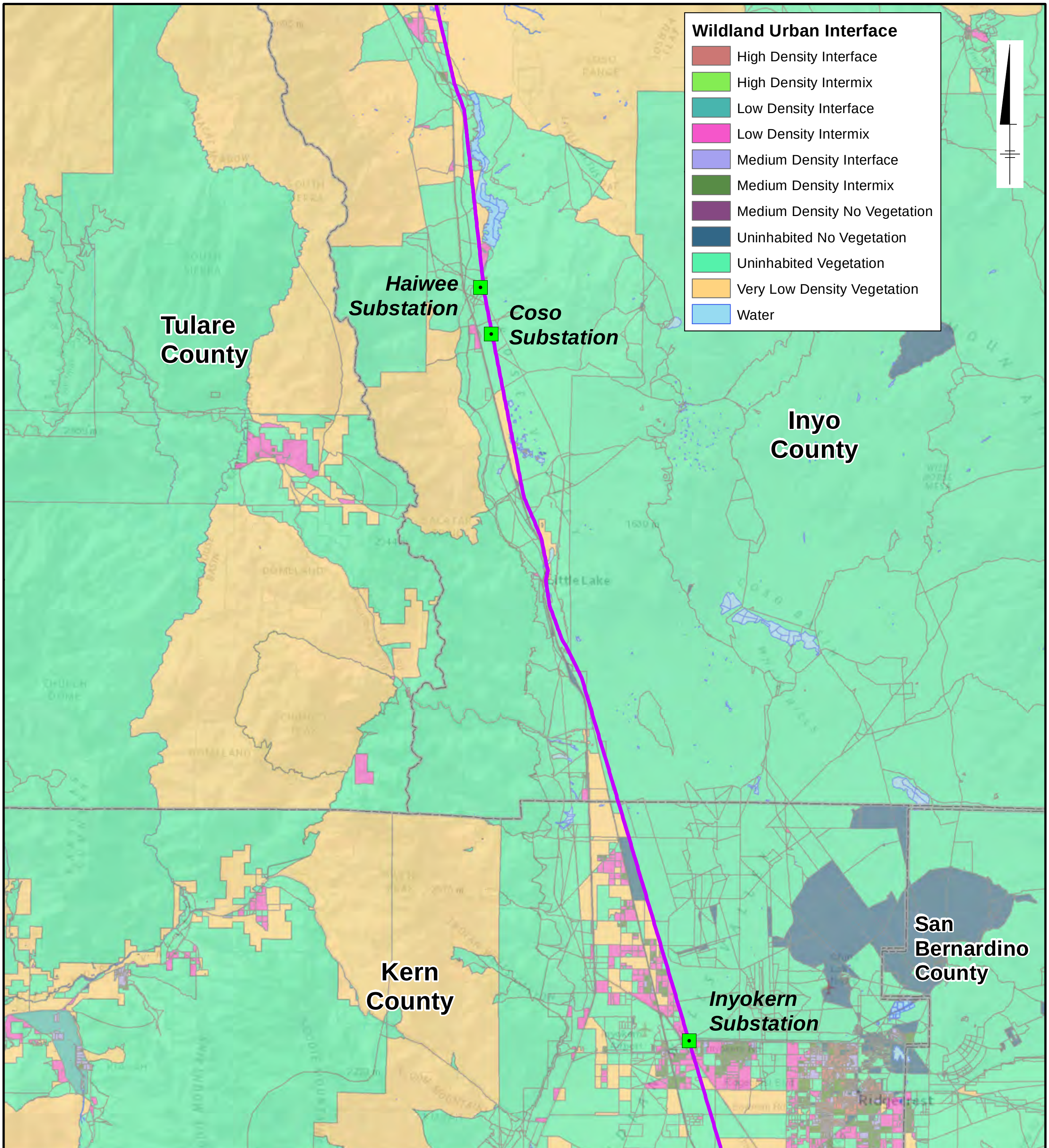

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Substation

IC Project Alignment

County

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Miles

NOTES:
(1) Wildland Urban Interface source: USDA Forest Service
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IVANPAH-CONTROL PROJECT

WILDLAND URBAN INTERFACE

ARCADIS

SOUTHERN CALIFORNIA EDISON

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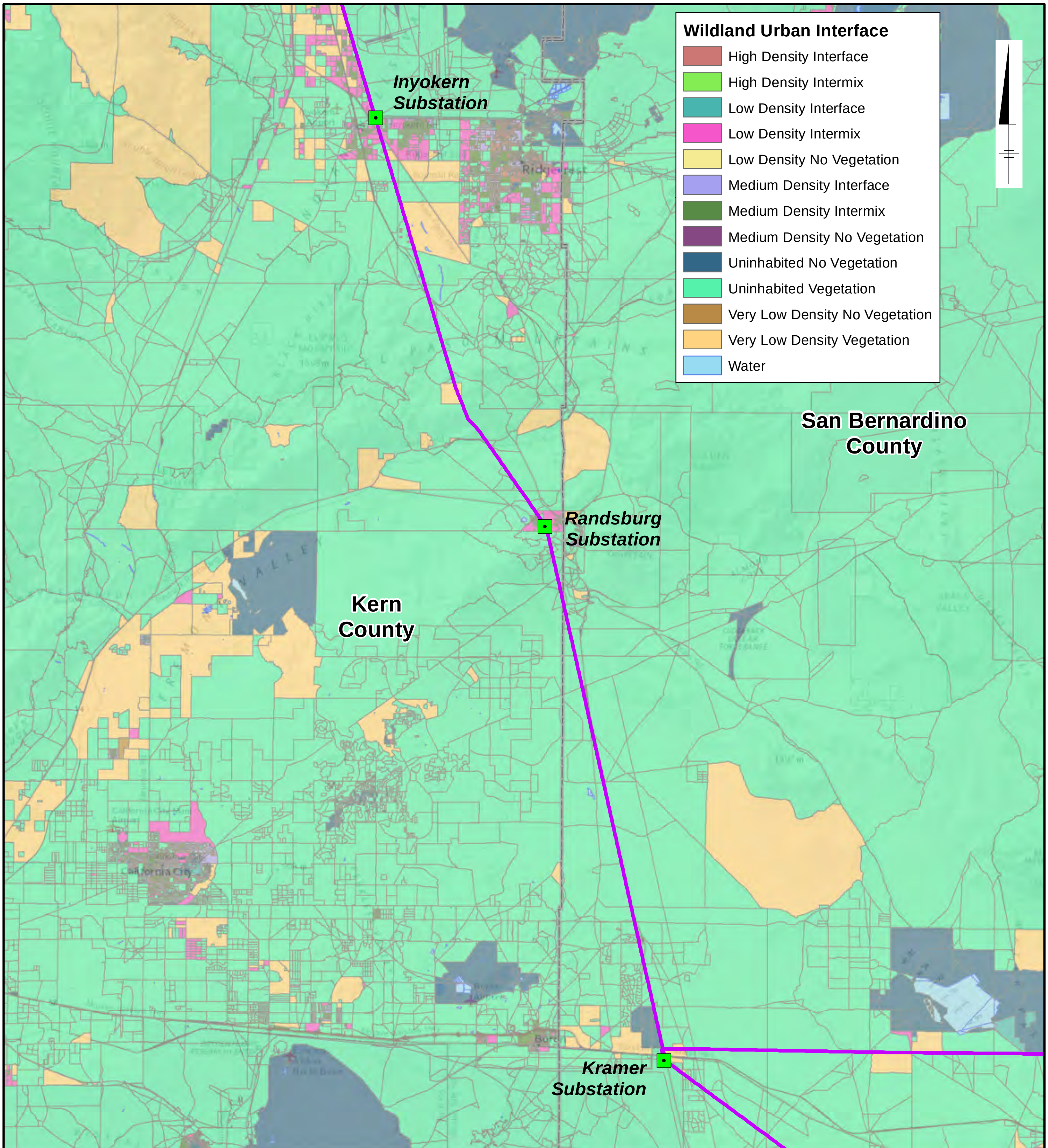

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Page 5 of 8

- Substation
- IC Project Alignment
- County

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Miles

NOTES:
(1) Wildland Urban Interface source: USDA Forest Service
https://www.fs.usda.gov/rds/archive/Product/RDS-2015-0012-2

IVANPAH-CONTROL PROJECT

WILDLAND URBAN INTERFACE

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SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

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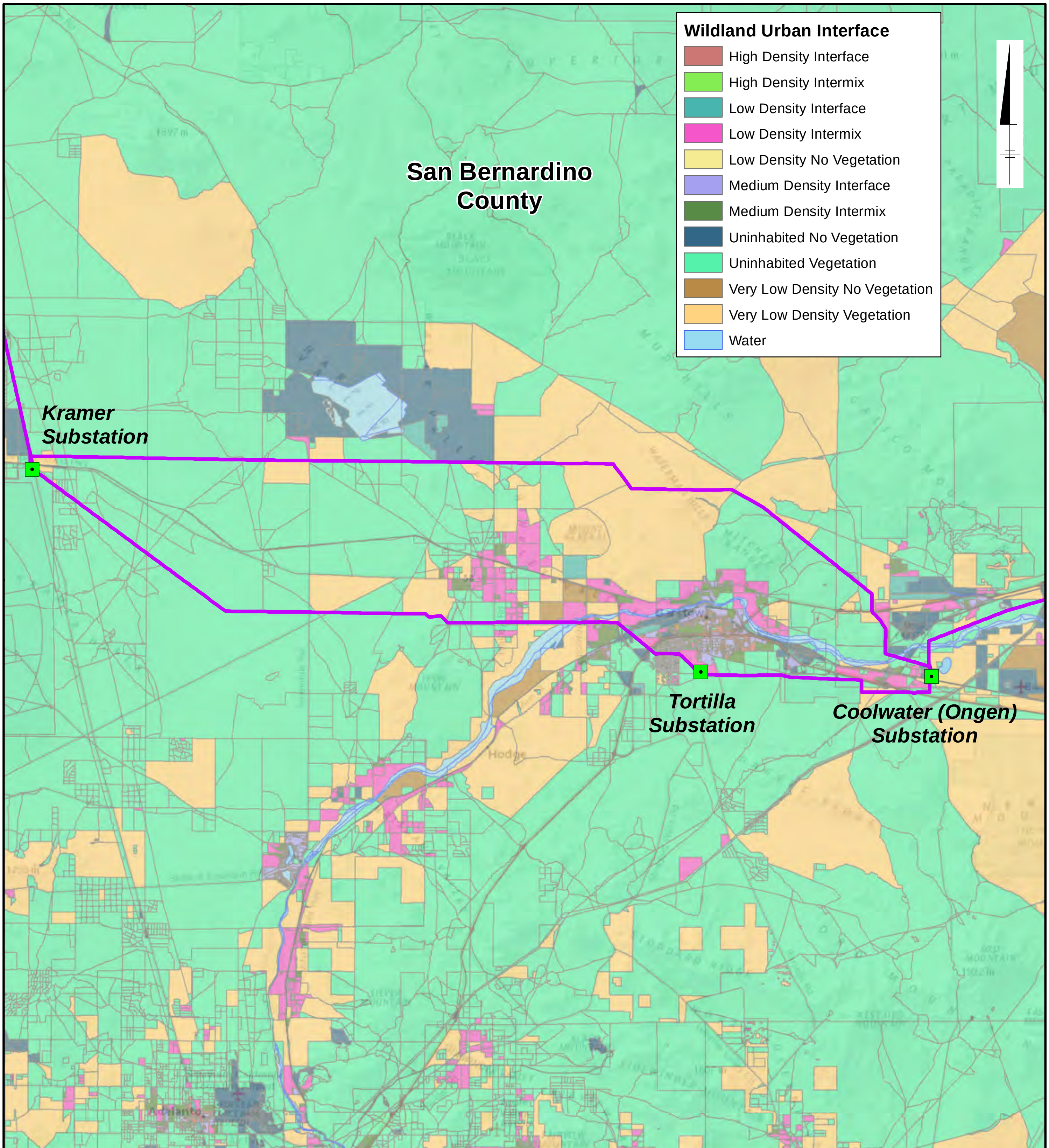

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- Substation
- IC Project Alignment
- County

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Miles

NOTES:
(1) Wildland Urban Interface source: USDA Forest Service
https://www.fs.usda.gov/rds/archive/Product/RDS-2015-0012-2

IVANPAH-CONTROL PROJECT

WILDLAND URBAN INTERFACE

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SOUTHERN CALIFORNIA EDISON

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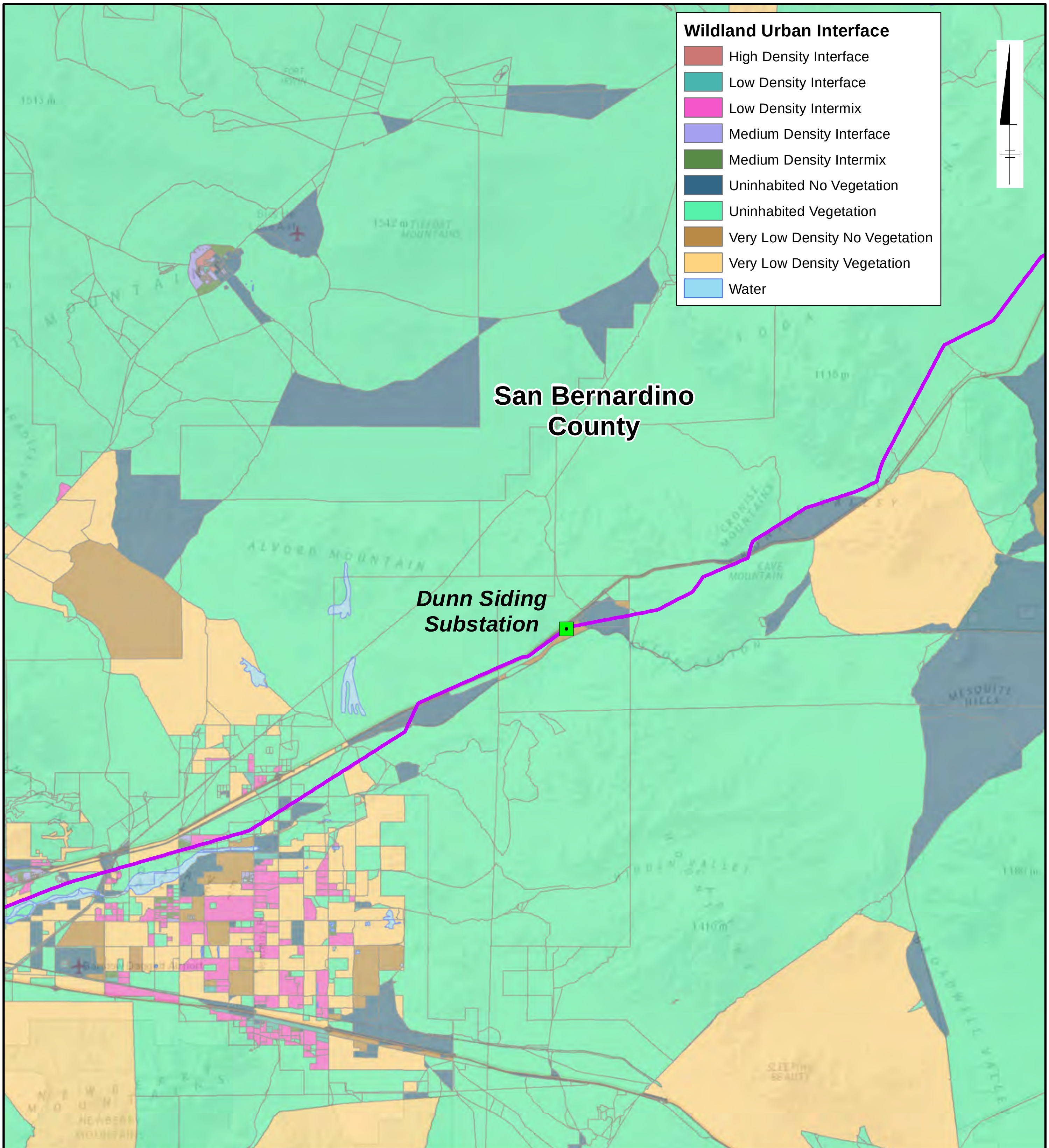


Legend

- Substation
- IC Project Alignment
- County

0 8
Miles

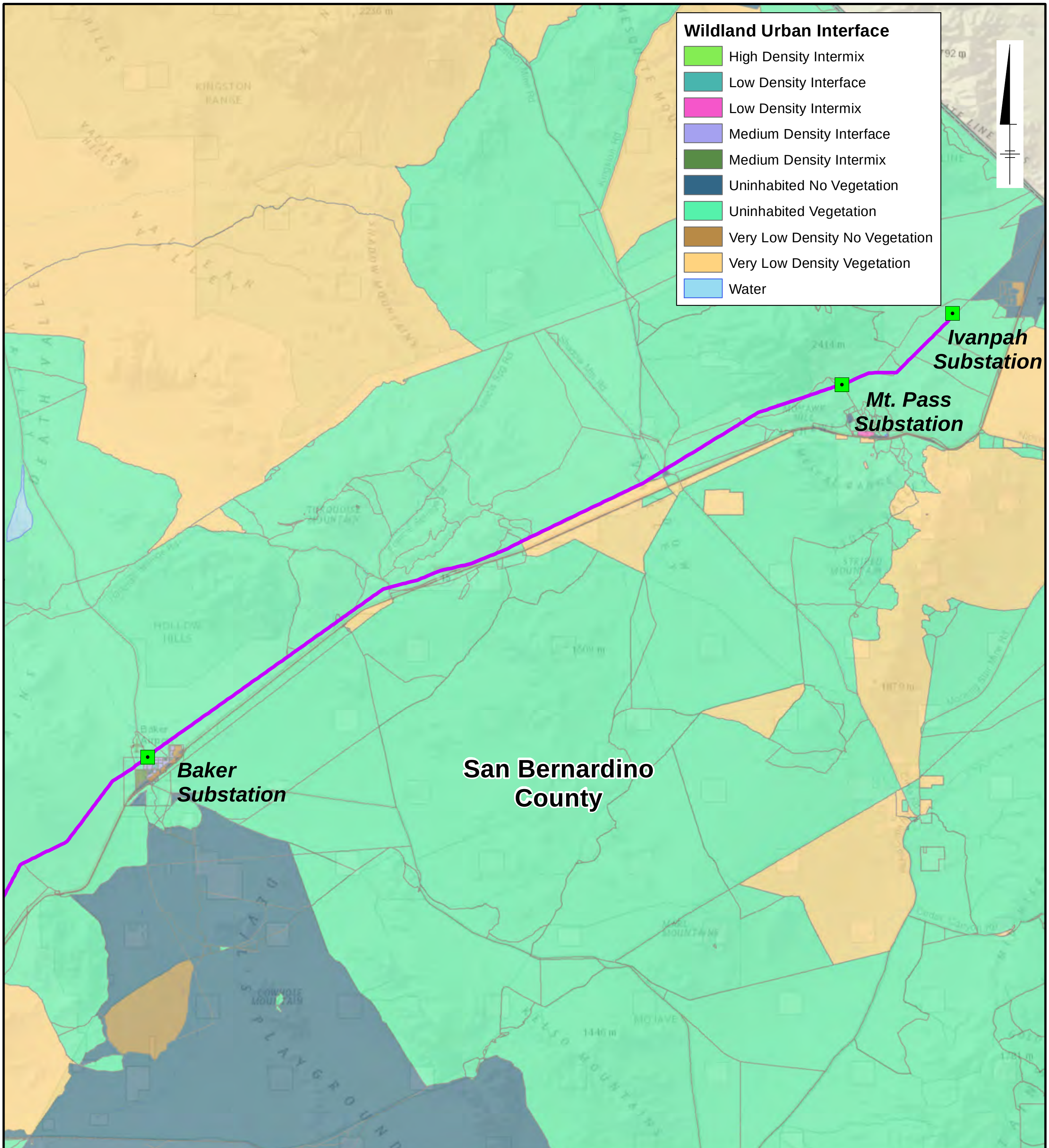
NOTES:
(1) Wildland Urban Interface source: USDA Forest Service
https://www.fs.usda.gov/rds/archive/Product/RDS-2015-0012-2

IVANPAH-CONTROL PROJECT

WILDLAND URBAN INTERFACE

ARCADIS
SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

FIGURESET:
4.9-4



Legend

Substation

IC Project Alignment

County

0 8

Miles

NOTES:
(1) Wildland Urban Interface source: USDA Forest Service
https://www.fs.usda.gov/rds/archive/Product/RDS-2015-0012-2

IVANPAH-CONTROL PROJECT

WILDLAND URBAN INTERFACE

ARCADIS

SOUTHERN CALIFORNIA EDISON

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4.10 Hydrology and Water Quality

This section describes the hydrology and water quality along the IC Project Alignment, as well as the potential impacts of construction and operation of the Full-Rebuild Concept. Hydrology and water quality along the IC Project Alignment were evaluated through review of the following:

- City and county General Plans
- United States Geological Survey (USGS) 7.5 minute quadrangle maps
- Aerial photographs
- Jurisdictional delineation reports prepared for the Ivanpah-Coolwater-Kramer-Inyokern and Control-Haiwee projects (found in Appendix I to this PEA)
- Publicly available data sources including the U.S. Fish and Wildlife Service's National Wetlands Inventory and U.S. Geological Survey's National Hydrologic Dataset
- Lahontan Regional Water Quality Control Board Water Quality Control Plan (Basin Plan)
- 2014 and 2016 California Integrated Report (Clean Water Act Section 303(d) List/305(b) Report)

4.10.1 Environmental Setting

The IC Project Alignment is located in Inyo, Kern, and San Bernardino counties. Segment 1 is located within the Owens Valley. Elevations in the Owens Valley range from a low of approximately 3,500 feet above mean sea level (amsl) to a high of approximately 4,000 feet amsl near Bishop, in Inyo County. Surface water on large alluvial fans, bajadas, and mountain streams of the eastern Sierra and White Mountains drain into Owens Valley and eventually the Owens River and Owens Lake.

The southern portion of Segment 2 and Segments 3N, 3S, and 4 lie within basin and range topography that is typical for the Mojave Desert. Elevations along the IC Project Alignment range from a low of approximately 2,000 feet amsl to a high of approximately 5,500 feet amsl. Surface water on large alluvial fans and bajadas, which occur adjacent to the mountain fronts, form ephemeral streams which drain and deposit alluvial materials into valleys and eventually into dry lakes and or the Mojave River; these are found along the Segments. Soils across the IC Project Alignment vary from extremely-gravelly to sandy loam.

4.10.1.1 Surface Water Resources

Surface waters are delineated by the United States Geological Service (USGS), which divides surface waters into successively smaller hydrologic units classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system.

The first level of classification divides the Nation into 21 major geographic areas, or regions. The second level of classification divides the 21 regions into 221 sub-regions. A sub-region includes the area drained by a river system, a reach of a river and its tributaries in that reach, a closed basin(s), or a group of streams forming a coastal drainage area. The third level of classification subdivides many of the sub-regions into accounting units. The fourth level of classification is the cataloging unit, the smallest element in the hierarchy of hydrologic units. A cataloging unit is a geographic area representing part or all of a surface drainage basin, a combination of drainage basins, or a distinct hydrologic feature (sometimes referred to as watersheds).

The IC Project Alignment is within the Northern Mojave Accounting Unit (180902) and the Northern Mojave-Mono Lake Subregion (1809). The Project is located within the following HUCs: Indian Wells-Searles Valley (18090205), Coyote-Cuddeback Lakes (18090207), Antelope-Fremont Valleys (18090206), Death Valley-Lower Amargosa (18090203), Mohave (18090208), Owens Valley (18090103) and Ivanpah-Pahrump Valleys (16060015). Maps depicting the HUCs within the IC Project Alignment are provided in Figureset 4.10-1. Many of the HUCs and or Hydrologic Area/Subwatersheds have the potential to be closed isolated valleys or have endorheic basins/dry lakes. Within these areas, the drainages, including unnamed ephemeral drainages, flow from the surrounding mountains and alluvial fans to the valley floor and into dry lakes. Major surface features within the HUCs that are crossed by, or are in close proximity to, the IC Project Alignment include the Mojave River, Owens Lake, Owens River, Cuddeback Lake, Tinemaha Reservoir, North Haiwee Reservoir, and South Haiwee Reservoir. The Los Angeles Aqueduct occurs proximate to the IC Project Alignment. The Owens Valley is a closed drainage system and prior to the construction of the Los Angeles Aqueduct, precipitation runoff was transported by tributary streams to the Owens River south to Owens Lake, the terminus of the drainage system. Historically, Owens Lake was a large lake which exceeded 100 square miles and 20 feet deep. Currently, evapotranspiration exceeds inflow and except in wet years, the lake is a playa.

4.10.1.1.1 Waters of the U.S., including Wetlands

Waters of the U.S., including wetlands, occur throughout the IC Project Alignment. Drainages identified within the IC Project Alignment are typical ephemeral washes of the Mojave Desert and are characterized as single or compound channels (single, low-flow, meandering channels inset into wider braided channel network). These drainages are highly susceptible to widening and avulsions during moderate to high discharges, while reestablishing a low-flow channel during subsequent flows. In Segments 2, 3N, 3S, and 4, drainages are generally dry except following rainstorms; it is expected that these drainages would be dry during the construction period. In Segment 1, the Owens River and many of its drainages are perennial streams, and thus would be wet during the construction period. There are no known wet crossings along Segment 1, and the need for wet crossings in Segment 1 is not anticipated at this time.

Three wetland types occur within the IC Project Alignment: emergent wetland, scrub-shrub wetland, and forested wetland. These features generally occur within the northern portion of the IC Project Alignment in Segments 1 and 2. Details on the waters of the U.S., including wetlands found along the IC Project Alignment, can be found in Appendix I to this PEA.

4.10.1.2 Groundwater Resources

Groundwater resources (basins) are delineated by the California Department of Water Resources. A basin is defined as an alluvial aquifer or a stacked series of alluvial aquifers with reasonably well-defined boundaries in a lateral direction and having a definable bottom. Groundwater in the region is used for agricultural and urban supply, particularly in drought years. Aquifers range from large extensive alluvial valleys with thick multilayered aquifers and aquitards to small inland valleys. (DWR 2003) Depth to groundwater along the IC Project Alignment ranges considerably, from the surface to more than 100 feet.

4.10.1.2.1 Groundwater Hydrology

The South Lahontan hydrologic region (HR) represents about 17 percent of the land area in California. The region includes Inyo County and portions of Mono, San Bernardino, Kern, and Los Angeles counties. Groundwater basins found along the IC Project Alignment are shown in Figureset 4.10-2.

The South Lahontan HR is bounded to the north by the drainage divide between Mono Lake and East Walker River; to the west and south by the Sierra Nevada, San Gabriel, San Bernardino, and Tehachapi mountains; and to the east by the State of Nevada. Drainage for most of the watershed in the region is underground. Along with the arid climate, this accounts for the presence of many dry lakebeds or playas in the region. Major lakes in the region include Mono Lake, June Lake, Convict Lake, Crowley Lake, Tinemaha Reservoir, Lake Arrowhead, Silverwood Lake, and Lake Palmdale. Rivers in the region include the Owens River, the Mojave River, and the Amargosa River.

Within the South Lahontan HR, the IC Project Alignment is located within the following Hydrologic Units (HUs)/Hydrologic Areas (HAs): Ivanpah/Undefine, Amargosa/Silurian hills, Mojave/Baker/Afton/Lower Mojave/Middle Mojave/Lockhart, Antelope/North Muroc, Cuddeback/Undefined, Freemont/Koehn, and Indian Wells/China Lake.

4.10.1.2.1.1 Ivanpah Hydrologic Unit

The Ivanpah Hydrologic Unit is a north-trending valley located along the California/Nevada border in northeastern San Bernardino County. Elevation of the valley floor ranges from 2,595 feet amsl at Ivanpah Dry Lake to about 4,000 feet amsl at the southern end of the valley. The area is bounded by the Clark Mountains on the northwest, the Ivanpah Range on the west, and the New York Mountains to the southeast. Elevation in the bordering mountains ranges from 7,903 feet amsl at Clark Mountain to about 7,500 feet amsl in the New York Mountains. Average annual precipitation ranges from about 4 to 10 inches. Surface water from the bordering mountains drains toward Ivanpah Lake.

4.10.1.2.1.2 Amargosa Hydrologic Unit

The Amargosa Hydrologic Unit in San Bernardino County includes the Lower Kingston and Upper Kingston valleys. The Lower Kingston Valley includes approximately 375 square miles total drainage, with elevations ranging from 500 to 3,000 feet amsl. The area is bounded by the Kingston Range and Dumont Hills on the north, the Shadow Mountains on the east, the Avawatz Mountains to the west, and the Silurian Hills on the southeast. Annual precipitation ranges from 4 to 8 inches. Runoff from the surrounding mountains drains to Salt Creek, which flows northwest across the valley. Kingston Wash conveys runoff west from the adjacent Upper Kingston Valley, discharging into Salt Creek; Salt Creek discharges form the valley to the west into the Amargosa River.

The Upper Kingston Valley includes approximately 277 square miles total drainage, with elevations ranging from 3,000 to 5,000 feet amsl. This valley is bounded by the Mesquite Mountains on the north, the Ivanpah and Clark Mountains on the east, the Shadow Mountains on the west, and Teutonia Peak on the south. Annual precipitation ranges from 5 to 10 inches. Runoff from the surrounding mountains flows north to Kingston Wash, which discharges to the west into Valjean Valley.

4.10.1.2.1.3 Mojave Hydrologic Unit

The Mojave Hydrologic Unit is located entirely within San Bernardino County and includes approximately 1,600 square miles of total drainage. Approximately 210 square miles of this drainage area are located in the San Bernardino Mountains, which make up the headwaters of the Mojave River. Elevations within the watershed range from 8,500 feet amsl at Butler Peak in the San Bernardino Mountains to 1,400 feet amsl at Afton Canyon near the terminus of the Mojave River.

Deep Creek and the West Fork of the Mojave River are located in the San Bernardino Mountains and are the two perennial tributaries to the Mojave River. Both tributaries have multiple branch tributaries within the San Bernardino Mountains.

The main hydrologic feature of the watershed is the Mojave River, with its headwaters in the San Bernardino Mountains. Snow melt provides most of the water for the river. The Mojave River is the largest waterway in the vicinity of the IC Project Alignment. The majority of the river has subsurface flow with surface flow occurring during storm events and at the upper narrows between Victorville and Apple Valley, as well as downstream past Barstow at the lower narrows as the river flows through Afton Canyon.

4.10.1.2.1.4 Antelope Hydrologic Unit

The Antelope Hydrologic Unit is within the Antelope Valley, which is an extensive alluvial valley in the western Mojave Desert. The elevation of the valley ranges from 2,300 to 3,500 feet amsl. Antelope Valley is bounded on the northwest by the Garlock fault zone at the base of the Tehachapi Mountains and on the southwest by the San Andreas fault cone at the base of the San Gabriel Mountains. The valley is bounded on the east by ridges, buttes, and low hills that form a surface drainage divide and by Fremont Valley on the north.

4.10.1.2.1.5 Cuddeback Hydrologic Unit

The Cuddeback Hydrologic Unit is within the Cuddeback Valley, a roughly east trending valley in western San Bernardino County. Surface elevations range from about 2,550 feet amsl at Cuddeback Dry Lake to 2,800 feet amsl in the northeastern portion of the valley. The valley is bounded by the Lava Mountains on the north, the Rand Mountains on the west, Fremont Peak and the Gravel Hills on the south and southeast, and a series of granitic hills on the east. Annual rainfall is about 5 inches. Surface flows from the surrounding uplands drain toward Cuddeback Lake in the central part of the valley.

4.10.1.2.1.6 Fremont Hydrologic Unit

The Fremont Hydrologic Unit is within the Fremont Valley in eastern Kern County and northwestern San Bernardino County. The valley is bounded on the northwest by the Garlock fault zone, the El Paso Mountains, and the Sierra Nevada Range. The valley is bounded on the east by the Summit Range, Red Mountain, Lava Mountains, Rand Mountains, Castle Butte, Bissel Hills, and Rosamond Hills. The valley is bounded on the southwest by the Antelope Valley. Average annual rainfall in the Fremont Valley ranges from 4 to 12 inches. Surface water in the valley drains toward Koehn Dry Lake; however, surface drainage overlying the southwestern-most part travels southward toward the town of Rosamond.

4.10.1.2.1.7 Indian Wells Hydrologic Unit

The Indian Wells Hydrologic Unit is within the Indian Wells Valley. The valley is bound by the Sierra Nevada Range on the west, the Coso Range on the north, the Argus Range on the east, and the El Paso Mountains on the south. China Lake, a perennial lake, is situated in the central-northeastern portion of the valley.

4.10.1.3 Surface Water Quality

The IC Project Alignment is located within the jurisdiction of the Lahontan Regional Water Quality Control Board (RWQCB). The Lahontan RWQCB’s Water Quality Control Plan for the Lahontan Region (Basin Plan) designates beneficial uses for surface waters and groundwater in the basin and also sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and to conform to the State’s antidegradation policy.

The Basin Plan identifies beneficial uses and water quality objectives that are the water quality standards for the area Lahontan Region. The Lahontan Region identifies 23 beneficial uses for the surface and groundwater resources within the region. Beneficial uses for drainages located along the IC Project Alignment are shown below in Table 4.10-1; the IC Project Alignment crosses each of the named features in this table.

Table 4.10-1: Beneficial Uses

Feature	**MUN**	**AGR**	**PRO**	**IND**	**GWR**	**FRSH**	**NAV**	**POW**	**REC-1**	**REC-2**	**COMM**	**AQUA**	**COLD**	**WARM**	**SAL**	**WILD**	**BIOL**	**RARE**	**MGR**	**SPWN**	**WQE**	**FLD**
Lahontan Region Basin Plan																						
Indian Wells Hydrologic Unit																						
China Lake Hydrologic Area																						
Minor Surface Waters	x	x			x				x	x	x		x	x		x						
Rose Hydrologic Area																						
Minor Surface Waters	x	x			x				x	x	x		x	x		x						
Owens Hydrologic Unit																						
Lower Owens Hydrologic Area																						
Little Lake*									x	x	x		x	x		x					x	x
Ash Creek	x	x			x				x	x	x			x		x	x			x		
Cottonwood Creek	x	x			x			x	x	x	x			x		x				x		
George Creek	x	x			x				x	x	x			x		x				x		
Stevens Canal	x	x			x				x	x	x			x		x				x		
Owens Lake									x	x	x		x	x	x	x			x			
Owens Lake Wetlands	x	x			x				x	x			x	x		x					x	x
Minor Surface Waters	x	x		x	x				x	x	x		x	x		x		x		x		
Minor Wetlands	x	x			x	x			x	x	x		x	x		x					x	x
Upper Owens Hydrologic Area																						
Owens River	x					x		x	x	x	x			x		x		x	x	x		
Owens River Wetlands	x	x			x				x	x			x	x		x			x		x	x
Tinemaha Creek	x	x			x				x	x	x			x		x				x		
Big Pine Creek	x	x		x					x	x	x			x		x						
Baker Creek																						
Rawson Creek	x	x			x				x	x	x			x		x						
Bishop Creek	x	x			x				x	x	x			x		x						
Minor Surface Waters	x	x			x	x			x	x	x					x				x		
Minor Wetlands	x	x			x	x			x	x	x			x		x		x		x	x	x
Ivanpah Hydrologic Unit																						
Minor Surface Waters*	x	x			x				x	x	x		x	x		x						
Amargosa Hydrologic Unit																						
Minor Surface Waters	x	x			x				x	x			x	x		x		x	x			
Silurian Hydrologic Area																						

Table 4.10-1: Beneficial Uses

Feature	MUN	AGR	PRO	IND	GWR	FRSH	NAV	POW	REC-1	REC-2	COMM	AQUA	COLD	WARM	SAL	WILD	BIOL	RARE	MGR	SPWN	WQE	FLD
Lahontan Region Basin Plan																						
Minor Surface Waters	x	x			x				x	x				x		x		x				
Mojave Hydrologic Unit																						
Minor Surface Waters	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Baker Hydrologic Unit																						
Minor Surface Waters	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Afton Hydrologic Unit																						
Minor Surface Waters	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lower Mojave Hydrologic Area																						
Minor Surface Waters	x	x			x				x	x			x	x		x						
Middle Mojave Hydrologic Area																						
Mojave River	x	x			x				x	x	x		x	x		x						
Minor Surface Waters	x	x			x			x	x	x			x	x		x						
Lockhart Hydrologic Area																						
Minor Surface Waters	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antelope Hydrologic Unit																						
Minor Surface Waters	x	x			x				x	x	x			x		x						
North Muroc Hydrologic Unit																						
Minor Surface Waters	x	x			x				x	x	x		x	x		x						
Cuddeback Hydrologic Unit																						
Minor Surface Waters																						
Fremont Hydrologic Unit																						
Minor Surface Waters	x	x			x				x	x	x		x			x						
Koehn Hydrologic Unit																						
Minor Surface Waters	x	x			x		x		x	x			x			x						

Acronyms & Abbreviations:

AGR – Agricultural Supply
PRO – Industrial Process Supply
IND – Industrial Service Supply
GWR – Ground Water Recharge
FRSH – Freshwater Replenishment
NAV – Navigation
POW – Hydropower Generation
REC1 – Water Contact Recreation
REC2 – Non-contact Water Recreation
COMM – Commercial and Sport Fishing
AQUA – Aquaculture
COLD – Cold Freshwater Habitat
WARM – Warm Freshwater Habitat
SAL – Inland Saline Water Habitat
WILD – Wildlife Habitat
BIOL – Preservation of Biological Habitats of Special Significance
RARE – Rare, Threatened or Endangered Species
MGR – Migration of Aquatic Organisms
SPWN – Spawning, Reproduction, and Development
WQE – Water Quality Enhancement
FLD – Flood Peak Attenuation/Flood Water Storage
x – Existing Beneficial Uses
I – Intermittent Uses
NA – Not Available

4.10.1.4 Impaired Waterbodies Clean Water Act Section 303(d)

The State Water Resources Control Board (SWRCB) and RWQCBs assess water quality data for California's waters every two years to determine if they contain pollutants at levels that exceed protective water quality criteria and standards. This biennial assessment is required under Section 303(d) of the CWA. In the area surrounding the IC Project Alignment, only the Mojave River (receiving waters) is listed as a 303(d) impaired water; however, that portion of the Mojave River crossed by the IC Project Alignment is not listed (Table 4.10-2).

Table 4.10-2: Impaired Waterbodies per CWA Section 303(d)

Region	Region Name	Water Body Name	Water Body Type	Water Body Type Code	Pollutant	Pollutant Category	Final Listing Decision	TMDL Requirement Status
6	Regional Board 6 - Lahontan Region	Haiwee Reservoir	Lake/ Reservoir	L	Copper	Other Inorganics	List on 303(d) list (TMDL required list)	5A
6	Regional Board 6 - Lahontan Region	Mojave River (Mojave Forks Reservoir outlet to Upper Narrows)	River and Stream	R	Fluoride	Other Inorganics	List on 303(d) list (TMDL required list)	5A
6	Regional Board 6 - Lahontan Region	Mojave River (Upper Narrows to Lower Narrows)	River and Stream	R	Fluoride	Other Inorganics	List on 303(d) list (TMDL required list)	5A
6	Regional Board 6 - Lahontan Region	Mojave River (Upper Narrows to Lower Narrows)	River and Stream	R	Sulfates	Other Inorganics	List on 303(d) list (TMDL required list)	5A
6	Regional Board 6 - Lahontan Region	Mojave River (Upper Narrows to Lower Narrows)	River and Stream	R	Sulfates	Other Inorganics	List on 303(d) list (TMDL required list)	5A
6	Regional Board 6 - Lahontan Region	Mojave River (Upper Narrows to Lower Narrows)	River and Stream	R	Total Dissolved Solids	Salinity	List on 303(d) list (TMDL required list)	5A

Acronyms & Abbreviations:
R – Riverine
L – Lake
TMDL – Total Maximum Daily Loads
5A – 303(d) list requiring the development of a TMDL

4.10.1.5 Groundwater Quality

Groundwater along the IC Project Alignment is used for public and domestic water supply and for irrigation. The primary water bearing units are gravel, sand, silt, and clay derived from the surrounding mountains. Recharge to the groundwater system is primarily runoff from the Sierra Nevada and by direct filtration from irrigation. Because some recharge is a result of irrigation, inorganic constituents are generally found in groundwater within the region. Naturally occurring inorganic constituents do occur naturally in groundwater and the concentration can be affected by natural processes. (USGS 2013)

Groundwater along the IC Project Alignment has a preponderance of calcium and bicarbonate ions, but the range of dissolved constituents is generally considered small. (Hollett et al 1991)

4.10.1.6 Floodplains

As shown in Figureset 4.10-1, the majority of the IC Project Alignment is located in areas with a nominal mapped flood hazard. Portions of Segments 1 and 2 are routed through, and cross, 100-year floodplains (designated as Floodways on Figureset 4.10-1). No portions of Segments 3N or 3S are located within or cross a 100-year or 500-year floodplain. In Segment 4, a short portion of the IC Project Alignment near the existing Baker Substation crosses a 100-year floodplain. Floodplain areas that could result in impacts in the event of a flood are mapped (i.e., Mohave River). The smaller ephemeral and intermittent drainages crossed by the IC Project Alignment in Segments 2, 3N, 3S, and 4 would not be expected to result in a high potential for flood risk.

4.10.2 Regulatory Setting

Federal, state, and local regulations were reviewed for applicability to the IC Project.

4.10.2.1 Federal

4.10.2.1.1 Clean Water Act

Enacted in 1972, the Federal Clean Water Act (CWA; 33 U.S.C. § 1251 et seq.) and subsequent amendments outline the basic protocol for regulating discharges of pollutants to waters of the U.S. It is the primary federal law applicable to water quality of the nation’s surface waters, including lakes, rivers, and coastal wetlands. Enforced by the USEPA, it was enacted “… to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.” The CWA authorizes States to adopt water quality standards and includes programs addressing both point and non-point pollution sources. The CWA also established the NPDES, and provides the USEPA the authority to implement pollution control programs, such as setting wastewater standards for industry and water quality standards for surface waters (see below for a discussion of the NPDES program).

In California, programs and regulatory authority under the CWA have been delegated by USEPA to the SWRCB and its nine RWQCBs. Under Section 402 of the CWA as delegated to the State of California, a discharge of pollutants to navigable waters is prohibited unless the discharge complies with an NPDES permit. The SWRCB and RWQCBs have developed numeric and narrative water quality criteria to protect beneficial uses of state waters and waterways. Beneficial uses along the IC Project Alignment include water supply, groundwater recharge, aquatic habitat, wildlife habitat, and recreation.

4.10.2.1.2 Section 303(d), Impaired Water Bodies and Total Maximum Daily Loads

Section 303(d) of the CWA requires states to identify waters where adopted water quality standards and beneficial uses are still unattained. These lists of prioritized impaired water bodies, known as the “303(d) lists,” are submitted to the USEPA every 2 years.

The law requires the development of Total Maximum Daily Loads (TMDL) to improve water quality of impaired water bodies. TMDLs are the quantities of pollutants that can be assimilated by a water body without violating water quality standards. A TMDL must account for point and nonpoint sources as well as background (natural) sources and are implemented by allocating the total allowable pollutant loading among dischargers. States are developing TMDLs for impaired water bodies to maintain beneficial uses, achieve water quality objectives, and reduce the potential for future water quality degradation.

4.10.2.1.3 Section 401, Water Quality Certification

Section 401 of the CWA specifies that the State Water Resources Control Board (SWRCB) or applicable RWQCB must certify that any discharge into waters of the U.S. complies with state water quality standards, including beneficial uses (23 CCR § 3830, et seq.). Under California's policy of no net loss of wetlands, the SWRCB and RWQCBs require mitigation for dredge and fill impacts to wetlands and waterways (see Section 4.4, Biological Resources). Dredge and fill activities in wetlands and waterways that impact waters of the U.S. will require a Federal Section 404 permit from the USACE. These permits trigger the requirement to obtain a Section 401 certification, which must be obtained prior to issuance of a Section 404 permit.

4.10.2.1.4 Section 402, National Pollution Discharge Elimination System

The SWRCB and the RWQCBs implement and enforce the NPDES program in California. Issued in 1972, the NPDES regulations initially focused on municipal and industrial wastewater discharges, followed by stormwater discharge regulations, which became effective in December 1990. NPDES permits provide two levels of control: technology-based limits and water quality-based limits. Technology-based limits are based on the ability of dischargers to treat wastewater, while water quality-based limits are required if technology-based limits are not sufficient to protect the water body. Additionally, stormwater permitting for construction site discharges is described below under state Regulations.

Dischargers with water quality-based effluent limitations must achieve water quality standards in the receiving water. Published by the USEPA on May 18, 2000, the California Toxics Rule (CTR) largely reflects the water quality criteria contained in the USEPA's Section 304(a) Gold Book (USEPA 1986) and the later National Recommended Water Quality Criteria. (USEPA 2006) With promulgation of the CTR, these federal criteria are legally applicable in California to inland surface waters, enclosed bays, and estuaries for all purposes and programs under the CWA. NPDES permits must also incorporate TMDL waste load allocations when they are developed.

4.10.2.1.5 Section 404, Placement of Dredge or Fill Material into Waters of the U.S., including Wetlands

The USACE is responsible for issuing permits under CWA Section 404 for placement of dredge or fill material into waters of the U.S, including wetlands. Waters of the U.S. refers to oceans, bays, rivers, streams (including non-perennial streams with a defined bed and bank), lakes, ponds, and seasonal and perennial wetlands. Project proponents must obtain a permit from the USACE for all discharges of fill or dredged material before proceeding with a proposed activity. The USACE may issue either an individual permit or a general permit.

4.10.2.2 State

4.10.2.2.1 Porter-Cologne Water Quality Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) requires protection of water quality by appropriate designing, sizing, and construction of erosion and sediment controls. The Porter-Cologne Act established the SWRCB and divided California into nine regions, each overseen by a RWQCB. The SWRCB is the primary state agency responsible for protecting the quality of the state's surface and groundwater supplies and has delegated primary implementation authority to the nine RWQCBs. The Porter-Cologne Act assigns responsibility to the SWRCB and the nine RWQCBs for implementing CWA, including Sections 401 through 402 (see above).

The nine RWQCBs also implement CWA Section 303(d). Under Section 303(d), the RWQCBs identify streams and waters that have “Water Quality Limited Segments,” or portions that do not meet water quality standards even after point sources of pollution have installed the minimum required levels of pollution control technology. Pursuant to the CWA, the SWRCB establishes priority rankings for water on the lists and develops total maximum daily load criteria (i.e., the maximum quantity of a particular contaminant that a water body can assimilate without experiencing adverse effects) to improve water quality.

Under the Porter-Cologne Act and the NPDES, the SWRCB administers California’s stormwater permitting program. This program requires all projects that will disturb more than one acre of land to implement stormwater BMPs to prevent discharge of sediments and stormwater. The permit (General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities, Order 2009-0009-DWQ as amended by Order 2010-0014-DWQ) requires preparation of a SWPPP and implementation of BMPs, stormwater sampling, and reporting.

The SWRCB and the RWQCBs are responsible for addressing dredge and fill impacts to wetlands and waterways in California to support the State goal of no net loss of wetlands. The SWRCB and the RWQCBs are responsible for the issuance of Section 401 water quality certifications for federal actions that result in dredge and fill activities in federally jurisdictional wetlands and waterways. Dredge and fill activities in non-federally jurisdictional wetlands and waterways must be covered under a waste discharge requirement (WDR) issued by the SWRCB or applicable RWQCB.

The Porter-Cologne Act requires the development and periodic review of water quality control plans (Basin Plans) that designate beneficial uses of California’s major rivers and groundwater basins and establish narrative and numerical water quality objectives for those waters, provide the technical basis for determining waste discharge requirements, identify enforcement actions, and evaluate clean water grant proposals. The Basin Plans are updated every three years.

4.10.2.2.2 Lahontan Basin Plan

The majority of the IC Project Alignment falls within the jurisdiction of the Lahontan Regional Water Quality Control Board. The water quality objectives for the Lahontan Region, and specifically the Owens Valley and Mojave Desert, include measures to reduce the potential for contaminants. The Basin Plan lists restrictions on waste discharges and sediment and erosion control requirements. The Basin Plan identifies the majority of issues related to water quality within the Region are a result of non-point sources. The allocation of waters within the Region to areas outside the Region are also identified. The discussion of the Los Angeles Aqueduct and the State Water Project area also identified. Because of the size of the Region, careful consideration is between water quality and water quantity is a primary goal in the planning process for the Region.

4.10.2.2.3 California Fish and Game Code § 1600-1616

CFG Code Section 1600 et seq. sets forth guidelines for the protection and conservation of fish and wildlife, including habitat. The law requires any person, state or local governmental agency, or public utility to notify CDFW before beginning an activity that would substantially modify the bank or bed of a river, stream, or lake (i.e., prior to causing any potential hydrological impacts). If CDFW determines that the activity could substantially adversely affect a fish and wildlife resource, a Lake or Streambed Alteration Agreement is required. Refer to Section 4.4, Biological Resources, for additional information.

4.10.2.3 Local

The California Public Utilities Commission (CPUC) has sole and exclusive state jurisdiction over the siting and design of the IC Project. Pursuant to CPUC General Order 131-D (GO 131-D), Section XIV.B, "Local jurisdictions acting pursuant to local authority are preempted from regulating electric power line projects, distribution lines, substations, or electric facilities constructed by public utilities subject to the CPUC's jurisdiction. However, in locating such projects, the public utilities shall consult with local agencies regarding land use matters." Consequently, public utilities are directed to consider local regulations and consult with local agencies, but the counties' and cities' regulations are not applicable as the counties and cities do not have jurisdiction over the IC Project. Accordingly, the following discussion of local land use regulations is provided for informational purposes only.

4.10.2.3.1 Inyo County General Plan

The Inyo County General Plan Public Safety Element contains objectives to preserve natural water courses and reduce the potential for erosion and sedimentation, and encourage groundwater recharge. General Plan policies to improve water quality include development of detention basins, reducing channelization of water course, and restoration of degraded areas. It does not contain any specific goals or policies that are relevant to the IC Project.

4.10.2.3.2 Kern County General Plan

The Kern County General Plan Safety Element addresses watersheds, flooding, mudslides, and other hydrology-related topics. It does not contain any specific goals or policies that are relevant to the IC Project.

4.10.2.3.3 San Bernardino County General Plan

The County of San Bernardino General Plan does not contain any specific goals or policies that are relevant to the IC Project.

4.10.3 Significance Criteria

The significance criteria for assessing the impacts to hydrology and water quality come from the California Environmental Quality Act (CEQA) Environmental Checklist. According to the CEQA Checklist, a project causes a potentially significant impact if it would:

- Violate any water quality standards or waste discharge requirements
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local ground water table level
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on site or off site
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or a substantial increase in the rate or amount of surface runoff in a manner which would result in flooding on site or off site
- Create or contribute to runoff water, which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff
- Otherwise substantially degrade water quality
- Place housing within a 100-year floodplain, as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map, or other flood hazard delineation map
- Place structures within a 100-year flood hazard area, which would impede or redirect flood flows

- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including as a result of the failure of a levee or dam
- Expose people or structures to a significant risk of loss, injury, or death involving inundation by seiche, tsunami, or mudflow

4.10.4 Impact Analysis

4.10.4.1 Would the project violate any water quality standards or waste discharge requirements?

4.10.4.1.1 Construction

Less than Significant. Implementation of the Full-Rebuild Concept would require ground-disturbing activities that could increase soil erosion rates, potentially resulting in violating water quality standards and impacts to beneficial uses in adjacent water bodies. The Full-Rebuild Concept crosses erosion-prone areas and areas with potential for sedimentation. To minimize soil erosion and resulting impacts on water quality, SCE would comply with state stormwater regulations and the terms of ministerial grading permits from local and county jurisdictions (if such permits are necessary). Because the Full-Rebuild Concept would disturb more than 1 acre of soils, SCE would apply for coverage under a General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, Order 2009-0009-DWQ as amended by Order 2010-0014-DWQ. This general permit requires submittal of a Notice of Intent and preparation of a SWPPP and implementation of BMPs to address material management, non-stormwater discharge, sediment discharge, and erosion control to meet water quality standards. Site-specific BMPs would be developed including, but not limited to: erosion and sediment control, sediment stabilization, and good site housekeeping.

The Full-Rebuild Concept crosses the Mojave River in two locations, one each east and west of the City of Barstow, and is located proximate to and upslope of Haiwee Reservoir. With implementation of the project-specific SWPPP and compliance with the terms and conditions of federal and state permits, Full-Rebuild Concept activities would not result in water quality impacts or violate the TMDLs for the Mojave River or Haiwee Reservoir. Full-Rebuild Concept-specific stormwater BMPs would not result in exceedances for total dissolved solids in the Mohave River or Haiwee Reservoir by retaining construction-related stormwater runoff onsite. Therefore, construction of the Full-Rebuild Concept would not contribute to the degradation of water quality within a 303(d) listed waterbody.

Materials used during construction (e.g., diesel fuel, hydraulic fluid, oils, grease, and concrete) have the potential to be transported by storm water runoff and threaten aquatic life. These materials could violate water quality standards if they come in contact with storm water and/or are transported to nearby water resources or a municipal separate storm sewer system. The handling, storage, and disposal of potentially hazardous materials are discussed in Section 4.9, Hazards and Hazardous Materials, and specific measures to manage hazardous materials would be addressed in the SWPPP.

Wastewater would be generated by construction workers during construction of the Full-Rebuild Concept. However, the wastewater generated during the construction period would be contained within portable restrooms and disposed of by a licensed contractor. No wastewater would be discharged from the site.

Potential water quality impacts during construction within jurisdictional drainages would be minimized through compliance with the conditions set forth in the federal or state permits and agreements, and coordination with the resource agencies. Work within CWQ wetlands and other waters may require a CWA Section 404 permit for the placement of dredge or fill material in federally jurisdictional waters of the U.S. As such, SCE would be required to obtain a Section 401 water quality certification from the SWRCB or applicable RWQCB. Work within streams or drainages may require a 1602 Lake or Streambed Alteration Agreement from CDFW. Obtaining permits for dredge and fill activities and compliance with the terms and conditions in these authorizations would ensure that these activities would not violate any water quality standards or waste discharge requirements.

Earth moving activities including vegetation removal, rehabilitation of existing access roads, and construction of new spur roads have the potential to create stormwater runoff during rain events and violate water quality standards. With the implementation of BMPs from the SWPPPs required under the state construction stormwater permit program, and compliance with terms and conditions of other required permits (including ministerial grading permits), the Full-Rebuild Concept would not violate water quality standards or applicable waste discharge requirements associated with construction activities. With implementation of the Full-Rebuild Concept-specific BMPs provided in the SWPPP and with proper disposal of any groundwater encountered during construction activities, the Full-Rebuild Concept would not violate any water quality standards or waste discharge requirements; therefore, impacts would be less than significant.

4.10.4.1.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.10.4.2 Would the project substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local ground water table level?

4.10.4.2.1 Construction

Less than Significant Impact. During earth-disturbing activities, water would be used to control dust and stabilize unvegetated areas. Water for dust control would be obtained from existing surface water- and groundwater-fed supplies. It is estimated that up to 3,100 acre-feet of water may be used over the construction period; this is a highly conservative estimate, and actual water consumption would be substantially less due to refinements in construction scheduling during final engineering. The consumptive use of 3,100 acre-feet over the construction period would not result in a substantial depletion of groundwater supplies: the annual water supply in 2010 reported by the Mojave Water Agency (MWA, which covers the southern portion of Segment 2, all of Segments 3N and 3S, and the western portion of Segment 4) was 179,438 acre-feet; demand was 145,875 acre-feet. Forecast supply in 2020 is 192,339 acre-feet, with demand estimated to be 159,544 acre-feet. The MWA notes that almost all of the water use within the Region is supplied by pumped groundwater. (MWA 2014) The Full-Rebuild Concept's approximate 1,000 acre-feet of annual water consumption represents approximately 3 percent of the annual supply surplus, and thus would not substantially deplete groundwater supplies and would not lower the local ground water table level.

During installation of TSPs and LWS poles and underground facilities, shallow groundwater may be encountered. In these instances, excavations would be dewatered and either discharged on-site to the surface or stored in Baker tanks or similar equipment prior to disposal off-site; this water may also be used for dust control. Groundwater dewatered from excavations and discharged to land or used for dust control would infiltrate into the existing groundwater system; during this process some groundwater would be lost to evapotranspiration, but this loss would be minor and would not substantially deplete groundwater supplies Dewatering would be localized, of short duration, and of a small volume, and would not substantially deplete groundwater supplies.

The Full-Rebuild Concept does not involve substantial grading operations or alterations to the existing terrain that would substantially alter existing drainage patterns that would affect groundwater supplies.

TSP foundations represent the only new impervious surfaces that would result from the Full-Rebuild Concept. The total area of these foundations would be less than 1 acre; an increase in less than 1 acre of impervious surface would not impede groundwater recharge or restrict infiltration to the groundwater table. The new foundations would not create a contiguous impervious surface and would therefore not reduce the potential for infiltration and impacts would be less-than-significant.

Because of the relatively small volume of groundwater that would be used during construction when compared to the existing groundwater supplies in the area; the limited volumes of dewatering waters; and that TSP foundations would not impede groundwater recharge or restrict infiltration to the groundwater table, construction-related impacts under this criterion would be less than significant.

4.10.4.2.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.10.4.3 Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?

4.10.4.3.1 Construction

Less than Significant Impact. The Full-Rebuild Concept crosses several ephemeral and intermittent drainages as well as the Owens River and Mojave River. The Full-Rebuild Concept involves vegetation removal and grading associated with the rehabilitation of existing access and spur roads and the establishment of structure installation and removal sites, pull sites, and other construction work areas; the installation of replacement subtransmission poles; the construction of new spur roads; and the establishment and use of staging areas. Many of the existing access and spur roads cross ephemeral or intermittent drainages, or are located in areas that are prone to erosion and sedimentation. Rehabilitation of these existing access and spur roads and the construction of new spur roads may result in localized changes to the existing drainage patterns. Construction of new pole foundations would result in a small increase in above-ground impervious surfaces, but this would not result in a change in the drainage patterns that could result in erosion and sedimentation on or off-site. The new foundations would extend approximately 2 feet above the ground surface and be up to approximately 8 feet in diameter.

Removal of existing subtransmission structures may cause minor changes in existing drainage patterns; where foundations would be removed, final grading and contouring would return the removal areas to pre-project conditions to the extent feasible. A site-specific SWPPP would be prepared that would identify BMPs to reduce runoff rates which would minimize the potential for erosion and sedimentation that could alter drainage patterns.

Work within streams or rivers would be avoided to the extent feasible. However, where work within drainages is required, SCE would implement measures contained in APM WET-1, including the implementation of appropriate Best Management Practices (BMPs) (e.g., silt fencing and straw wattles) to reduce the risk of an unintended release of sediments or other materials into jurisdictional waters. Where required, permits per CWA Sections 404 and 401, the Porter Cologne Act, and CDFW 1602 LSAA would be obtained and all conditions of compliance would be implemented including, but not limited to, returning all drainage features temporarily impacted during construction to pre-project conditions. Therefore, impacts would be less than significant during construction under this criterion.

4.10.4.3.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.10.4.4 Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or a substantial increase in the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

4.10.4.4.1 Construction

Less than Significant Impact. As described above, work associated with the Full-Rebuild Concept would result in a minor increase in impervious surface compared with existing conditions, and vegetation removal and grading would result in minor changes to drainage patterns. However, the overall drainage patterns would remain unchanged and the Full-Rebuild Concept would not alter the course of a stream or river. The Full-Rebuild Concept SWPPP would include measures to control stormwater runoff rates which would minimize the potential for significant alteration of drainage patterns that would result in flooding on-site or off-site. Improvements to existing access roads and spur roads and construction of new spur roads would include design considerations to maintain or improve drainage patterns. Through drainage design and SWPPP implementation, the Full-Rebuild Concept would not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or a substantial increase in the rate or amount of surface runoff in a manner which would result in flooding on- or off-site, and thus impacts would be less than significant.

4.10.4.4.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.10.4.5 Would the project create or contribute to runoff water, which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?

4.10.4.5.1 Construction

Less than Significant Impact. As previously described, the Full-Rebuild Concept would not substantially increase the area of impervious surfaces that could result in a substantial increase in runoff.

Grading of construction work areas, rehabilitation of access roads and spur roads, construction of new spur roads, and construction of TSP foundations could contribute to minor increases of polluted runoff during construction. These activities would be temporary, and impacts would be reduced by the implementation of BMPs identified in the site-specific SWPPP. Because Full-Rebuild Concept activities would not substantially increase polluted runoff, the minor increase in runoff resulting from Full-Rebuild Concept activities would not exceed the capacity of existing or planned stormwater drainage systems. Therefore, impacts would be less than significant.

4.10.4.5.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.10.4.6 Would the project otherwise substantially degrade water quality?

4.10.4.6.1 Construction

Less than Significant Impact. As previously discussed, the Full-Rebuild Concept would not increase or create new sources of potential water quality degradation, decrease the availability of groundwater sources, violate waste discharge requirements or water quality standards or result in substantial increases in impervious surfaces. As described in Chapter 3, project-specific BMPs would be implemented that would reduce the potential for water quality impacts during implementation of the Full-Rebuild Concept. Therefore, less than significant impacts would be realized under this criterion.

4.10.4.6.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No material changes in O&M activities or the locations of these activities are anticipated with implementation of the Full-Rebuild Concept, and therefore no impacts would be realized under this criterion during operations and maintenance.

4.10.4.7 Would the project place housing within a 100-year floodplain, as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

4.10.4.7.1 Construction

No Impact. No housing is proposed as part of the Full-Rebuild Concept. Therefore, the Full-Rebuild Concept would not place housing within the 100-year flood hazard area as mapped on a Federal Flood Hazard map or Federal Insurance Map, and no impacts would result.

4.10.4.7.2 Operations

No Impact. No housing is proposed as part of the Full-Rebuild Concept. Therefore, the Full-Rebuild Concept would not place housing within the 100-year flood hazard area as mapped on a Federal Flood Hazard map or Federal Insurance Map, and no impacts would result.

4.10.4.8 Would the project place within a 100-year flood hazard area structures which would impede or redirect flood flows?

4.10.4.8.1 Construction

Less than Significant Impact. The replacement subtransmission structures to be installed under the Full-Rebuild Concept would not alter drainage patterns and would not have a large cross section that would significantly impede flood flows. Therefore, any impacts from placing structures in a 100-year flood hazard zone would be less than significant.

4.10.4.8.2 Operation

No Impact. Operation and maintenance activities, that exist today, would not change as a result of the Full-Rebuild Concept. Nor would any additional structures or facilities be placed in the 100-year flood zone, through operation and maintenance, which would potentially alter drainage patterns or impede water flows. Therefore, no impacts would occur during operation of the Full-Rebuild Concept under this criterion.

4.10.4.9 Would the project expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

4.10.4.9.1 Construction

Less than Significant Impact. Portions of the Full-Rebuild Concept in Segment 1 at Control Substation, between Control Substation and Owens Lake, areas upstream of the South Haiwee Reservoir and downstream of the North Haiwee Reservoir dam, are located in areas that could be inundated during flooding or following a dam failure. In the unlikely event of flooding, including flooding as a result of the failure of a levee or dam, construction crews would evacuate in accordance to established evacuation plans and routes. Further, replacement structures installed in areas subject to flooding related to dam or levee failure are located in areas that are sparsely populated and where third-party infrastructure is not present; therefore, impacts related to dam or levee failure and risk of injury or death resulting from flooding would be less than significant.

4.10.4.9.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No O&M activities, including safety and evacuation procedures are expected to be altered as a result of the rebuild of structures that would expose people or structures at greater risk. Therefore, no impacts would be realized under this criterion during operations and maintenance.

4.10.4.10 Would the project expose people or structures to a significant risk of loss, injury or death involving inundation by seiche, tsunami, or mudflow?

4.10.4.10.1 Construction

Less than Significant Impact. The Full-Rebuild Concept is not located in an area subject to a tsunami. Seiches are waves generated within an enclosed large body of water (such as a lake) that are caused by an earthquake. Within the Full-Rebuild Concept area, seiches could occur within the reservoirs along Segment 1. Replacement structures would generally be sited further away from the shorelines of the reservoirs than are the existing subtransmission poles and towers, and thus less susceptible to inundation by seiche. Therefore, in areas potentially subject to inundation by seiche, the replacement subtransmission poles would not expose third-party structures to any greater risk of loss, injury, or death than the existing subtransmission poles and towers pose to third-party structures.

The Full-Rebuild Concept is routed through areas that may be susceptible to mudflows. However, the Full-Rebuild Concept does not include the construction of residences or other structures or facilities designed for human occupation. Further, most of the Full-Rebuild Concept is located in uninhabited, open space areas with few third-party structures or habited buildings. The installation of replacement structures in areas subject to mudflows would not expose third-party structures or people to any greater risk of loss, injury, or death than the existing subtransmission poles and towers pose to third-party structures or people. Therefore, impacts under this criterion would be less than significant.

4.10.4.10.2 Operations

No Impact. As presented in Chapter 3, SCE is currently performing operation and maintenance (O&M) activities, including inspections, along the subtransmission lines that would be rebuilt under the Full-Rebuild Concept. No O&M activities, including safety and evacuation procedures, are expected to be altered as a result of the rebuild of structures that would expose people or structures to a greater risk. Therefore, no impacts would be realized under this criterion during operations and maintenance.

4.10.5 Applicant Proposed Measures

Compliance with current laws and regulations, including adherence to the General Permit and SWPPP and implementation of BMPs, impacts would be less than significant and no additional measures are proposed.

4.10.6 Alternatives

Alternatives to the Full-Rebuild Concept are addressed in Section 5.2, Description of Project Alternatives and Impact Analysis.

4.10.7 References

Kern County. 2009. General Plan, Safety Element. Available at https://psbweb.co.kern.ca.us/planning/pdfs/kcgp/KCGPChp4Safety.pdf.

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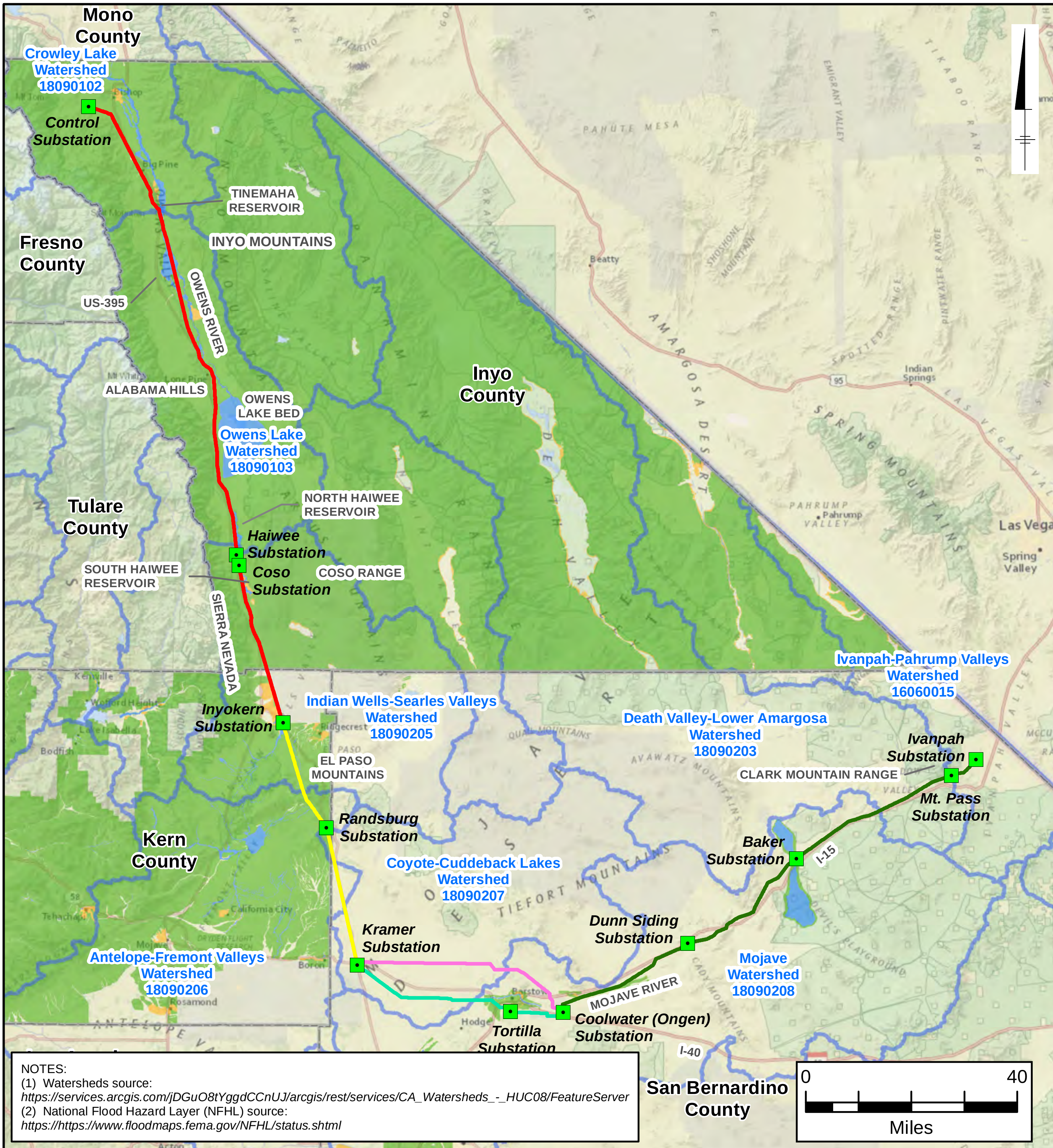

NOTES:
(1) Watersheds source:
https://services.arcgis.com/jDGuO8tYggdCCnUJ/arcgis/rest/services/CA_Watersheds_-_HUC08/FeatureServer
(2) National Flood Hazard Layer (NFHL) source:
https://https://www.floodmaps.fema.gov/NFHL/status.shtml

Legend

- Substations
- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
- Segment 4
- Counties
- Watersheds - HUC08

Flood Zone Subtype

- Floodway
- 0.2% Annual Chance Flood Hazard
- Area of Minimal Flood Hazard

IVANPAH-CONTROL PROJECT

WATERSHEDS AND FLOODPLAINS

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FIGURESET: 4.10-1

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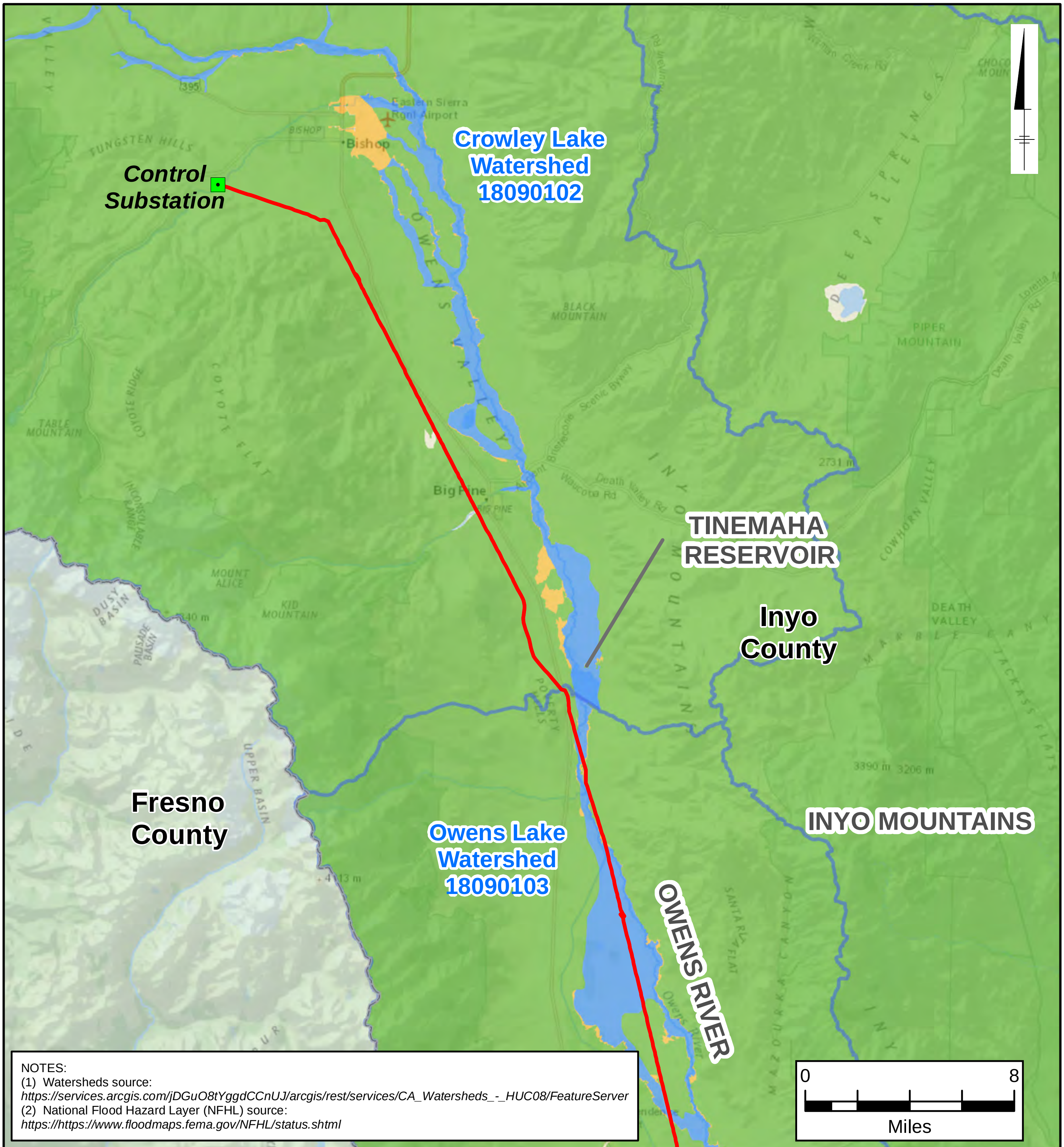

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Legend

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- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
- Segment 4
- Counties
- Watersheds - HUC08

Flood Zone Subtype

- Floodway
- 0.2% Annual Chance Flood Hazard
- Area of Minimal Flood Hazard

IVANPAH-CONTROL PROJECT

WATERSHEDS AND FLOODPLAINS

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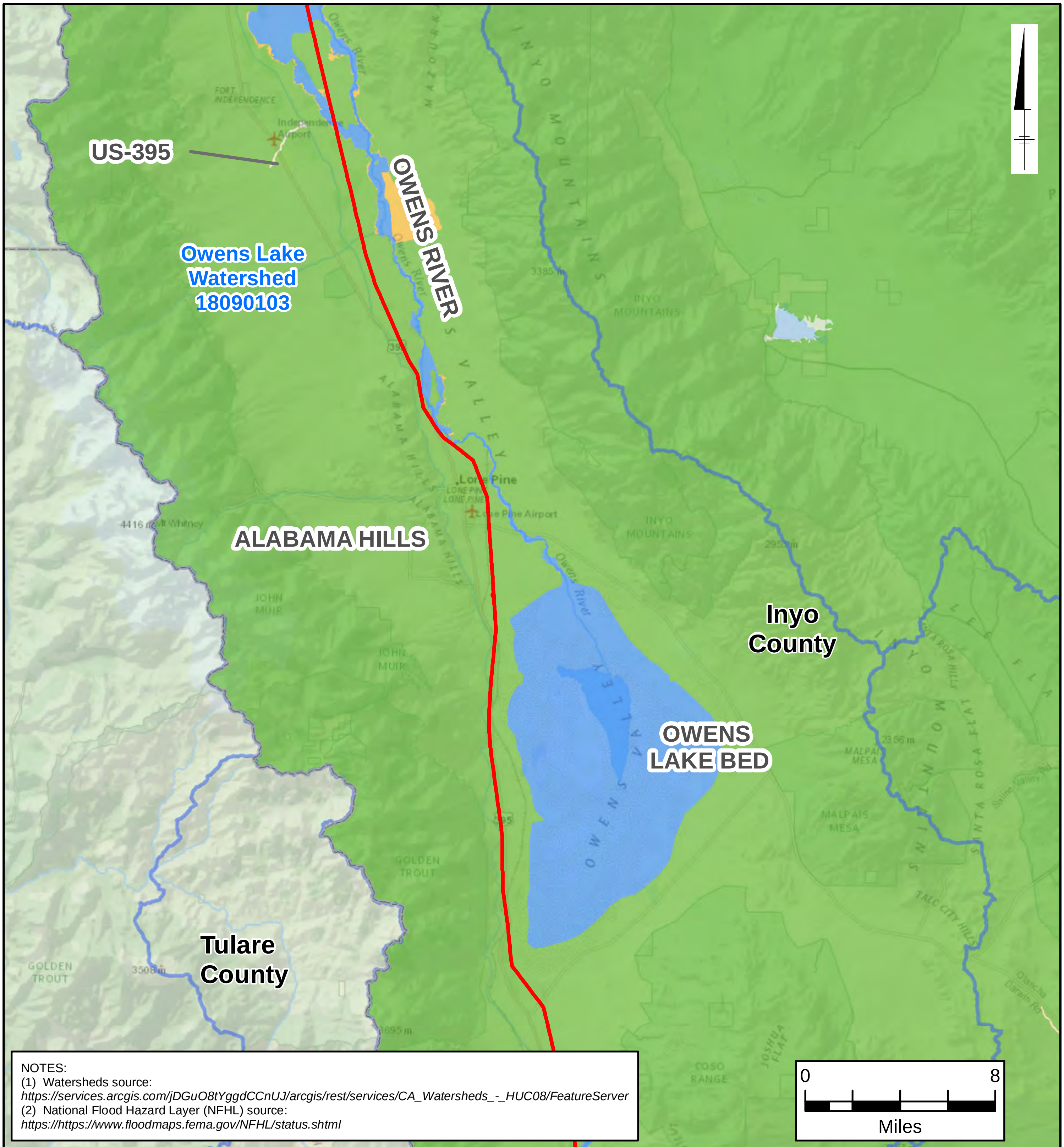

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Legend

- Substations
- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
- Segment 4
- Counties
- Watersheds - HUC08

Flood Zone Subtype

- Floodway
- 0.2% Annual Chance Flood Hazard
- Area of Minimal Flood Hazard

IVANPAH-CONTROL PROJECT

WATERSHEDS AND FLOODPLAINS

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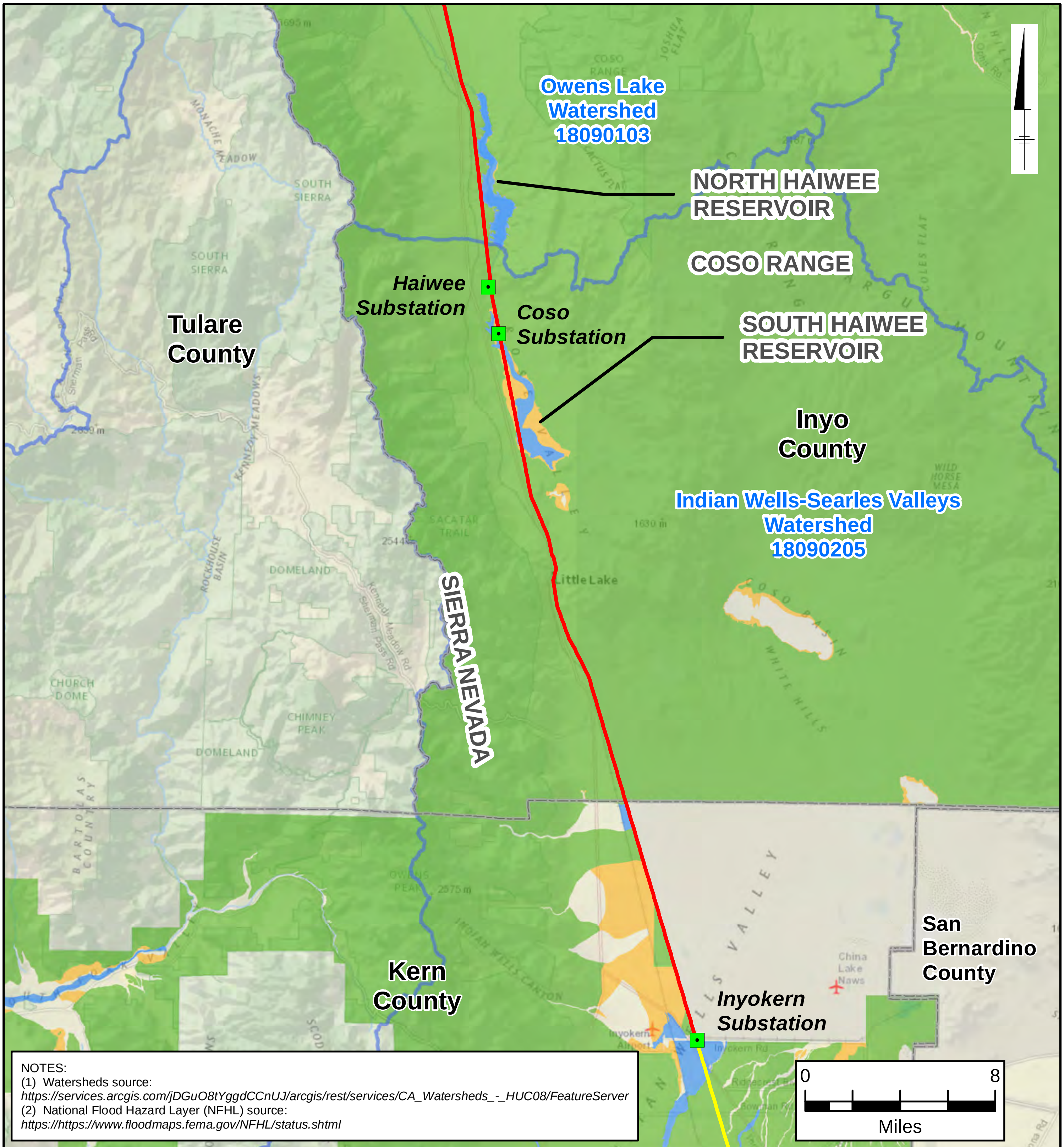

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(2) National Flood Hazard Layer (NFHL) source:
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Legend

- Substations
- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
- Segment 4
- Counties
- Watersheds - HUC08

Flood Zone Subtype

- Floodway
- 0.2% Annual Chance Flood Hazard
- Area of Minimal Flood Hazard

IVANPAH-CONTROL PROJECT

WATERSHEDS AND FLOODPLAINS

ARCADIS
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FIGURESET:
4.10-1

City: Div/Group: Created By: Last Saved By: MGI01044
Project (Project #)
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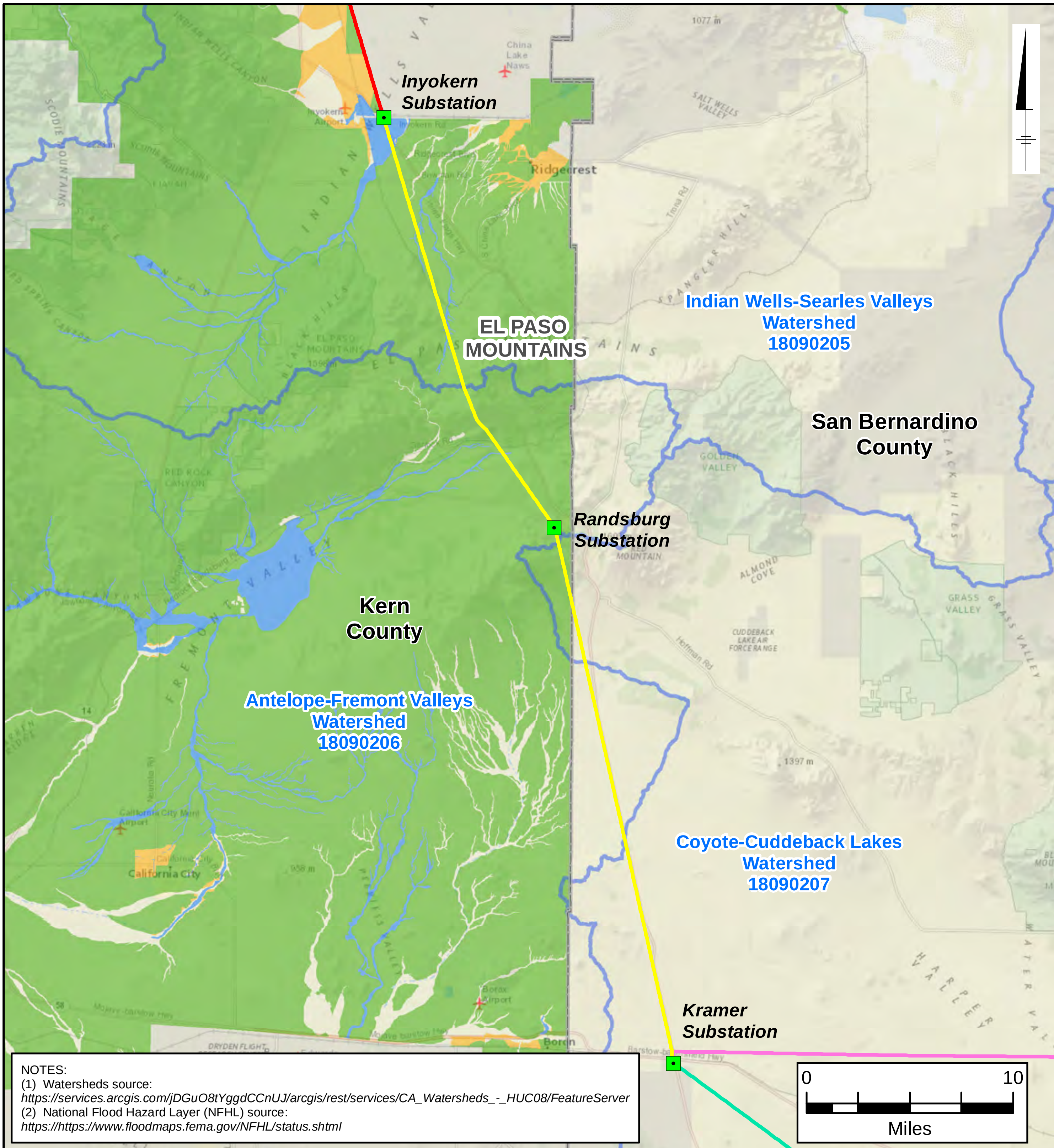

NOTES:
(1) Watersheds source:
https://services.arcgis.com/jDGuO8tYggdCCnUJ/arcgis/rest/services/CA_Watersheds_-_HUC08/FeatureServer
(2) National Flood Hazard Layer (NFHL) source:
https://https://www.floodmaps.fema.gov/NFHL/status.shtml

Legend

- Substations
- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
- Segment 4
- Counties
- Watersheds - HUC08

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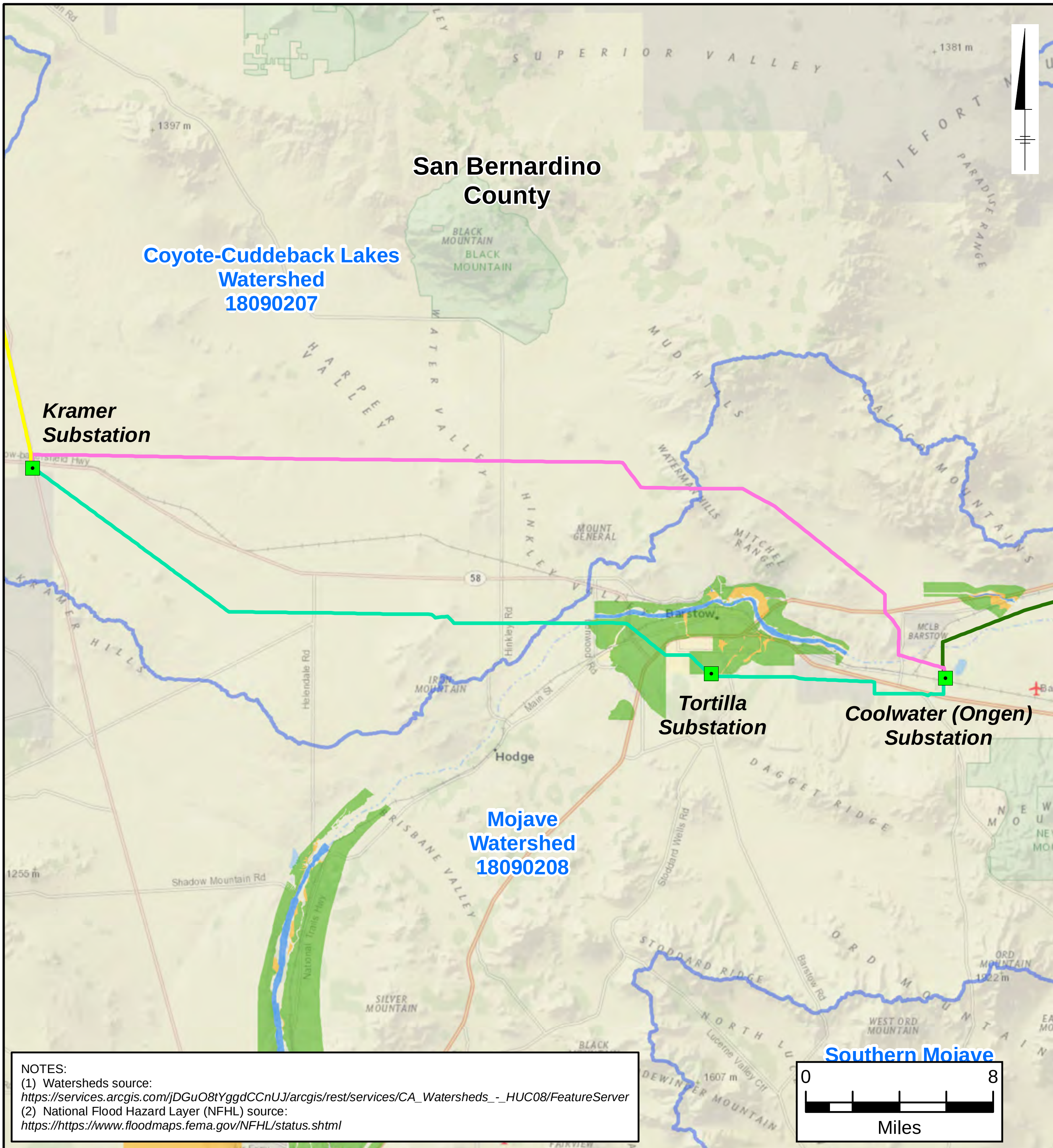

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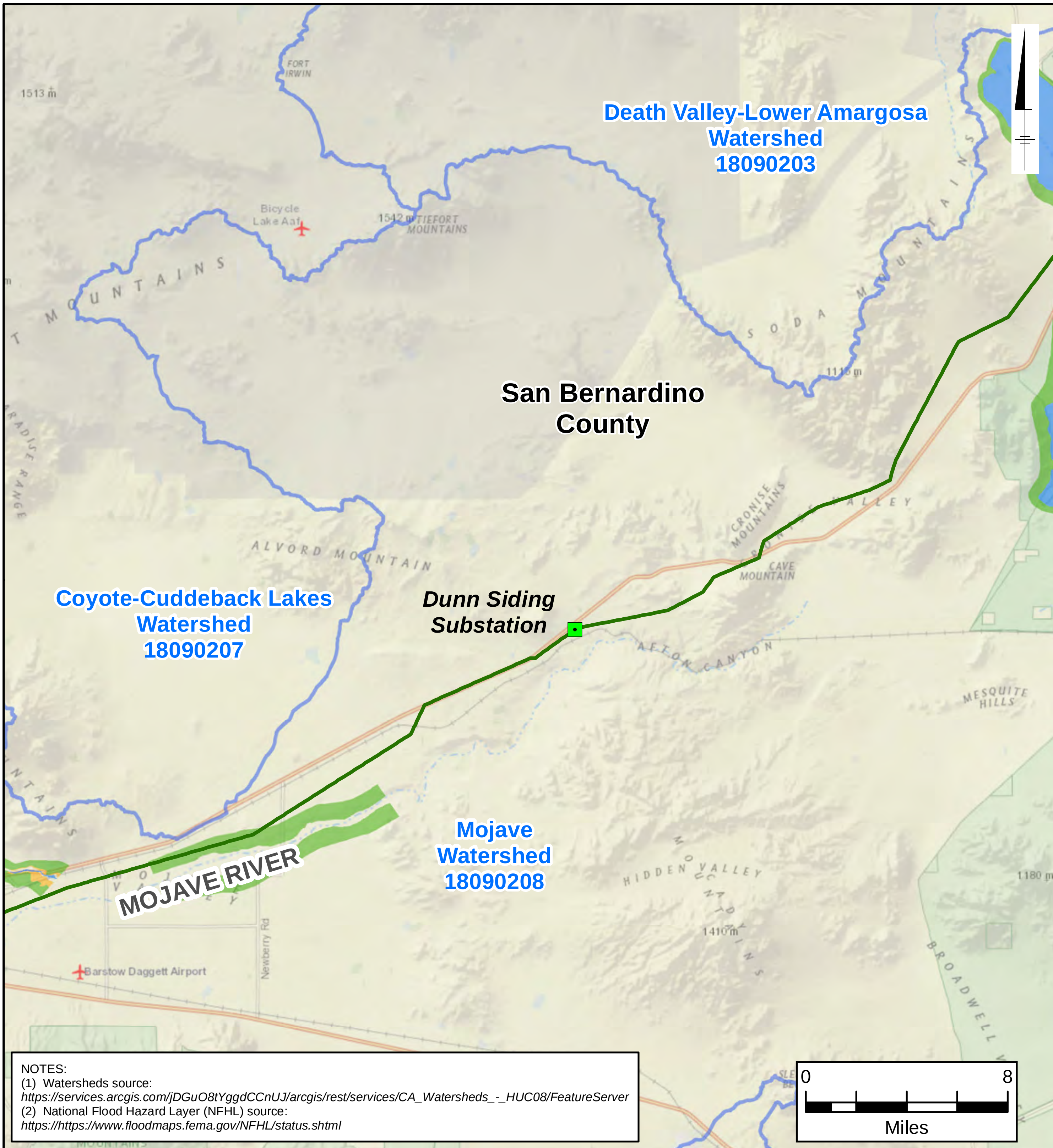

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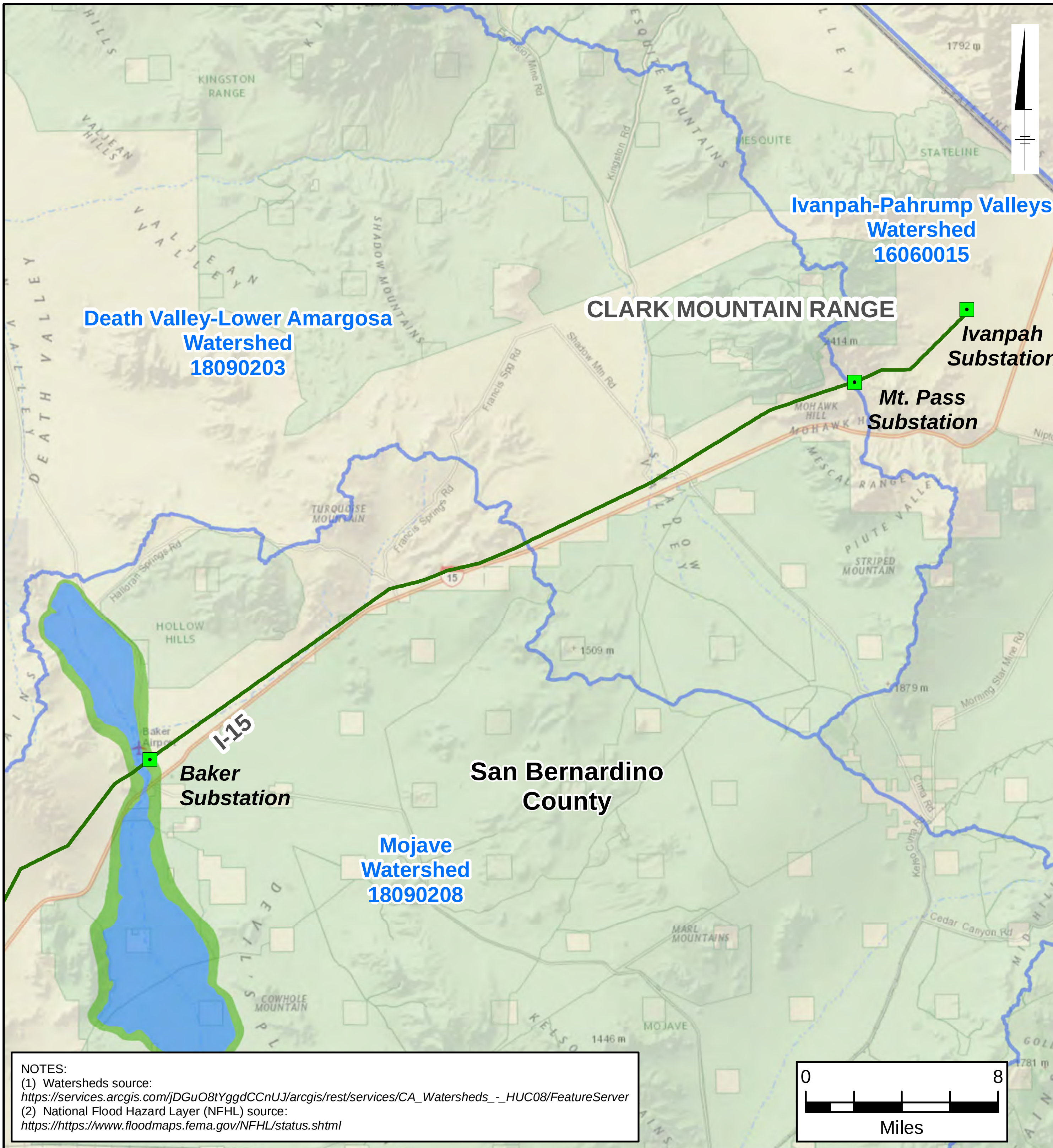

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IVANPAH-CONTROL PROJECT

WATERSHEDS AND FLOODPLAINS

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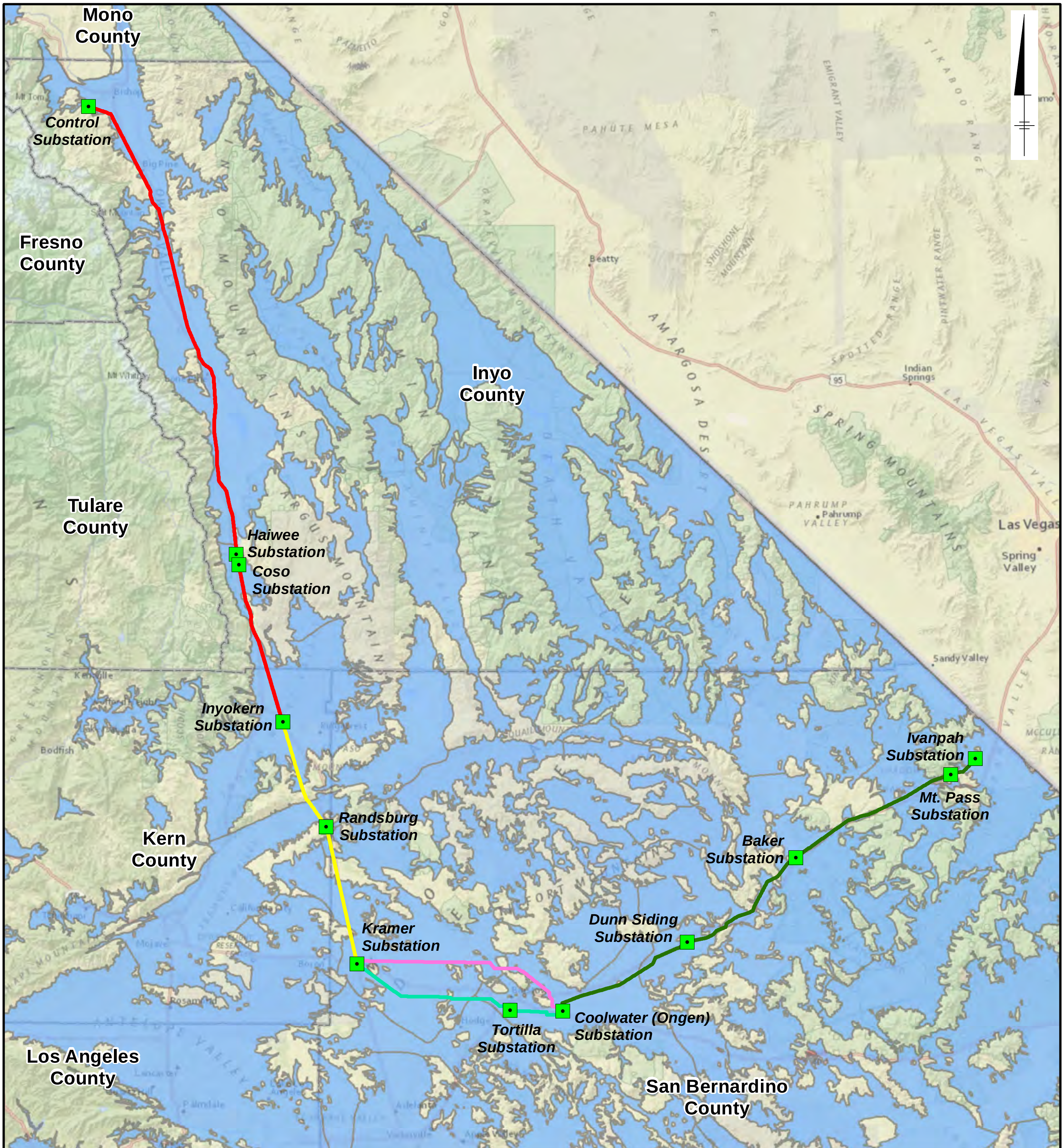

Legend

- Substations
- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
- Segment 4
- Counties
- Groundwater Basins

0 40

Miles

IVANPAH-CONTROL PROJECT

GROUNDWATER BASINS

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FIGURESET:

4.10-2

City: Div/Group: Created By: Last Saved By: MGI01044
Project (Project #)
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Legend

Substations
Segment 1
Segment 2
Segment 3N
Segment 3S
Segment 4
Counties
Groundwater Basins

0 8
Miles

IVANPAH-CONTROL PROJECT

GROUNDWATER BASINS

ARCADIS SOUTHERN CALIFORNIA EDISON

FIGURESET: 4.10-2

City: Div/Group: Created By: Last Saved By: MGI01044
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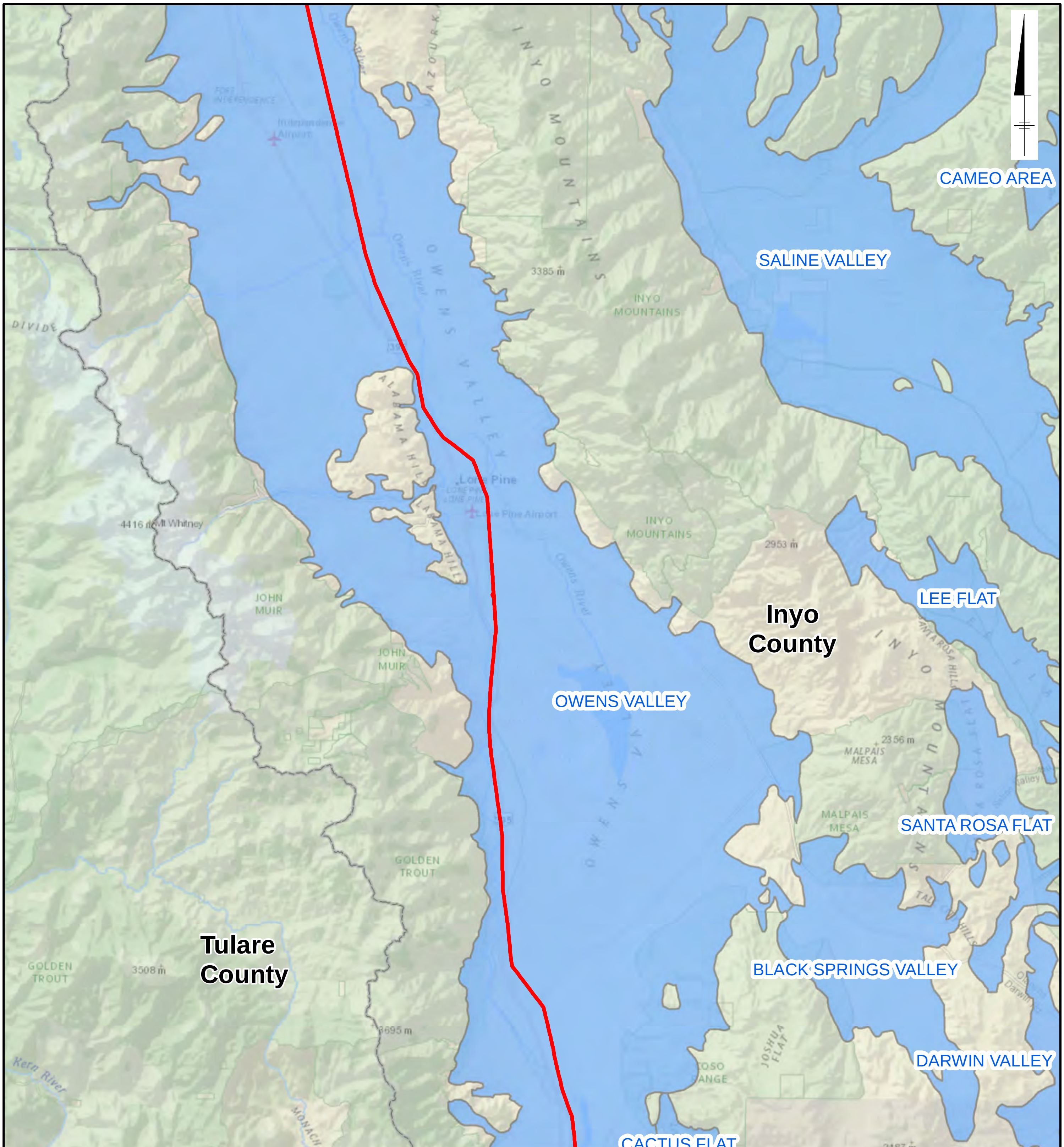

Legend

- Substations
- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
- Segment 4
- Counties
- Groundwater Basins

0 8
Miles

IVANPAH-CONTROL PROJECT

GROUNDWATER BASINS

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FIGURESET: 4.10-2

Legend

- Substations
- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
- Segment 4
- Counties
- Groundwater Basins

0 8
Miles

IVANPAH-CONTROL PROJECT

GROUNDWATER BASINS

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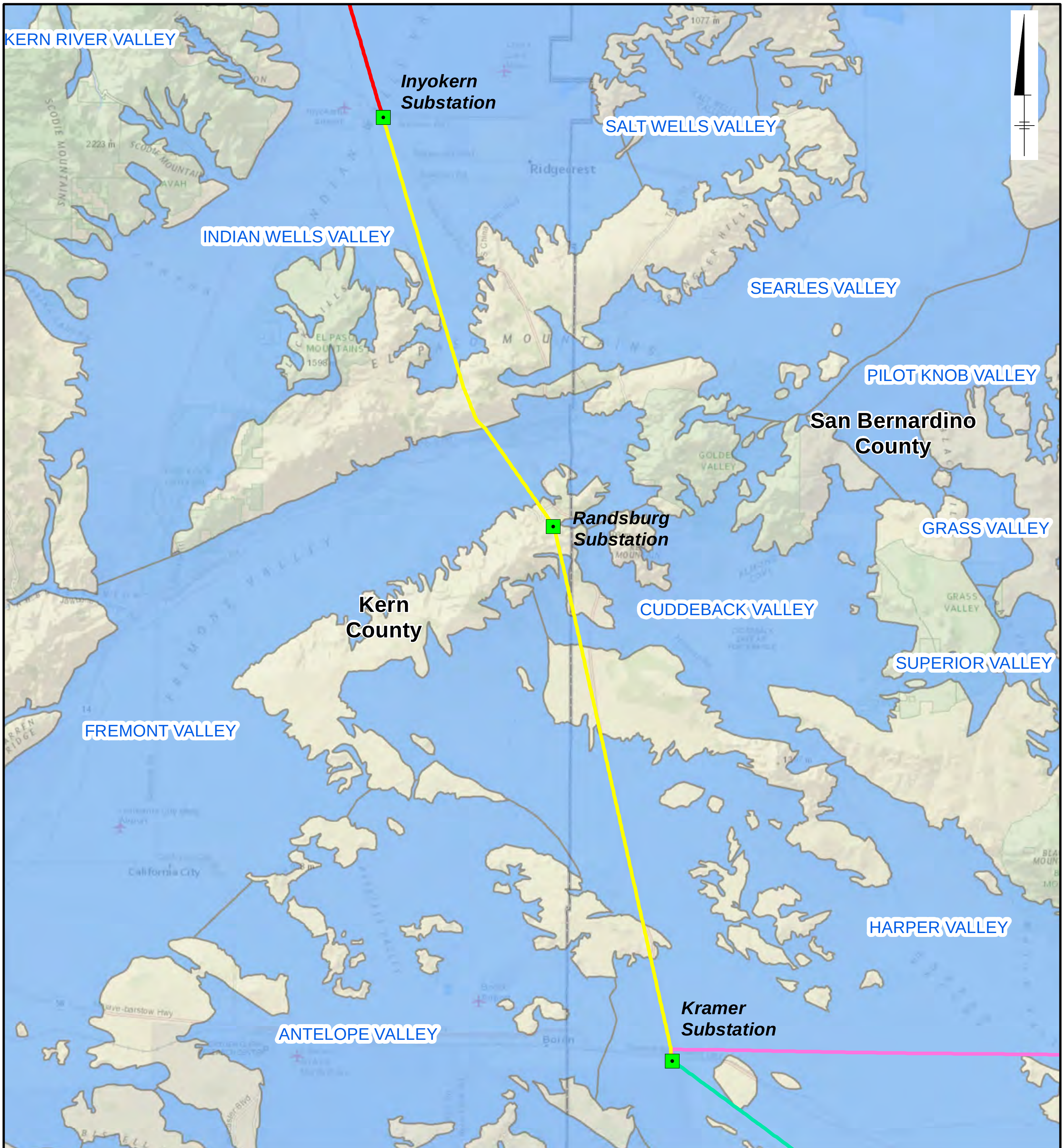
FIGURESET:
4.10-2



Legend

Substations		Counties	
Segment 1		Groundwater Basins	
Segment 2			
Segment 3N			
Segment 3S			
Segment 4			

0 10

Miles

IVANPAH-CONTROL PROJECT

GROUNDWATER BASINS

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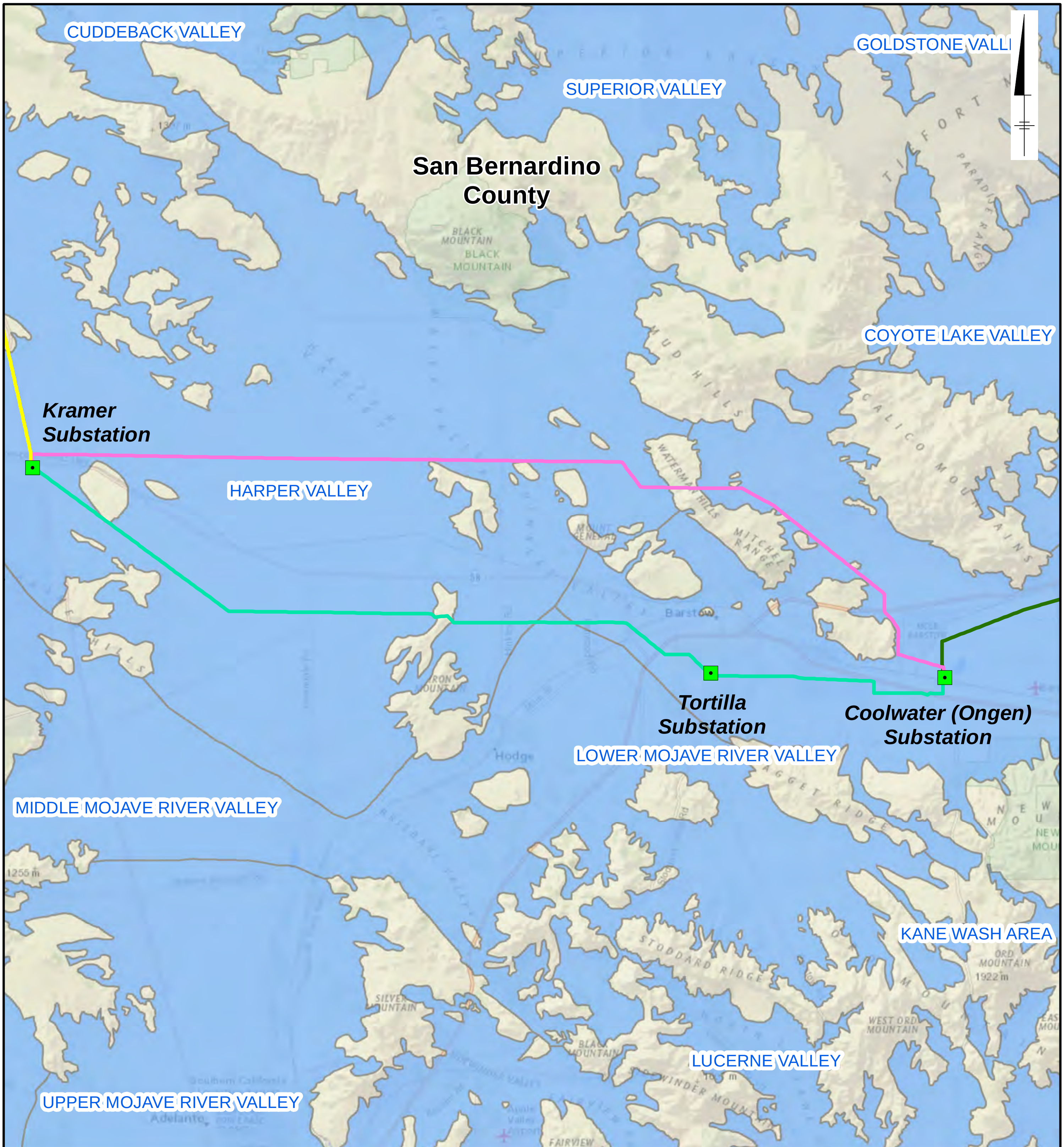

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Legend

- Substations
- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
- Segment 4
- Counties
- Groundwater Basins

0 — 8 Miles

IVANPAH-CONTROL PROJECT

GROUNDWATER BASINS

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FIGURESET: **4.10-2**

Legend

- Substations
- Segment 1
- Segment 2
- Segment 3N
- Segment 3S
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- Groundwater Basins

0 — 8 Miles

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GROUNDWATER BASINS

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Legend

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0 8
Miles

IVANPAH-CONTROL PROJECT

GROUNDWATER BASINS

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FIGURESET:
4.10-2