June 2010

RIVERSIDE TRANSMISSION RELIABILITY PROJECT

Earth Resources Technical Report

PROJECT NUMBER:
111728 / 111734

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1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

In 2004, pursuant to Southern California Edison's (SCE) Federal Energy Regulatory Commission (FERC)-approved Transmission Owner (TO) Tariff, Riverside Public Utilities (RPU) submitted a request for SCE to provide additional transmission capacity to meet projected load growth and to provide for system reliability. SCE determined that in order to meet RPU's request, SCE should expand its regional electrical system to provide RPU a second source of transmission capacity to import bulk electric power. This would be accomplished by creation of a new SCE 230 kilovolts (kV) transmission interconnection, the construction of a new SCE substation, the construction of a new RPU substation, and the expansion of the RPU 69 kV subtransmission system. The proposed Project, called the Riverside Transmission Reliability Project (RTRP), would provide RPU with long-term system capacity for load growth, and needed system reliability and flexibility.

The additional transmission capacity to RPU would be available through the proposed SCE Wildlife Substation at 230 kV and then transformed to 69 kV for integration into the RPU electrical system serving the City of Riverside (City). The transformation or "stepping down" of power from 230 kV to 69 kV would take place at the proposed RPU Wilderness Substation. Wilderness and Wildlife Substations would be located adjacent to each other on property that is presently owned by and within the City.

In order to integrate the additional transmission capacity into RPU's electric system, RPU's 69 kV system would be expanded and divided into eastern and western systems. The existing source of energy from Vista Substation would continue to supply the eastern system, while the western system would be supplied through the proposed Wilderness Substation. Creating two separate 69 kV subsystems is necessary for prudent electric utility operation and would also help provide the required level of emergency back-up service, particularly in the event of an interruption to either 230/69 kV substation source.

Several new double-circuit 69 kV subtransmission lines would need to be constructed between 69 kV substations within the City. To accommodate these new subtransmission lines, upgrades would be required at four existing RPU 69 kV substations. The upgrades would take place within the existing boundaries of each substation.

New fiber optic communications would also be required for system control of Wilderness and Wildlife Substations and associated 69 kV and 230 kV transmission lines. The 69 kV communication facilities would be incorporated into the existing RPU fiber optic network. The 230 kV communications would meet SCE's reliability standards.

1.2 PROJECT LOCATION

The Project area is located in the western and northern sections of the City of Riverside and extends north into unincorporated areas of western Riverside County. The Project area is bordered to the north by State Route 60 (SR-60) and the existing Mira Loma to Vista SCE Transmission Lines to the west by Interstate 15, and to the south and east by State Route 91 (SR-91). The Santa Ana River roughly divides the Project area into northern and southern halves.

The natural topography of the Project area is valley lowland intersected by a sinuous river corridor, isolated bluffs, and rolling hills, and surrounded by mountain ranges. Elevations within the Project area range from 680 to above 1900 feet above mean sea level (MSL); however, Project components would be located in relatively level portions within this area. The Project area is almost entirely developed; the only remaining large areas of native habitats occur along the Santa Ana River and in the nearby Jurupa Mountains.

The Project area is characterized by rural, urban, and suburban development intermixed with agriculture and undeveloped lands. Extensive areas in the central portion of the Project area (Santa Ana River floodplain) are preserved open space, set aside for recreation, wildlife, and protected species. Rapid population growth in the Project area has resulted in increased development with accompanying changes in land use.

1.3 PROJECT COMPONENTS

The RTRP project components would be located within Riverside County. Overall, the proposed RTRP would require approximately one year (with workers working 10-hour days, five days a week) to construct. The proposed RTRP includes the following:

1. Construction of approximately 10 miles of new double-circuit 230 kV transmission line from the existing Mira Loma – Vista #1 Transmission Line to the proposed Wildlife Substation;
2. Construction of approximately 11 miles of new 69 kV subtransmission lines between 69 kV substations and other existing subtransmission lines within the City of Riverside:
    - Wilderness – Jurupa double-circuit subtransmission lines
    - RERC – Harvey Lynn/Freeman single- and double-circuit subtransmission lines
    - Wilderness – Mountain View double-circuit subtransmission line
3. Construction of two new substations (Wilderness and Wildlife);
4. Upgrade of two 230 kV substations to replace line protection relays (within existing control houses): Mira Loma and Vista;
5. Upgrade of four substations to conduct minor pole re-alignments: Harvey Lynn, Mountain View, Freeman, and RERC; and
6. New fiber optic communications for system control of Wildlife and Wilderness substations and associated 230 kV transmission and 69 kV subtransmission lines.

The Proposed Project adds a new source of transmission capacity to the City by construction of a new double-circuit 230 kV transmission line that would extend from the existing Mira Loma – Vista #1 230 kV Transmission Line to the proposed Wildlife Substation. This new double-circuit 230 kV transmission line would provide additional capacity to the City by interconnecting at the proposed Wildlife Substation, which would be constructed, owned and operated by SCE. To transfer increased capacity to the City, the proposed RPU-owned Wilderness Substation would be constructed immediately adjacent to Wildlife Substation and would transform or “step down” power from 230 kV to 69 kV.

With SCE providing a second point of delivery for bulk power to the City of Riverside’s electrical system, RPU would split its 69 kV subtransmission system into an eastern system served from the existing Vista Substation and a western system served from Wilderness Substation. To facilitate this, several 69 kV subtransmission lines would be constructed within the City by adding circuits to existing routes or through the construction of new lines. Upgrades would be made at various existing RPU substations, as well.

1.4 ENVIRONMENTAL SETTING

Over the last ten million years, climate in the Riverside region has fluctuated between cold and warm, wet and dry. The time period from the present back approximately 11,000 years is the Holocene geochronologic unit that marks the transition from the last ice age to our current drier conditions. The Pleistocene epoch extends from approximately 11,000 years before present (b.p.) to 1.6 million years b.p. (Bryant and Hart, 2007). During the Pleistocene, prehistoric animal species that are known to have lived in the region include the American lion, saber-toothed cat, prehistoric bison and mammoth. Portions of the 230 kV study corridors are underlain by Pleistocene age alluvial soils (Dibblee, 2004). Because of the relative age of these soils, there are potentially fossil-bearing localities within the study areas.

The 230 kV and 69 kV study corridors, Wildlife Substation, Wilderness Substation, and 69 kV substation upgrades are situated within the north central Peninsular Ranges Geomorphic Province of California. This geomorphic province is characterized by a series of mountain ranges separated by northwest trending valleys, sub-parallel to branching faults from the San Andreas fault (CGS, 2002). The San Andreas fault is considered to be the boundary of the crustal Pacific tectonic plate and the North American plate (CGS, 2002). Sub-parallel faults to the San Andreas fault which make up the San Andreas fault zone include the Newport-Inglewood fault, Elsinore fault zone, San Jacinto fault, and eastern California shear zone (CGS, 2002). The Peninsular Ranges Province extends approximately 900 miles from the Transverse Ranges southward to the tip of Baja California, Mexico (Norris and Webb, 1990).

Physiographically, the northern part of the Peninsular Ranges Province is divided into three major fault-bounded blocks named the Santa Ana Mountains, Perris Block, and the San Jacinto Mountains (Morton, 2004, pg 2). The Santa Ana Mountains block is the westernmost of the three, extending from the Pacific coastline eastward to the Elsinore Fault zone. Bedrock of this block includes Tertiary sedimentary rock in the western part to basement assemblages of Mesozoic metasedimentary and Cretaceous volcanic and batholithic rocks.

The central portion of the Peninsular Ranges, east of the Santa Ana Mountain block and west of the San Jacinto fault zone, is the Perris Block. This roughly rectangular area has relatively low topographic relief underlain by metasedimentary rocks intruded by plutons of the Cretaceous age Peninsular Ranges Batholith. Generally the bedrock within the study corridors consists of quartz diorite plutonic rock.

The San Jacinto Mountains block lies east of the Perris block and is bounded on the west by the San Jacinto fault and on the east by the San Andreas fault. Most of the San Jacinto Mountains block is underlain by a thick section of Pre-Cretaceous metasedimentary rocks that were intruded by Cretaceous age granite rocks of the Peninsular Ranges Batholith.

Alluvium, colluvium, and slope-wash deposits of late Pleistocene and Holocene times are found within existing drainage features, including valleys and streams. The alluvial deposits grade indiscernibly with colluvium and slope-wash deposits that generally flank the lower slopes adjacent to the valleys. These deposits are lithologically variable and generally reflect the local source material from which they were derived. Generally, the alluvial deposits within the study corridors consist of Pleistocene fluvial and/or fan deposits and Holocene fluvial deposits in the active Santa Ana River flood plain.

The dominant natural drainage course that crosses the study corridor area is the Santa Ana River channel. The Santa Ana River basin covers approximately 2,450 square miles, with the headwaters beginning in the San Bernardino and San Gabriel Mountains and outlets into the Pacific Ocean in Newport Beach (SCGS, 1978). The Santa Ana River channel enters the study area in Colton at an approximate elevation of 930 feet above MSL and exits the area near Norco at approximate elevation 630 feet above MSL.

1.4.1. Geologic Processes

Geologic processes that result in geologic hazards include: surface rupture, ground shaking (seismicity), ground failure, landslides, mudflows, subsidence of the land, liquefaction, tsunamis, seiches, and flooding due to failure of dams and levees. Because the study area is generally considered to be geologically active, most of the study corridors and substations will be exposed to some risk from geologic hazards such as earthquakes. Thus, significant geologic impacts exceed the typical risk of hazards for the region.

Surface ruptures are the displacement and cracking of the ground surface along a fault trace. Surface ruptures are visible instances of horizontal or vertical ground displacement, or a combination of the two, typically confined to a narrow zone along a fault. The effects of ground shaking, the actual ground motion during an earthquake, can vary widely across an area and depend on such factors as the earthquake intensity and fault mechanism, duration of shaking, soil conditions, type of structure and other factors. Ground failure results from the cyclical ground acceleration generated during an earthquake, producing landslides, ground cracking, subsidence and differential settlement. Liquefaction is a form of earthquake-induced ground failure that occurs primarily in relatively shallow, loose, granular, water-saturated soils.

Tsunamis are large ocean waves generated by large-scale, short-duration submarine earthquakes. Tsunami waves are capable of traveling great distances (over 1,000 miles) and damaging low-lying coastal regions. Seiches are waves formed from oscillations in enclosed or restricted bodies of water (i.e., harbors, lakes, reservoirs). Seiches can cause water to overtop reservoirs and lakes.

Landslides and mudflows are the downslope movement of soil and/or rock under the influence of gravity. Landslide and mudflow processes are influenced by factors such as thickness of soil or fill over bedrock, steepness and height of slope, physical properties of the fill, soil or bedrock materials, and moisture content. Mudflows can also occur when loose surficial deposits become saturated during periods of heavy rainfall and during flash flooding in ephemeral drainages near steep hillsides. Mudflow hazards typically increase significantly after loss of vegetation cover by fires or grading. These factors may increase the effective force of gravity upon a slope, decrease the ability of a slope to resist gravitational influences, or result in a combination of the two, which can lead to mudflows and landslides.

Slope instability has the potential to undermine foundations and cause distortion and distress to overlying structures. Slope failures include landslides (deep-seated shaped failures), slumps, mudflows, debris flows, block failures, and rock falls. Gravitational and erosional forces that can cause a variety of modes of slope failure act continuously upon slopes.

Igneous bedrock terrain is typically prone to block failures and rock falls. Block failures occur when a large slab of rock material separates along a preexisting joint or fractures on steep slopes and slides downslope. Weakening of the rock from normal erosional/weathering processes, seismic shaking, or a build-up of hydrostatic pressure from groundwater can initiate the failure.

Rock falls occur on very steep slopes where either weakened rock material eventually collapses or “uprooted” boulders or blocks are dislodged and roll down a slope.

Liquefaction is a phenomenon in which loose, saturated, granular soil deposits lose shear strength and mobilize as a result of increased pore water pressure induced by strong ground shaking during an earthquake. Structures founded on or above potentially liquefiable soil may experience settling (both total and differential) and loss of foundation support. The factors known to influence liquefaction potential include soil type, grain size, relative density, confining pressure, shallow depth to ground water, and the intensity and duration of ground shaking. Soils most susceptible to liquefaction are saturated, loose, sandy soils and some silty soils.

Dams and levees may fail for seismic or geologic reasons, including high ground accelerations during an earthquake, surface fault rupture, or poor geologic foundation materials. Flooding from the failure of a dam or levee is the result of a project site being situated topographically down-gradient from a reservoir or cannel breach.

1.5 STUDY PERSONNEL

The principle investigator of the earth resources study was Mr. Michael Cook, CEG, Senior Engineering Geologist for Kleinfelder. Mr. Cook was assisted by Mr. Richard Escandon, CEG, Principal Geologist; Mr. Andrew Turner, Staff Geologist; Mr. Kevin Paul, PE, Project Engineer; Mr. William Mumbleau, GIS Manager; and Ms. Vanessa Reynolds, GIS Staff Analyst, all of Kleinfelder.

2.0 REGULATORY FRAMEWORK

2.1 FEDERAL AUTHORITIES AND ADMINISTERING AGENCIES

The 2006 International Building Code (IBC) defines minimum standards for buildings, construction and grading activities. Where applicable, structures are design and constructed to resist the effects of earthquake motions in accordance with ASCE -7.

2.2 CALIFORNIA STATE AUTHORITIES AND ADMINISTERING AGENCIES

California Building Code. The State of California provides a minimum standard for building design through the 2007 California Building Code (CBC). The 2007 CBC is based on the 2006 International Building Code (IBC), but has been modified for California conditions. The CBC regulates site demolition, excavation, grading activities, including drainage and erosion control, and construction methods to protect people and property from geologic hazards. It is generally adopted on a jurisdiction-by-jurisdiction basis, subject to further modification based on local conditions. Commercial and residential buildings are plan-checked by local building officials and not by state agencies.

Alquist-Priolo Earthquake Fault Zoning Act. The Alquist-Priolo Earthquake Fault Zoning Act of 1972 prohibits the construction of buildings used for human occupancy on active surface faults, which are faults which have ruptured the ground surface in the past 11,000 years (Holocene Time). Unless proven otherwise, the area within 50 feet of an active fault is presumed to be underlain by active branches of the fault (CGS, 2007). California Geological Survey Special Publication 42 (Bryant and Hart, 2007) summarizes the responsibilities of the Alquist-Priolo Earthquake Fault Zoning Act. Transmission towers are not subject to the provisions of the Alquist-Priolo Earthquake Fault Zoning Act; however, planned structures should not be built on or adjacent to state-designated active faults. No portions of the study corridors are included within or cross an Alquist-Priolo Earthquake Fault Zone designated by the State of California.

Seismic Hazards Mapping Act. The Seismic Hazards Mapping Act (California Code of Regulations, Title 14, Article 10) provides for a state-wide seismic hazards mapping program to assist cities and counties in fulfilling their requirements for protecting the public health and safety from the effects of strong ground shaking, liquefaction, landslides or other ground failure and other seismic hazards caused by earthquakes. In accordance with the Public Resources Code (PRC) Sections 2690-2699.6 (Seismic Hazard Zonation Program), the California Geological Survey (CGS) shall prepare probabilistic ground shaking maps depicting a 10 percent probability of limits being exceeded in 50 years. These maps will be used to develop and define seismic hazards zones based on potential amplified ground shaking levels requiring mitigation, liquefaction hazard zones with potential permanent ground disturbance requiring mitigation, and/or earthquake-induced landslide hazard zones with the potential for permanent ground displacement requiring mitigation as defined in PRC Section 2693(c). CGS's Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California, provides guidance for evaluation and mitigation of earthquake-related hazards for projects within designate hazard zones.

3.0 INVENTORY METHODS

This section presents the methodology used to evaluate and analyze the environmental conditions and geologic setting as it relates to potential geohazards within the 230 kV and 69 kV study corridors, Wildlife Substation and Wilderness Substation, and the 69 kV Substation upgrades. Existing geologic conditions in the area were evaluated from a review of available published and unpublished literature, current aerial photographs from the Riverside County Flood Control, City of Riverside General Plan, online photos, and limited site reconnaissance. Descriptions of geologic units were derived from published sources from the CGS, United States Geological Survey (USGS), professional organizations, and academic resources.

4.0 INVENTORY RESULTS

4.1 230 KV TRANSMISSION CORRIDORS

Because the 230 kV corridors are within an area considered to be geologically active, the corridors will be exposed to some risk from geologic hazards, such as ground shaking and ground failure due to earthquakes.

4.1.1. Seismicity and Faults

There are no active faults that cross the 230 kV corridors; however, the corridors are located in the seismically active southern California region. The San Andreas fault trends along a roughly northwest/southeast alignment and is located approximately 16.2 miles northeast of the northeastern-most 230 kV study area. The San Andreas fault zone delineates the boundary between two global tectonic plates known as the North American Plate and Pacific Plate. The San Andreas Fault is the largest fault structure contained within a system of numerous subsidiary faults. The three closest active subsidiary faults are the Elsinore fault approximately 6.3 miles from the western-most 230 kV study corridor, the Cucamonga fault approximately 10.1 miles from the northern-most study corridor, and the San Jacinto fault approximately 11.0 miles from the northeastern-most study corridor at the Wilderness substation.

4.1.2. Seismic-Related Ground Failure

Locally, the 230 kV study corridors are underlain in some areas by soil which may be prone to liquefaction or settlement. These areas may be subject to ground deformation due to a large seismic event on one or more of the active faults in the region. The areas most susceptible to liquefaction are along the active Santa Ana River channel. Areas that are topographically at higher elevations than the Santa Ana River are mapped as having high to very high susceptibility to liquefaction due to shallow groundwater conditions and the underlying alluvial soils.

4.1.3. Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

Most of the 230 kV corridors are located along relatively level ground and away from steep slopes, except for portions along the boundaries of the Santa Ana River floodplain. Generally, the steep slopes along the Santa Ana River expose granite bedrock, which is not prone to landslides or debris flows. A portion of one 230 kV corridor is situated along the Santa Ana River bluff in an area underlain by older alluvium capping granite bedrock. This area is considered to have a low potential for slope stability issues.

Potential hazards to the 230 kV study corridors with respect to block failures or rock falls range from low to no impact in most of the study corridors, with the steeper slopes having a moderate potential for rock falls.

4.1.4. Tsunamis and Seiches

There are no impacts due to tsunamis because of the inland location of the study corridors. Geologic hazard impacts associated with seiches are insignificant within all the study corridors.

4.1.5. Flooding Due to Dam or Levee Failure

The 230kV study corridors cross the Santa Ana River channel. The potential seismic flooding hazard ranges from high to low depending on the 230 kV corridor's proximity to mapped inundation zones and distance from lakes and reservoirs within the region. A narrow portion of one study corridor has a high potential for seismic flooding hazard where the corridor crosses a mapped inundation zone.

4.2 69 KV TRANSMISSION CORRIDORS

Because the 69 kV corridors are within an area considered to be geologically active, the corridors will be exposed to some risk from geologic hazards, such as ground shaking and ground failure due to earthquakes.

4.2.1. Seismicity and Faults

There are no active faults that cross the 69 kV corridors; however, the corridors are located in the seismically active southern California region. The two closest active subsidiary faults of the San Andreas system are the Elsinore fault approximately 7.3 miles from the western-most 69 kV study corridor, and San Jacinto fault approximately 10.5 miles from the northeastern-most 69 kV study corridor.

4.2.2. Seismic-Related Ground Failure

In some areas, the 69 kV study corridors are underlain by soil which may be prone to liquefaction or settlement. These areas may be subject to ground deformation due to a large seismic event on one or more of the active faults in the region.

4.2.3. Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

Most of the 69 kV study corridors are located along relatively level ground and away from steep slopes, except for portions along the Santa Ana River floodplain.

Potential hazards to the 69 kV study corridors with respect to block failures or rock falls range from low to no impact in most of the study corridors, with the steeper slopes having a moderate potential for rock falls.

4.2.4. Tsunamis and Seiches

There are no impacts due to tsunamis because of the inland location of the study corridors. Several of the 69 kV study corridors are situated within outflow areas of Lake Mathews and local reservoirs. The potential seiche hazard ranges from high to low depending on the distance from lakes and reservoirs within the region.

4.2.5. Flooding Due to Dam or Levee Failure

Portions of several of the 69 kV study corridors are situated within outflow areas of Lake Mathews and local reservoirs. The potential seismic flooding hazard ranges from high to low depending on the distance from lakes and reservoirs within the region.

4.3 WILDLIFE AND WILDERNESS SUBSTATIONS

Because Wildlife Substation and Wilderness Substation are within an area considered to be geologically active, the substations will be exposed to some risk from geologic hazards, such as ground shaking and ground failure due to earthquakes.

4.3.1. Seismicity and Faults

There are no active faults that cross Wildlife Substation and Wilderness Substation; however, the substations are located in the seismically active southern California region. The two closest active faults are the Elsinore fault approximately 11.2 miles west, and the San Jacinto fault approximately 11.0 miles northeast.

4.3.2. Seismic-Related Ground Failure

Wildlife Substation and Wilderness Substation are underlain by granitic bedrock and are not prone to liquefaction or settlement, or subject to ground deformation due to a large seismic event on one or more of the active faults in the regions.

4.3.3. Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

Due to the relatively level ground surface and no upslope drainages, there is no impact with respect to mudflows, debris flows, or rock falls at Wildlife Substation or Wilderness Substation.

Steep slopes near the Santa Ana River are granitic bedrock and are not prone to gross slope instability or landslides.

4.3.4. Tsunamis and Seiches

There are no impacts due to tsunamis because of the inland locations of Wildlife Substation and Wilderness Substation, and no geologic hazard impacts associated with seiches due to the substations being situated near the crest of a topographic high area.

4.3.5. Flooding Due to Dam or Levee Failure

There are no impacts due to seismic-induced flooding hazards because the Wildlife Substation and Wilderness Substation are situated near the crest of a topographic high area, away from outflow areas of Lake Mathews and reservoirs within the region.

4.4 69 KV SUBSTATION UPGRADES

Because the 69 kV Substation upgrades are within an area considered to be geologically active, the substations will be exposed to some risk from geologic hazards, such as ground shaking and ground failure due to earthquakes.

4.4.1. Seismicity and Faults

There are no active faults that cross any of the 69 kV substation sites; however, the substations are located in the seismically active southern California region. The two closest active subsidiary faults of the San Andreas are the Elsinore fault approximately 7.3 miles west of Harvey Lynn Substation, and the San Jacinto fault approximately 10.5 miles northeast of the Mountain View Substation.

4.4.2. Seismic-Related Ground Failure

Harvey Lynn Substation and Freeman Substation are underlain by alluvial soil with shallow groundwater, which may be prone to liquefaction or subject to ground deformation due to a large seismic event on one or more of the active faults in the region.

4.4.3. Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

The 69 kV substations and the surrounding topography are relatively level sites underlain by older alluvial deposits. Due to the relatively level ground surface and no upslope drainages, there is no impact with respect to mudflows and debris flows at the 69 kV Substation upgrades.

4.4.4. Tsunamis and Seiches

There are no impacts due to tsunamis because of the inland locations of the 69 kV Substation upgrades, and no geologic hazard impacts associated with seiches due to the substations' general location away from any large bodies of open water.

4.4.5. Flooding Due to Dam or Levee Failure

There are no impacts due to seismic-induced flooding hazards because the 69 kV Substations are situated beyond potential flood inundation areas of Lake Mathews and reservoirs within the region. The Freeman Substation is situated adjacent to the potential flood inundation zone delineated for Mockingbird Canyon Dam. The potential seismic flooding hazard is low for the Freeman Substation.

5.0 IMPACT METHODS

The environmental impact analysis from a geohazards study evaluates existing geologic conditions which would adversely impact Project development components including tower and pole construction, temporary construction sites and permanent maintenance access roads, pulling areas, and tower and pole foundations.

5.1 METHODS

The earth resources analysis addresses the potential for the 230 kV and 69 kV study corridors and substations to be impacted by adverse geologic conditions. Geologic hazards include seismic shaking, surface fault rupture, landslides, earthquake-induced ground failure, and seismic induced flooding. These hazards were evaluated for potential impacts on project components including tower and pole sites, temporary construction and permanent access roads, pulling sites, and structure foundations. Soils and Mineral Resources were not included in the detailed analysis since impacts to these resources are considered less than significant.

5.2 SIGNIFICANCE CRITERIA

Geologic hazard impacts are considered potentially significant if the proposed Project development, including tower and pole construction, temporary construction areas and permanent maintenance access roads, and pulling areas activity, including all proposed mitigation measures, could result in substantially increased erosion, landslides, soil creep, mudslides and unstable slopes. In addition, impacts are considered significant when people or structures would be exposed to major geologic hazards upon implementation of the Project.

Geohazard impacts were assessed by reviewing the existing sites' geologic conditions, including geologic unit types, topography, groundwater, and distance to active faults. The significance of a potential geohazard impact was based on the proximity to active faulting, anticipated peak site ground acceleration, depth to ground water, anticipated slope conditions, slope steepness, and underlying potentially liquefiable soils.

5.3 MITIGATION MEASURES

Specific mitigation measures would be applied for impacts related to paleontological resources.

TABLE 1. MITIGATION MEASURES—PALEONTOLOGICAL RESOURCES

Mitigation Measure	Description
MM CUL-01	**Related to Cultural Resources**
MM CUL-02	**Related to Cultural Resources**

Mitigation Measure	Description
MM CUL-03	**A qualified paleontological monitor shall attend any pre-construction meetings at locations that are judged to have high potential for containing intact paleontological resources to consult with grading and excavation contractors concerning excavation schedules, paleontological field techniques, and safety issues.** A paleontological monitor is defined as an individual who has experience in the collection and salvage of fossil materials. The paleontological monitor shall work under the direction of a qualified paleontologist. A qualified paleontologist is defined as an individual with an M.S. or PhD in paleontology or geology, or closely related field, who is experienced with paleontological procedures and techniques, who is knowledgeable in the geology and paleontology of Southern California, and who has worked as a paleontological mitigation project supervisor in the region for at least one year.
MM CUL-04	**A qualified paleontological monitor shall spot-check the original cutting of previously undisturbed deposits of high paleontological resource sensitivity (e.g., Older Quaternary Alluvium)**. The paleontological monitor shall work under the direction of a qualified paleontologist.
MM CUL-05	**When significant fossils are discovered, the paleontologist (or paleontological monitor) shall recover them.** In most cases, this fossil salvage can be completed in a short period of time. Because of the potential for the recovering of small fossil remains, such as isolated mammal teeth, it may be necessary to recover bulk sedimentary matrix samples for off-site wet screening. However, some fossil specimens (such as complete large mammal skeletons) may require an extended salvage period. In these instances, the paleontologist (or paleontological monitor) should be allowed to temporarily direct, divert, or halt earthwork activities to allow recovery of fossil remains in a timely manner.
MM CUL-06	**Fossil remains collected during monitoring and salvage shall be cleaned, repaired, sorted, and cataloged as part of the mitigation program.**
MM CUL-07	**Prepared fossils, along with copies of all pertinent field notes, photos, maps, and measured stratigraphic sections, shall be deposited (as a donation) in a scientific institution with permanent paleontological collections, such as the Western Center for Archaeology and Paleontology, the San Bernardino County Museum, or the San Diego Natural History Museum.** Donation of the fossils shall be accompanied by financial support for initial specimen cataloguing and storage.
MM CUL-08	**A final summary report shall be completed that outlines the results of the mitigation program.** This report shall include discussions of the methods used, stratigraphic section(s) exposed, fossils collected, and significance of recovered fossils.

6.0 IMPACT RESULTS

The impact results presented here evaluate the potential for the Project to be impacted by adverse geologic conditions. These hazards were evaluated for potential impacts on Project components including tower and pole sites, temporary construction and permanent access roads, pulling sites, and structure foundations. In addition, potential impacts to people or structures that would be exposed to major geologic hazards upon implementation of the Project are considered.

Each Project component—230 kV transmission corridors, 69 kV transmission corridors, proposed new Wildlife and Wilderness substations, and upgrade of 69 kV substations—is described for the study corridors and study areas and evaluated in the following terms:

Geology—geologic units and deposits
Seismicity and faulting—potential for ground shaking and acceleration relative to proximity to active faults
Seismic-related ground failure—potential for ground failure related to deposits and depth to groundwater
Slope instability, landslides, mudflows, debris flows, and rock falls—potential for instability related to slope conditions and potentially liquefiable soils
Flooding due to dam or levee failure—potential for flooding induced by seismic activity and impact to dams or levees

Potential impact areas are identified by milepost and mapped in Appendix A.

6.1 230 KV TRANSMISSION CORRIDORS

6.1.1. Geology

The 230 kV study corridors cross three main different geologic units. From youngest to oldest they are: Holocene age – artificial fill, recent alluvial deposits, windblown deposits, and slope wash (map units: Qaf, Qya, Qye, Qyw, Qw, and Qyf5 age), Pleistocene age - older alluvial deposits (map units: Qoa, Qof, Qof1, Qof3, Qow, Qvoa and Qvof) and Cretaceous age - quartz diorite and/or gabbroic type bedrock (map units: Kcg, Kdqd, Kgb, Kqd, Krg, Pzq and Pzsgp).

Recent alluvial deposits are present within the study corridors from Link Ax milepost 1.1 to 1.2 and 1.4 to 1.5, Link Bx milepost 0.1 to 0.2 and milepost 1.4 to 1.8, Link Ja milepost 0.1 to 0.5, Link Jb milepost 0.0 to 0.3, Jc milepost 0.0 to 0.8, Jd milepost 0.0 to 0.2, 0.7 to 0.9, and 1.1 to 3.5, Link K milepost 0.6 to 1.8, milepost 3.1 to 4.4, Link L milepost 0.0 to 0.1, Link R milepost 0.6 to 0.7 and milepost 3.0 to 3.3, Link S, Link T milepost 0.1 to 0.2, Link U milepost 0.0 to 0.1 (see Appendix A).

Older alluvial deposits are present within the study corridors from Link Ax milepost 0.5 to 0.7, milepost 0.8 to 1.1, milepost 1.2 to 1.4, and milepost 1.5 to 2.0, Link Bx milepost 0.9 to 1.2, Link D milepost 0.4 to 2.0, Link H milepost 0.2 to 1.2, Link I milepost 0.1 to 0.7, Link Ja milepost 0.0 to 0.1, Jb milepost 0.3 to 1.0, Jd milepost 0.2 to 0.7, and milepost 0.9 to 1.1, Link K milepost 0.0 to 0.6 and milepost 1.8 to 3.1, Link M milepost 0.1 to 0.6, Link N mile post 0.3 to 0.7, Link P, Link Q milepost 0.0 to 0.2 and milepost 0.4 to 0.7, Link R milepost 0.0 to 0.6 and milepost 0.7 to 3.0, Link U milepost 0.2 to 0.3 (see Appendix A).

Bedrock is present within the study corridors, Link Ax milepost 0.0 to 0.5, milepost 0.7 to 0.8, and milepost 2.0 to 2.2, Link Bx milepost 0.0 to 0.1, milepost 0.2 to 0.9, and milepost 1.2 to 1.4, Link D milepost 0.0 to 0.4, and 2.0 to 2.2, Link H milepost 0.0 to 0.2, Link I milepost 0.0 to 0.1, Link L milepost

0.1 to 0.2, Link M milepost 0.0 to 0.1, Link N milepost 0.0 to 0.3, Link U milepost 0.1 to 0.2 and milepost 0.3 to 0.4, and Link T milepost 0.0 to 0.1 and milepost 0.2 to 0.3 (see Appendix A).

Portions of the study corridors are underlain by older alluvial deposits which potentially could be fossil bearing localities. Application of mitigation measures CUL-03 through CUL-08 would reduce the paleontological impact to a less than significant level.

6.1.2. Seismicity and Faulting

The study corridor is anticipated to be affected by strong ground shaking. Ground acceleration is measured in gravitational units (g). A peak ground acceleration of approximately 0.43g to 0.75g can be expected along the length of the study corridor due to an earthquake occurring on one of the region's active faults. No active faults cross the study corridor.

Seismic-related horizontal and vertical ground accelerations have the potential to directly cause structure failures, resulting in equipment loss and power outages. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

6.1.3. Seismic-Related Ground Failure

The potential for seismic-induced ground failure impacts is present where alluvial deposits and shallow groundwater conditions are present. These areas are present within the 230kV study corridors Link Ax milepost 0.5 to 2.0, Link Bx milepost 0.1 to 0.2 and milepost 1.5 to 1.8, Link Ja milepost 0.1 to 0.5, Link Jb milepost 0.0 to 0.3, Link Jd milepost 0.1 to 0.2, milepost 0.7 to 0.9 and milepost 1.1 to 1.8, Link K milepost 0.1 to 2.1, Link L milepost 0.0 to 0.1, Link M, Link N, Link P, Link Q milepost 0.0 to 0.2 and 0.3 to 0.7, Link R milepost 0.0 to 2.3, Link T milepost 0.1 to 0.2, Link U milepost 0.0 to 0.1 (see Appendix A).

The potential for seismic-related ground failure exists for both the proposed 230 kV and 69 kV lines, and at the four substations to be upgraded as these areas are underlain by alluvial deposits and shallow groundwater where liquefaction could occur. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

6.1.4. Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

Potential slope instability impacts are present within study corridors Link Ax milepost 1.5 to 1.7, Link Bx milepost 0.0 to 1.4, Link D 0.7 to 1.1, Link K milepost 0.0 to 0.6, Link T, Link U milepost 0.2 to 0.4 (see Appendix A).

During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

6.1.5. Flooding Due to Dam or Levee Failure

The potential for flooding due to a dam or levee failure within the 230 kV study area is less than significant except for a portion of Link Ax. The potential for flooding due to a dam or levee failure of Link Ax study corridor is from milepost 1.3 to 1.7 (see Appendix A). This is a region identified by the City of Riverside as an area of potential flooding from reservoirs and dams situated south of the city of Riverside.

6.2 69 KV TRANSMISSION CORRIDORS

6.2.1. Wilderness – Mountain View 69 kV Subtransmission Line

Geology

The Wilderness – Mountain View 69 kV study corridor crosses two different geologic units. From youngest to oldest they are: Pleistocene age - older alluvial deposits (map unit: Qof3) and Cretaceous age - igneous quartz diorite bedrock (map unit: Kqd).

Older alluvial deposits are present within the study corridor from Link 3 milepost 0.7 to 1.1, Link 3(old) milepost 0.4 to 1.1, Link 6 milepost 0.0 to 0.1, Link 7 milepost 0.1, Link 8, Link 9, Link 10, Link 11, Link 12, and Link 13 (see Appendix A).

Igneous bedrock is present within the study corridor at Link 1, Link 2, Link 3 milepost 0.0 to 0.7, Link 3(old) milepost 0.0 to 0.4, Link 4, Link 5, Link 6 milepost 0.1, and Link 7 milepost 0.0 to 0.1 (see Appendix A).

Seismicity and Faulting

The study corridor is anticipated to be affected by strong ground shaking. A peak ground acceleration of approximately 0.40g can be expected due to an earthquake occurring on one of the region's active faults. No active faults cross the study corridor.

Seismic-related horizontal and vertical ground accelerations have the potential to directly cause structure failures, resulting in equipment loss and power outages. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Seismic-Related Ground Failure

The potential for seismic induced ground failure impacts are present where older alluvial deposits and shallow groundwater conditions are present. Areas of moderate to high liquefaction potential are present within the study corridor Link 3 milepost 0.4 to 0.9, Link 3(old) milepost 0.4 to 0.9, Link 6 milepost 0.0 to 0.1, Link 7 milepost 0.1, Link 8 milepost 0.1, Link 12 milepost 0.0 to 0.1, and Link 13 (see Appendix A).

The potential for seismic-related ground failure exists for both the proposed 230 kV and 69 kV lines, and at the four substations to be upgraded as these areas are underlain by alluvial deposits and shallow groundwater where liquefaction could occur. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

Slope instability impacts are present within study corridors Link 3 milepost 0.2 to 0.4, and Link 3(old) milepost 0.2 to 0.7 (see Appendix A).

During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

6.2.2. RERC – Harvey Lynn/Freeman 69 kV Subtransmission Line

Geology

The RERC – Harvey Lynn/Freeman 69 kV study corridors cross three predominant geologic units. From youngest to oldest they are: Holocene age – artificial fill, young alluvial fan, and slope wash deposits (Qaf, Qya, Qyf, Qyw, and Qw), Pleistocene age - older alluvial deposits (Qof3, Qts), and Cretaceous age – gabbro, quartz diorite, granite, and tonalite bedrock (Kgb, Kqd, Krg, and Kt).

Artificial fill is present within the study corridors from Link 3 from milepost 0.1 to 0.2 and Link 5 from milepost 0.1 to 0.2 (see Appendix A).

Young alluvial deposits are present within the study corridor from Link 3 from milepost 0.3 to 0.6, Link 19 from milepost 0.6 to 0.8, Link 25 from milepost 0.6 to 0.8, Link 31, Link 32, Link 33, Link 34, Link 35, Link 36, Link 37 from milepost 0.3 to 0.4, Link 38 from milepost 0.0 to 0.4 and milepost 0.6 to 0.7, Link 39, Link 40 from milepost 0.0 to 0.4 and milepost 0.7 to 0.8, Link 41, and Link 42 (see Appendix A).

Older alluvial deposits are present within the study corridors Link 2, Link 3 from milepost 0.2 to 0.3 and milepost 0.5 to 0.6, Link 4, Link 5 from milepost 0.0 to 0.1, Link 6 from milepost 0.0 to 0.4, Link 7 from milepost 0.0 to 0.6, Link 8 from milepost 0.6 to 0.8, Link 9, Link 10, Link 11, Link 12, Link 13, Link 14, Link 15a from milepost 0.0 to 0.1, Link 16 from milepost 0.0 to 0.1, Link 18 milepost 0.3 to 0.8, Link 19 from milepost 0.0 to 0.6, Link 20a from milepost 0.3 to 0.5, Link 20b, Link 21, Link 22, Link 23, Link 24, Link 25 from milepost 0.0 to 0.6, Link 26, Link 27, Link 28, Link 29, Link 30, Link 37 from milepost 0.0 to 0.3, Link 38 from milepost 0.4 to 0.6, Link 40 from milepost 0.4 to 0.7, Link N3 from milepost 0.2 to 0.6, Link N4 milepost 0.2, Link N5 and RERC-1 Substation (see Appendix A).

Bedrock is present within the study corridors in Link 1, Link 3 from milepost 0.0 to 0.2, Link 6 from milepost 0.4 to 0.5, Link 7 from milepost 0.6 to 0.9, Link 8 from milepost 0.0 to 0.6, Link 15a from milepost 0.1 to 1.2, Link 15b, Link 16 from milepost 0.1 to 1.4, Link 17a, Link 17b, Link 18 from milepost 0.0 to 0.3, Link 20a from milepost 0.0 to 0.3, Link N1, Link N2, Link N3 from milepost 0.0 to 0.2, Link N4 from milepost 0.0 to 0.2 (see Appendix A).

Seismicity and Faulting

The study corridor is anticipated to be affected by strong ground shaking. A peak ground acceleration of approximately 0.40g can be expected due to an earthquake occurring on one of the region's active faults. No active faults cross the study corridor.

Seismic-related horizontal and vertical ground accelerations have the potential to directly cause structure failures, resulting in equipment loss and power outages. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Seismic-Related Ground Failure

The potential for seismic-induced ground failure impacts is present where recent alluvial deposits and shallow groundwater conditions are present. These areas are present within the study corridor for Link 1, Link 2, Link 3, Link 4, Link 5, Link 6 from milepost 0.0 to 0.4, Link 8 from milepost 0.6 to 0.8, Link 9, Link 10, Link 11, Link 12, Link 13, Link 14, Link 15 milepost 0.0 to 0.1, Link 16 milepost 0.0 to 0.1, Link 18 milepost 0.3 to 0.8, Link 19, Link 20a milepost 0.2 to 0.5, Link 20b, Link 21, Link 22, Link 23, Link 24, Link 25, Link 26, Link 27, Link 28, Link 29, Link 30, Link 31, Link 32, Link 33, Link 34, Link 35, Link 36, Link 37, Link 38,Link 39, Link 40, Link 41, Link 42, and Link N3 from milepost 0.2 to 0.6, Link N4 from milepost 0.2 to 0.3, and Link N5 (see Appendix A).

The potential for seismic-related ground failure exists for both the proposed 230 kV and 69 kV lines, and at the four substations to be upgraded as these areas are underlain by alluvial deposits and shallow groundwater where liquefaction could occur. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

Slope instability impacts are present within the study corridors in Link 3 milepost 0.2 to 0.4 and Link 5 milepost 0.1 to 0.2 (see Appendix A).

During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Flooding Due to Dam or Levee Failure

The potential for flooding due to a dam or levee failure is present on a portion of the study corridors Link 2 from milepost 0.5 to 0.6, Link 4, Link 5, Link 6 from milepost 0.0 to 0.1, Link 7 from milepost 0.0 to 0.2, Link 9, Link 10, Link 11 from milepost 0.0 to 0.5, Link 31 from milepost 0.3 to 0.8, Link 32 from milepost 0.2 to 0.3, Link 33, Link 34, Link 35, Link 36, Link 37, Link 38, Link 39, Link 40, Link 41, Link 42 (see Appendix A). This is a region of potential flooding from reservoirs and dams situated south of the city of Riverside.

6.3 WILDLIFE SUBSTATION AND WILDERNESS SUBSTATION

6.3.1. Geology

Wildlife Substation and Wilderness Substation are underlain by Cretaceous age quartz diorite bedrock.

6.3.2. Seismicity and Faulting

Wildlife Substation and Wilderness Substation are anticipated to be affected by strong ground shaking. A peak ground acceleration of approximately 0.43g can be expected due to an earthquake occurring on one of the region's active faults. No active faults cross the Wildlife Substation and Wilderness Substation sites.

Seismic-related horizontal and vertical ground accelerations have the potential to directly cause structure failures, resulting in equipment loss and power outages. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

6.3.3. Seismic-Related Ground Failure

The potential for seismic-induced ground failure impacts is present where recent alluvial deposits and shallow groundwater conditions are present.

Impacts due to seismic-induced ground failure are less than significant at the Wildlife Substation and Wilderness Substation sites.

6.3.4. Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

Due to the site being underlain by granitic bedrock, slope instability impacts within and adjacent to the site are less than significant.

6.3.5. Flooding Due to Dam or Levee Failure

The potential for flooding due to a dam or levee failure is less than significant due to the sites location beyond limits of potential flooding from reservoirs and dams situated south of the city of Riverside.

6.4 69 KV SUBSTATION UPGRADES

6.4.1. Harvey Lynn Substation

Geology

Harvey Lynn Substation is underlain by older alluvium.

Seismicity and Faulting

Harvey Lynn Substation is anticipated to be affected by strong ground shaking. A peak ground acceleration of approximately 0.40g can be expected due to an earthquake occurring on one of the region's active faults. No active faults cross Harvey Lynn Substation.

Seismic-related horizontal and vertical ground accelerations have the potential to directly cause structure failures, resulting in equipment loss and power outages. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Seismic-Related Ground Failure

The potential for seismic-induced ground failure impacts is present where alluvial deposits and shallow groundwater conditions are present. Harvey Lynn Substation is located in an area of potential liquefaction.

The potential for seismic-related ground failure exists for both the proposed 230 kV and 69 kV lines, and at the four substations to be upgraded as these areas are underlain by alluvial deposits and shallow groundwater where liquefaction could occur. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

The site is relatively level. There is a less-than-significant impact to the site due to slope instability, landslides, mudflows, debris flows, and rock falls.

Flooding Due to Dam or Levee Failure

The potential for flooding due to a dam or levee failure is less than significant due to the sites location beyond limits of potential flooding from reservoirs and dams situated south of the city of Riverside.

6.4.2. Mountain View Substation

Geology

Mountain View Substation is underlain by older alluvium.

Seismicity and Faulting

Mountain View Substation is anticipated to be affected by strong ground shaking. A peak ground acceleration of approximately 0.44g can be expected due to an earthquake occurring on one of the region's active faults. No active faults cross Mountain View Substation.

Seismic-related horizontal and vertical ground accelerations have the potential to directly cause structure failures, resulting in equipment loss and power outages. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Seismic-Related Ground Failure

The potential for seismic-induced ground failure impacts is present where alluvial deposits and shallow groundwater conditions are present. Mountain View Substation is located in an area of potential liquefaction.

The potential for seismic-related ground failure exists for both the proposed 230 kV and 69 kV lines, and at the four substations to be upgraded as these areas are underlain by alluvial deposits and shallow groundwater where liquefaction could occur. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

The site is relatively level. There is a less-than-significant impact to the site due to slope instability, landslides, mudflows, debris flows, and rock falls.

Flooding Due to Dam or Levee Failure

The potential for flooding due to a dam or levee failure is less than significant due to the sites location beyond limits of potential flooding from reservoirs and dams situated south of the city of Riverside.

6.4.3. RERC Substation

Geology

RERC Substation is underlain by older alluvium.

Seismicity and Faulting

RERC Substation is anticipated to be affected by strong ground shaking. A peak ground acceleration of approximately 0.43g can be expected due to an earthquake occurring on one of the region's active faults. No active faults cross RERC Substation.

Seismic-related horizontal and vertical ground accelerations have the potential to directly cause structure failures, resulting in equipment loss and power outages. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Seismic-Related Ground Failure

The potential for seismic induced ground failure impacts is present where alluvial deposits and shallow groundwater conditions are present. RERC Substation is located in an area of potential liquefaction.

The potential for seismic-related ground failure exists for both the proposed 230 kV and 69 kV lines, and at the four substations to be upgraded as these areas are underlain by alluvial deposits and shallow groundwater where liquefaction could occur. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

The site is relatively level. There is a less than-significant-impact to the site due to slope instability, landslides, mudflows, debris flows, and rock falls.

Flooding Due to Dam or Levee Failure

The potential for flooding due to a dam or levee failure is less than significant due to the sites location beyond limits of potential flooding from reservoirs and dams situated south of the city of Riverside.

6.4.4. Freeman Substation

Geology

Freeman Substation is underlain by recent alluvium.

Seismicity and Faulting

Freeman Substation is anticipated to be affected by strong ground shaking. A peak ground acceleration of approximately 0.41g can be expected due to an earthquake occurring on one of the region's active faults. No active faults cross Freeman Substation.

Seismic-related horizontal and vertical ground accelerations have the potential to directly cause structure failures, resulting in equipment loss and power outages. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Seismic-Related Ground Failure

The potential for seismic-induced ground failure impacts is present where alluvial deposits and shallow groundwater conditions are present. Freeman Substation is located in an area of moderate potential for liquefaction.

The potential for seismic-related ground failure exists for both the proposed 230 kV and 69 kV lines, and at the four substations to be upgraded as these areas are underlain by alluvial deposits and shallow groundwater where liquefaction could occur. During seismic events, potential slope instability impacts, including landslides, mudflows, debris flows and rock falls, could occur along the 230 kV and 69 kV lines and the RERC, Harvey Lynn and Freeman substations. As part of geotechnical investigations during the Proposed Project design phase, location-specific seismic analysis would be conducted. Based on findings, some minor structure location adjustments may be required. As appropriate, structure designs would be augmented or strengthened to meet site-specific requirements following modern professional engineering standards. Final designs would be reviewed by the CPUC and the City of Riverside for both RPU's 69 kV elements and SCE's 230 kV elements. As a result, the risk of structure collapse resulting in human injury or death during as seismic event is negligible. Impacts would be less than significant, as the design of the Proposed Project would incorporate recommendations from the geotechnical study into the final design.

Slope Instability, Landslides, Mudflows, Debris Flows, and Rock Falls

The site is relatively level. There is a less-than-significant impact to the site due to slope instability, landslides, mudflows, debris flows, and rock falls.

Flooding Due to Dam or Levee Failure

The potential for flooding due to a dam or levee failure is present at the Freeman Substation due to the sites location adjacent to identified regions of potential flooding from reservoirs and dams situated south of the city of Riverside.

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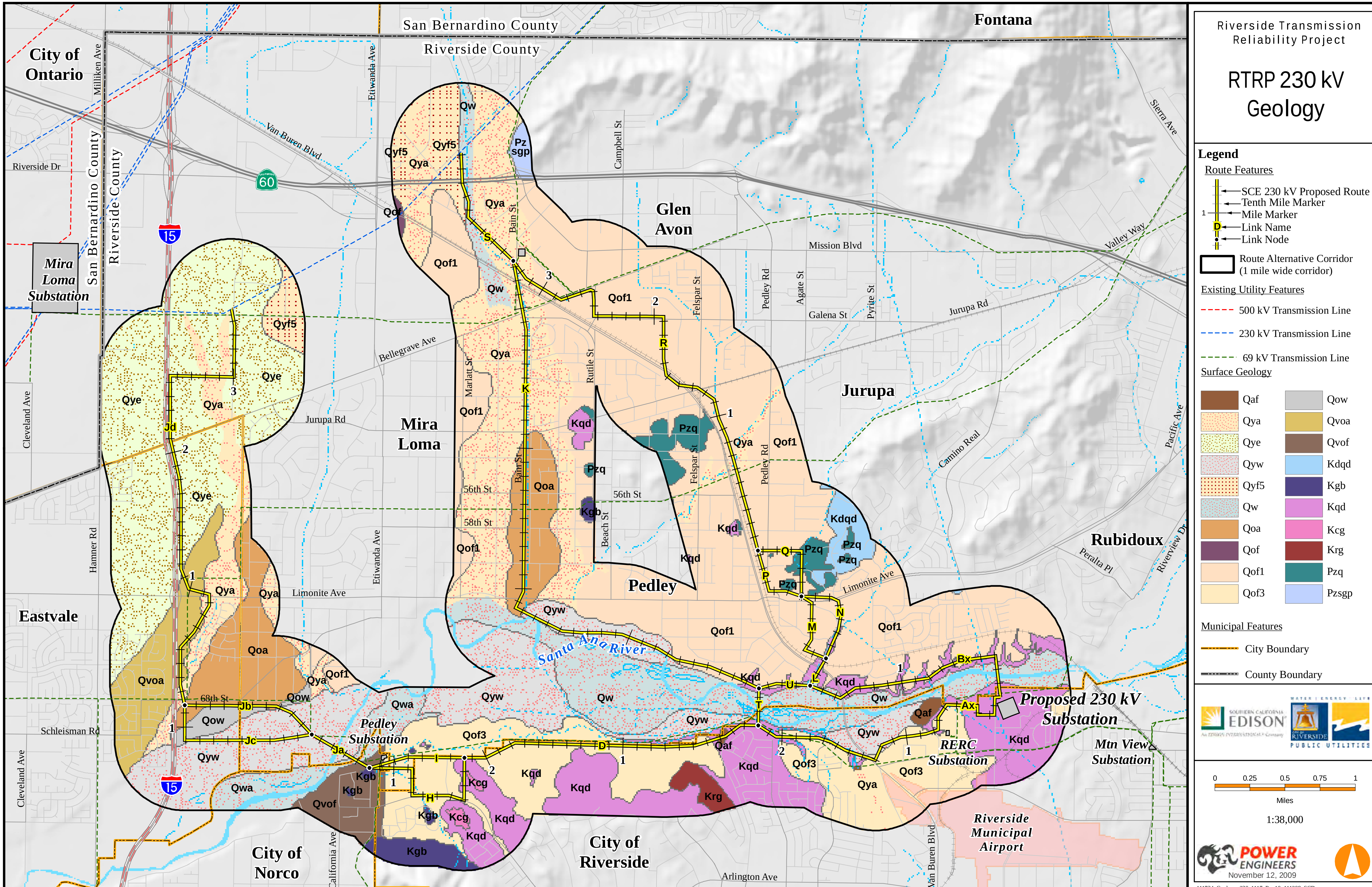

Riverside Transmission Reliability Project
RTRP 230 kV Geology
Legend
Route Features
SCE 230 kV Proposed Route
Tenth Mile Marker
Mile Marker
Link Name
Link Node
Route Alternative Corridor (1 mile wide corridor)
Existing Utility Features
500 kV Transmission Line
230 kV Transmission Line
69 kV Transmission Line
Surface Geology
Qaf
Qow
Qya
Qvoa
Qye
Qvof
Qyw
Kdqd
Qyf5
Kgb
Qw
Kqd
Qoa
Kcg
Qof
Krg
Qof1
Pzq
Qof3
Pzsgp
Municipal Features
City Boundary
County Boundary
0 0.25 0.5 0.75 1
Miles
1:38,000
POWER ENGINEERS
November 12, 2009
111734_Geology_230_1117_Rev10_111209_SCD
San Bernardino County
Riverside County
Fontana
City of Ontario
Mira Loma Substation
Glen Avon
Mira Loma
Jurupa
Rubidoux
Pedley
Eastvale
Pedley Substation
City of Norco
City of Riverside
Santa Ana River
Proposed 230 kV Substation
RERC Substation
Mtn View Substation
Riverside Municipal Airport
Van Buren Blvd
Riverside Dr
Milliken Ave
Etiwanda Ave
Campbell St
Mission Blvd
Jurupa Rd
Bellegrave Ave
Limonite Ave
Galena St
Pedley Rd
Agate St
Pyrite St
Felspar St
Bain St
Marlatt St
Rutile St
Beach St
56th St
58th St
68th St
Schleisman Rd
Cleveland Ave
Hamner Rd
California Ave
Arlington Ave
Valley Way
Sierra Ave
Camino Real
Pacific Ave
Riverview Dr
Peralta Pl

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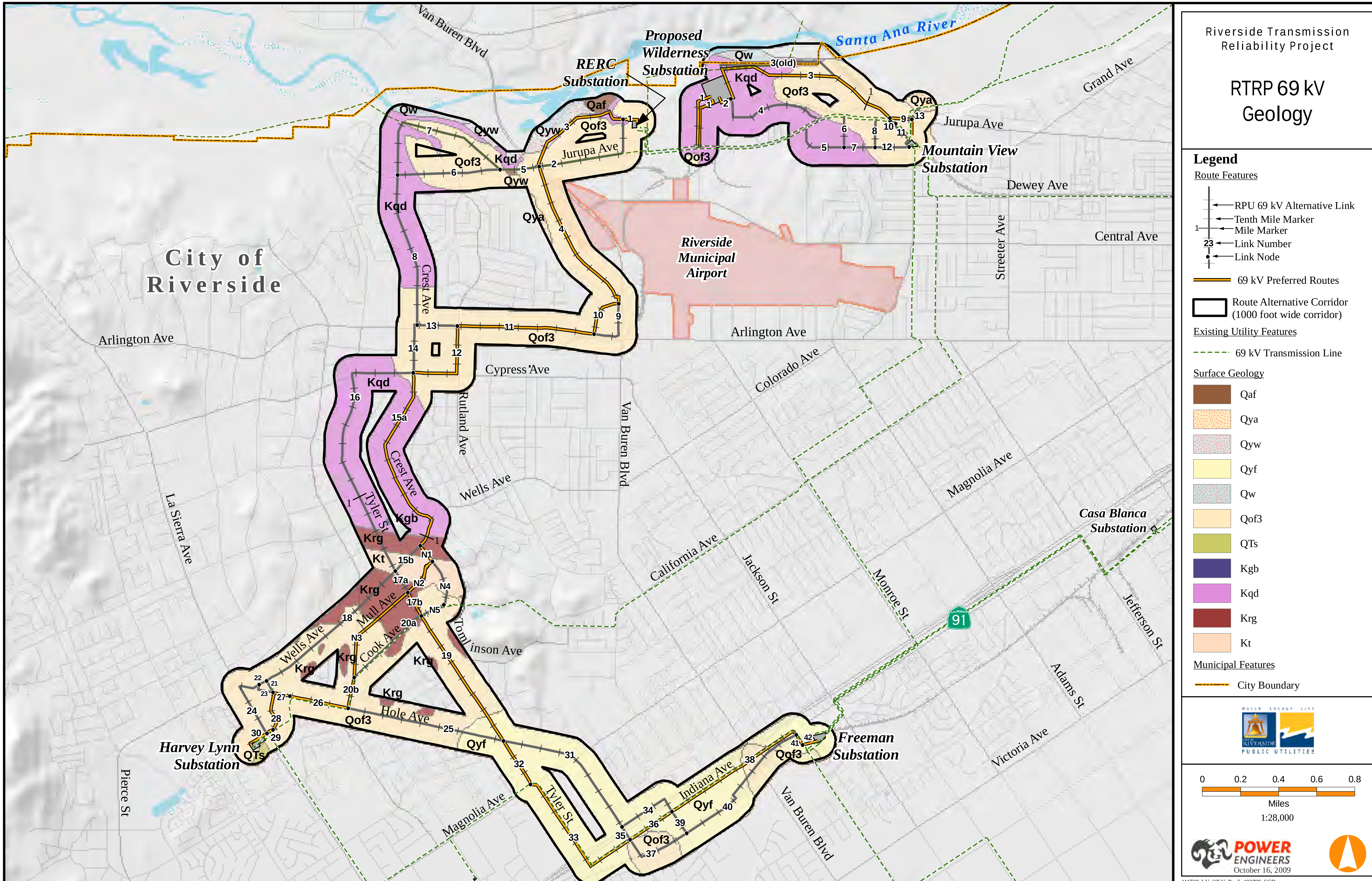
Riverside Transmission Reliability Project
RTRP 69 kV Geology
Legend
Route Features
RPU 69 kV Alternative Link
Tenth Mile Marker
Mile Marker
Link Number
Link Node
69 kV Preferred Routes
Route Alternative Corridor (1000 foot wide corridor)
Existing Utility Features
69 kV Transmission Line
Surface Geology
Qaf
Qya
Qyw
Qyf
Qw
Qof3
QTs
Kgb
Kqd
Krg
Kt
Municipal Features
City Boundary
0 0.2 0.4 0.6 0.8
Miles
1:28,000
POWER ENGINEERS
October 16, 2009
111728_LU_69kV_Rev5_102709_SCD
City of Riverside
Santa Ana River
RERC Substation
Proposed Wilderness Substation
Mountain View Substation
Riverside Municipal Airport
Casa Blanca Substation
Freeman Substation
Harvey Lynn Substation
Van Buren Blvd
Jurupa Ave
Grand Ave
Dewey Ave
Central Ave
Streeter Ave
Arlington Ave
Colorado Ave
Cypress Ave
Crest Ave
Rutland Ave
Wells Ave
Tyler St
Magnolia Ave
California Ave
Jackson St
Monroe St
Jefferson St
Adams St
Victoria Ave
Indiana Ave
Hole Ave
Mull Ave
Cook Ave
Tomlinson Ave
La Sierra Ave
Pierce St
91

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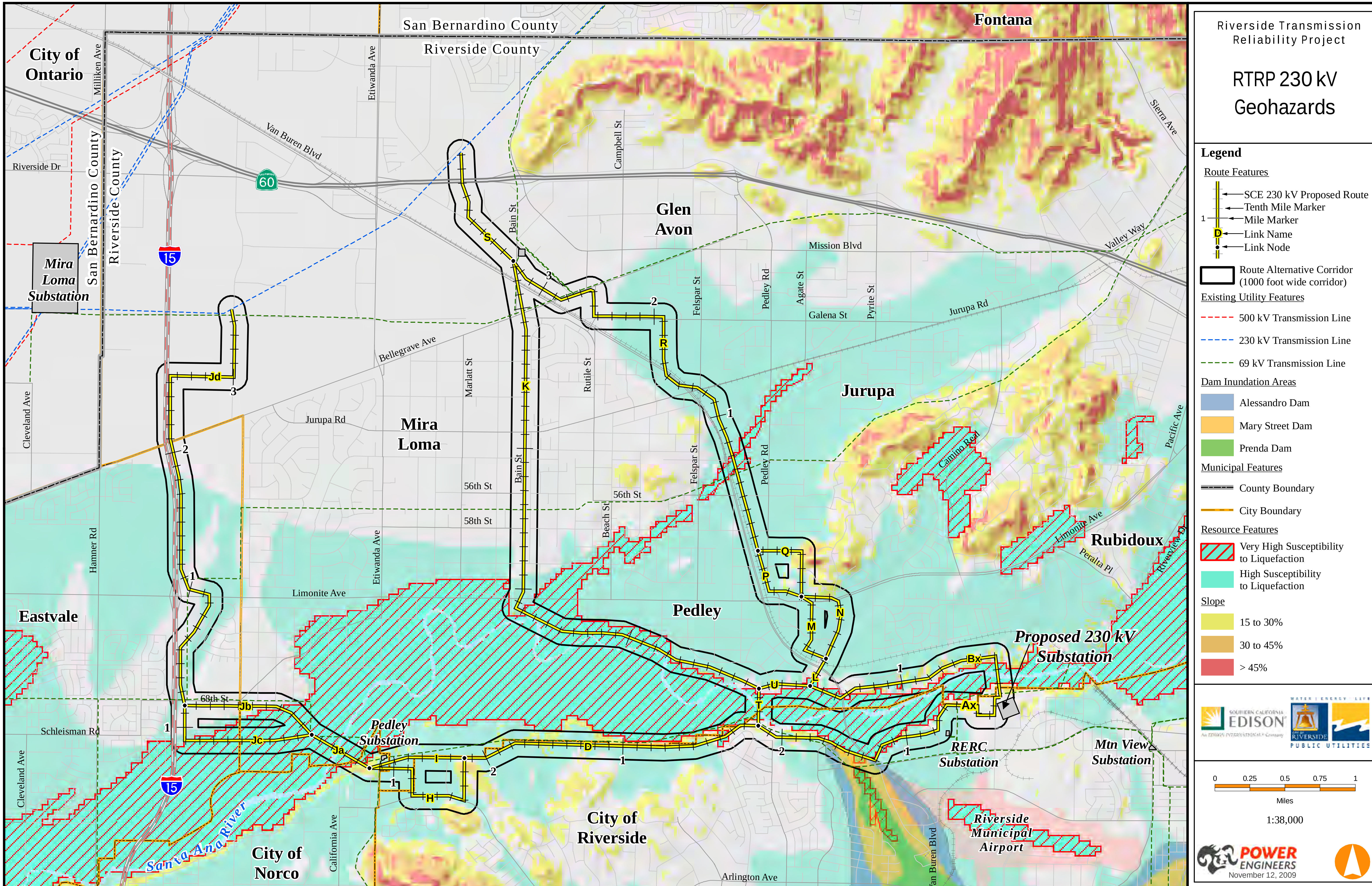

Riverside Transmission Reliability Project
RTRP 230 kV Geohazards
Legend
Route Features
SCE 230 kV Proposed Route
Tenth Mile Marker
Mile Marker
Link Name
Link Node
Route Alternative Corridor (1000 foot wide corridor)
Existing Utility Features
500 kV Transmission Line
230 kV Transmission Line
69 kV Transmission Line
Dam Inundation Areas
Alessandro Dam
Mary Street Dam
Prenda Dam
Municipal Features
County Boundary
City Boundary
Resource Features
Very High Susceptibility to Liquefaction
High Susceptibility to Liquefaction
Slope
15 to 30%
30 to 45%
> 45%
SOUTHERN CALIFORNIA EDISON
CITY OF RIVERSIDE PUBLIC UTILITIES
0 0.25 0.5 0.75 1
Miles
1:38,000
POWER ENGINEERS
November 12, 2009
111734_Geohaz_230_1117_Rev10_101509B_SCD
San Bernardino County
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Mira Loma Substation
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Felspar St
Pedley Rd
Agate St
Pyrite St
Galena St
Jurupa Rd
Bellegrave Ave
Marlatt St
Rutile St
Cleveland Ave
Camino Real
Pacific Ave
56th St
58th St
Beach St
Limonite Ave
Peralta Pl
Riverview Dr
Hamner Rd
68th St
Schleisman Rd
California Ave
Arlington Ave

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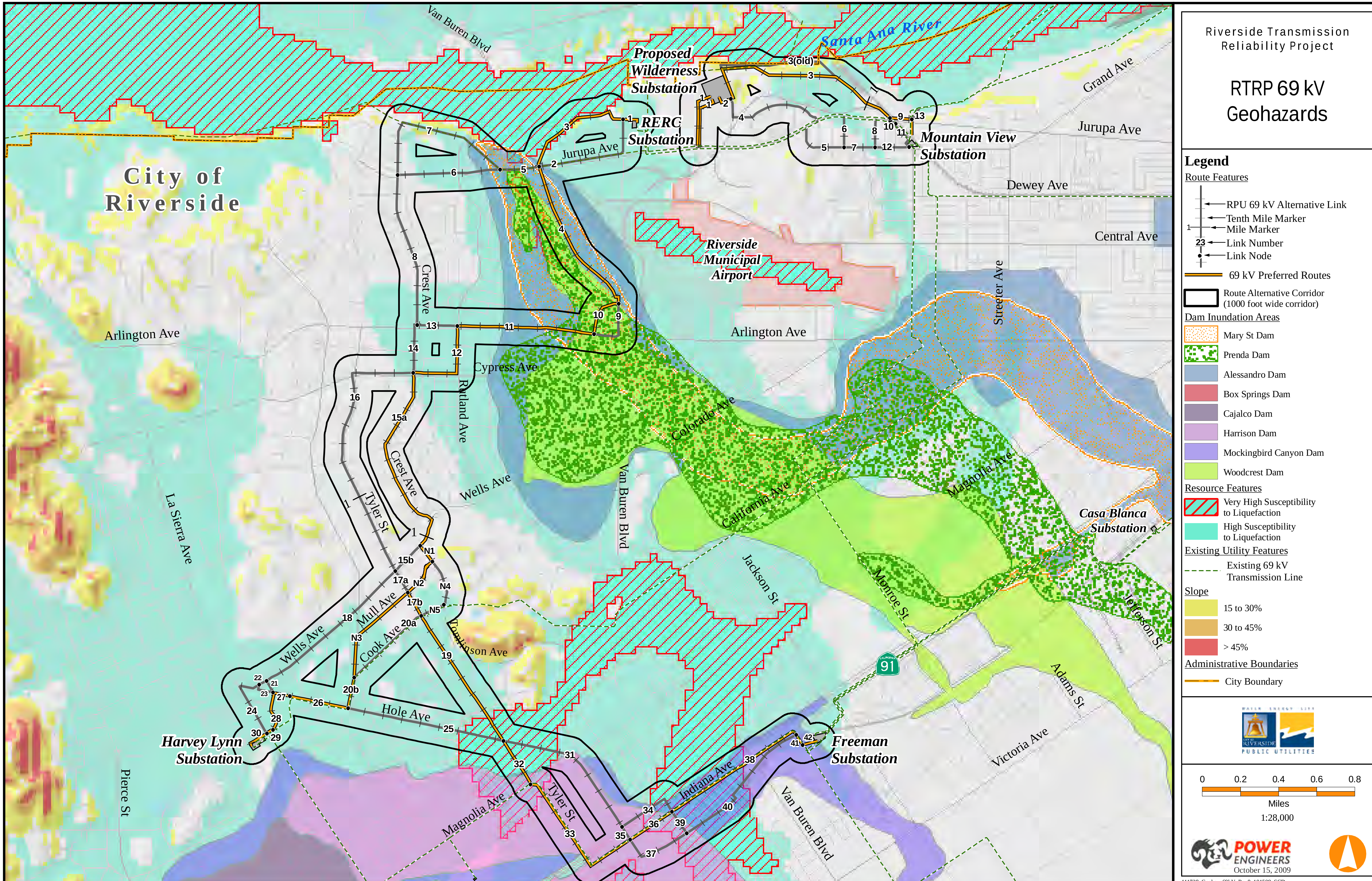

Riverside Transmission Reliability Project
RTRP 69 kV Geohazards
Legend
Route Features
RPU 69 kV Alternative Link
Tenth Mile Marker
Mile Marker
Link Number
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69 kV Preferred Routes
Route Alternative Corridor (1000 foot wide corridor)
Dam Inundation Areas
Mary St Dam
Prenda Dam
Alessandro Dam
Box Springs Dam
Cajalco Dam
Harrison Dam
Mockingbird Canyon Dam
Woodcrest Dam
Resource Features
Very High Susceptibility to Liquefaction
High Susceptibility to Liquefaction
Existing Utility Features
Existing 69 kV Transmission Line
Slope
15 to 30%
30 to 45%
> 45%
Administrative Boundaries
City Boundary
0
0.2
0.4
0.6
0.8
Miles
1:28,000
POWER ENGINEERS
October 15, 2009
111728_Geohaz_69kV_Rev8_101509_SCD
City of Riverside
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Rutland Ave
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Wells Ave
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Jefferson St
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Mull Ave
Cook Ave
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Hole Ave
Indiana Ave
Victoria Ave
Pierce St
91

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