

**Southern California Edison Company's Response to the California Public Utilities
Commissions' Deficiency Report For The Riverside Transmission Reliability Project
Application (A.15-04-013)
July 2015**

ATTACHMENT 6

Underground Alternatives Desktop Study (July 2015)

RIVERSIDE TRANSMISSION RELIABILITY PROJECT (RTRP) 230 KV UNDERGROUND ALTERNATIVES DESKTOP STUDY JULY 2015

Prepared by:

Hunly Chy, PE Engineer, Transmission Engineering
Martin Barriga, PE Engineer, Transmission Engineering

Reviewed/Approved by:

Caroline Meissner, Engineering Manager, Transmission Engineering
Peter Hlapcich, Principal Manager, Transmission, Civil, Structural,
Geotech, and TRTP Engineering

Table of Contents

1.0 Executive Summary	3
2.0 Limitations of this Desktop Study for Underground Transmission.....	5
3.0 Introduction.....	6
4.0 SCE’s History with Underground Sub-transmission and Transmission Lines.....	7
5.0 The State of Underground Transmission Line Technology.....	8
6.0 Engineering Processes for 230 kV Underground Alternatives.....	10
7.0 Feasibility	12
8.0 Reliability	13
9.0 Electrical Capacity (Ampacity) Requirement.....	15
10.0 Construction Methods.....	17
11.0 Operation and Maintenance Impacts and Requirements	21
12.0 Overview of the Three Underground Options for RTRP	22
12.1 Underground Route Alternate A – EIR UG Route	23
12.2 Underground Route Alternate B – Pats Ranch Road Route	24
12.3 Underground Route Alternate C – Wineville Route	25
12.4 Requirements Common to all Underground Alternatives.....	26
12.5 Riser Poles.....	28
12.6 Vaults	30
12.7 Shunt Compensation	34
13.0 Technical Scope.....	36
14.0 Appendices.....	39

1.0 Executive Summary

Pursuant to the California Public Utilities Commission's (CPUC's) May 21, 2015 deficiency letter (*see Appendix A*) and in support of Southern California Edison's (SCE's) *Amended Application For A Certificate Of Public Convenience And Necessity To Construct The Riverside Transmission Reliability Project (A.15-04-013)* (CPCN Application) and ongoing litigation proceedings (*City of Jurupa Valley v. City of Riverside* (Appellate Case No. B257623, appeal from Los Angeles County Sup. Ct. Case No. BS143085 (Hon. T. McKnew)) and *Southern California Edison Company v. City of Jurupa Valley* (Case No. RIC 1504590)), SCE's Transmission & Distribution (T&D) Engineering studied the feasibility of constructing a portion of the proposed 230 kV Transmission Line (T/L) for the Riverside Transmission Reliability Project (RTRP) using underground methods. This study anticipates that the CPUC will consider underground recommendations suggested in several protests submitted by neighboring developments with respect to SCE's CPCN Application.

T&D Engineering studied three alternative underground routes within the City of Jurupa Valley and in vicinity of the Riverbend housing project and Vernola Marketplace Apartment Community. The first underground route alternative closely follows the route proposed in RTRP's Final Environmental Impact Report (EIR) certified by the City of Riverside on February 5, 2013. The second underground route alternative predominantly runs along Pats Ranch Road and approximates a route suggested by Lennar Homes, Inc. in its protest to SCE's CPCN Application. The third underground route alternative predominantly runs along Wineville Avenue. These routes are approximately 4.5, 4.1 and 3.6 miles in length, respectively. For all three underground alternatives, the double circuit underground transmission line would rise up on two sets of two riser poles. Two riser poles are required at each end of the underground line; two riser poles at Goose Creek Golf Club and two more at the Mira Loma-Vista #1 230 kV Transmission Line (close to transmission tower M1-T2). An overview of the three underground routes is attached in [Appendix B](#).

[Appendix C](#) illustrates additional underground routes that were ruled out in the field due to evident technological and engineering challenges such as numerous grade separations, long river spans, adjacent rail roads, water channels, *etc.* While no other electrical system alternatives were considered here, this report should be read in concert with the alternatives described in the RTRP Final EIR and the *July 2015 Siting Report, Riverside Transmission Reliability Project Riverbend Development Segment Re-route Feasibility Study* (Siting Report).¹

This report outlines the major components required to underground significant portions of the proposed RTRP 230 kV transmission line based on SCE's prior undergrounding and licensing experience. The identified scope of work should be considered preliminary and subject to significant change based on confirmed field conditions and final engineering.

¹ The Van Buren and Bain St. alternative routes described in the RTRP Final EIR were not considered viable candidates for undergrounding for this analysis.

In summary and depending on the alternative, undergrounding the 230 kV transmission line would eliminate the need for 25 tubular steel poles and 8 lattice towers while it would install up to approximately 9 miles of underground duct bank, 62 transmission splice vaults and 31 telecom vaults.

Table 1 below provides a high level summary of certain challenges each undergrounding alternative would face. Preliminarily, Alternative A, the RTRP Final EIR route, presents the greatest number of technical and environmental challenges due to its long length and possible conflicts with existing and proposed freeway onramps and residential and commercial developments. Alternative C, the Wineville Avenue route, presents the fewest technical and environmental challenges due to its short length and minimal turns.

However, as stated previously, these preliminary evaluations are subject to change based on confirmed field conditions and final engineering. Additional and possibly more severe challenges may be identified as additional information becomes available for each route. For example, no survey of underground utilities has been completed to date. The presence of existing underground utilities would likely impact the technical and environmental challenges associated with each undergrounding alternative.

Table 1: Summary of Underground Alternatives.

Alternatives	Length	Possible Challenges ²
A) RTRP Final EIR Route	4.5 mi	Longest route paralleling 15 FWY, potential conflicts with CalTrans, potentially crossing freeway on-ramp, likely conflicts with planned residential/commercial developments
B) Pats Ranch Road Route	4.1 mi	Streets are newly developed, and potential underground utilities in the future could impact the double circuit 230 kV UG T/L
C) Wineville Avenue Route	3.6 mi	Street paving suggests newly installed underground utilities that might have to be avoided

² Table 1 summarizes challenges particular to the three alternatives in this study. There are other challenges common to all underground transmission lines, such as: acquisition of adequate right-of-way widths, identifying and acquiring riser pole locations, securing riser pole easements, location and ensuring adequate access to vaults and telecom vaults, mitigation of environmental impacts (*e.g.*, traffic impacts, air quality, soils disposal, noise, *etc.*).

2.0 Limitations of this Desktop Study for Underground Transmission

While this study analyzed the technical feasibility of certain undergrounding alternatives, it does not address all disciplines necessary to determine the feasibility of an underground route.

For example, environmental impacts associated with undergrounding alternatives are not addressed by this study. Land use and real property issues will also require additional studies and considerations. Specifically, an underground transmission line would require access along the entire route for maintenance and emergency repair work. As such, permanent building or structures cannot preclude access to the numerous required duct banks. The scope of existing rights-of-way and potential need for additional easements through City streets and private property in support of both the underground route and required access to the supporting infrastructure has not been evaluated here.

Further, additional investigations and surveys are required to identify any existing underground utilities, as well as to evaluate any planned or potential future improvements or expansions of such existing utilities and facilities along the underground routes. It is highly probable that existing underground utilities (*e.g.*, telecom, water, sewer, and electricity) exist on all of the underground route options. The feasibility of an underground transmission route could be materially affected by the presence of existing utilities and their potential relocation.

Moreover, additional electrical and system impact studies would be required to verify the feasibility of any proposed undergrounding alternative, as well as to determine the scope of the needed facilities and infrastructure in support of that alternative. For example, the installation of an underground transmission line could potentially raise the operating voltage of the line above the nominally rated 230 kV. To mitigate against this voltage rise, a special electrical device, similar to a transformer, may need to be installed. Also, generic assumptions about the required specifications of underground cables were made for this study, which could be modified by actual measured values.

Lastly, and as specified previously, confirmed field conditions and final engineering could affect the underground route alignments presented in this desktop study.

3.0 Introduction

SCE is proposing to construct a new double-circuit 230 kV transmission line to loop the existing Mira Loma-Vista #1 230 kV Transmission Line into SCE's proposed Wildlife Substation (*see Appendix D – Proposed Overhead Final EIR Route*). The proposed transmission line routes are in moderately populated communities adjacent to residential and commercial properties and some potentially environmentally sensitive areas. The proposed transmission project is planned using SCE's conventional overhead construction. However, this document will address the technical feasibility for constructing a significant segment (approximately 4 miles) of the route proposed in the RTRP Final EIR using underground cable construction.

This document summarizes the potential underground transmission line based on conditions that currently exist, are future entitled developments, and developments currently under construction. The report presents general characteristics of underground transmission technology and applications with emphasis on technologies and construction practices that would be applicable to RTRP.

4.0 SCE's History with Underground Sub-transmission and Transmission Lines

While SCE has an established method and successful history of undergrounding sub-transmission lines (66 kV and 115 kV), there are relatively few incidences of undergrounding bulk power lines (230 kV and above) on SCE's system.

Notably, in the early 1980's, SCE undergrounded a small portion of the El Nido-El Segundo and the Chevmain-El Nido 230 kV Transmission Lines. Costs of this project were paid by the customer. These 2,500 ft. underground circuits are High Pressure Fluid Filled (HPFF) pipe systems and run underneath a golf course in Manhattan Beach.

SCE has recently started construction on a 3.7 miles 500 kV cross-linked polyethylene (XLPE) cable installation in support of the Tehachapi Renewable Transmission Project (TRTP). However, TRTP is not yet operational and SCE has no operational history with this type of facility on which to draw experience.

5.0 The State of Underground Transmission Line Technology

The number of overhead transmission lines greatly exceeds the number of underground transmission lines that have been constructed in North America and the rest of the world regardless of voltage. This is, in general, due to economic considerations as the costs for overhead transmission lines, in most cases, are significantly less than those for similar capacity underground transmission lines. However, there are distinct advantages and disadvantages for both overhead and underground transmission lines that should be considered when planning a specific transmission line.

The primary advantages of underground transmission line construction are:

- Reduced visual impact
- Reduced ROW requirements

Conversely, when planning a new transmission line the disadvantages to underground construction should be considered. In addition to higher installation costs, additional disadvantages to underground transmission line construction include:

- Land disturbances and increased environmental impacts during construction
- Access and maintenance issues after construction
- Difficulties in identifying and accessing locations of line faults and longer outages for repair

Underground transmission lines can generally be classified into four categories. These are:

1. **High-pressure fluid-filled (HPFF) cable systems:** Typically for the HPFF cable system, all three phases of the cable reside in a steel pipe pressurized with dielectric fluid (such as mineral oil or polybutene). The pipe will typically have a minimum diameter of 8” and more than one pipe per circuit may be required. A pumping plant with an oil storage reservoir will be required to maintain proper pressure on the circuit.
2. **Self-contained fluid-filled (SCFF) cable:** Typically for the SCFF cable system, the cable consists of a hollow conductor, which is filled with dielectric fluid, high quality kraft paper insulation, outer shielding, and a lead or aluminum sheath which is covered by a PVC jacket. Stop joints and fluid reservoirs at splice vaults will be required to maintain proper pressure. The cable can either be direct buried or installed in conduit.
3. **Compressed-gas insulated transmission lines (CGIT):** For the CGIT cable system, an epoxy spacer insulator assembly holds the tubular conductor in place inside an aluminum enclosure filled with sulfur hexafluoride (SF₆) or a mixture of SF₆ and nitrogen (N₂). While this cable system can match the power transfer capabilities of any overhead line, its use has

been limited to relatively short installations due to its high cost. Direct burial is usually not considered.

4. **Solid dielectric or extruded dielectric cable systems (XLPE):** For the XLPE cable system, each phase consists of a stranded conductor (aluminum or copper), semi-conducting shields, cross-linked polyethylene (XLPE) insulation, copper sheath, and PVC jacket. Each cable is pulled into a separate duct in a common duct bank.

Currently, the industry trend is to use XLPE cable systems for undergrounding. In the U.S., at least two manufacturers have developed manufacturing capability for 230 kV cable. Outside the U.S., manufacturing capabilities of up to 765kV XLPE cable systems exists. Of the four available types of cable systems (HPFF, SCFF, CGIT, and XPLE), XPLE cable systems have the least complicated design, operation, and maintenance requirements. Also, because many manufacturers are now producing this cable and its accessories, the cost has decreased compared to other cable technologies. Because of these factors, and SCE's experience with XLPE cable design at 66 kV and 115 kV for nearly 40 years, only XLPE technology is considered in this evaluation.

6.0 Engineering Processes for 230 kV Underground Alternatives

The following outlines minimal engineering processes that would need to occur before construction of any of the underground alternatives could begin:

1. **Ground Excavation:**

- a. Perform soil assessment including assessing existing soil data, geological data
- b. Perform soil borings and evaluation of the soil boring data
- c. Seismic assessment verification
- d. Develop underground excavation details
- e. Develop a plan for how to handle excess spoils from the excavations
- f. Back fill material assessment and design needed for material protection and heat dissipation
- g. Evaluate potential construction companies who could perform this work
- h. Develop a construction specification for the excavation, bid the excavation construction, evaluate the construction bids, and award the construction excavation;

2. **Cable Material:**

- a. Identification of potential cable suppliers
- b. Evaluate potential materials supplier's plant
- c. Perform cable and splice performance evaluation
- d. Evaluate potential material suppliers installation and installation support capability
- e. Develop a material, installation, and installation support specification, bid the material, installation, and installation support specification, evaluate bids, and award the material, installation, and installation support.

3. **Duct Bank and Vault Design:**

- a. Develop duct bank and vault concept design
- b. Develop duct bank and vault material requirements
- c. Identify potential suppliers
- d. Develop material specifications for the duct banks and vaults, bid material, evaluate bids, and award the duct bank and vaults.

4. **Riser Structure Design:**

- a. Develop a detailed design for the riser poles
- b. Perform soil borings and evaluation of the soil boring data
- c. Identify structural and electrical material components needed
- d. Develop material specifications for structural and electrical components, bid material, evaluate bids, and award the riser structure material
- e. Develop construction installation specifications, bid the construction, evaluate bids, and award the construction contract for the riser structures.

5. **Cable System Design:**

- a. Perform systems studies to determine ampacity, short circuit duty, grounding requirement, impedances, and accessories sizing
 - b. Perform systems studies to determine cable racking and restraint requirement.
6. **Shunt Compensation Design and Circuit Breaker Evaluation:**
- a. Perform system studies to identify the need and size of any shunt reactors or circuit breakers needed due to the underground installation
 - b. Develop a detailed design layout for the shunt reactors and circuit breakers
 - c. Field survey the sites to obtain data and develop a civil grading plan
 - d. Identify structural and electrical material components needed
 - e. Develop material specifications for structural and electrical components, bid material, evaluate bids, and award the shunt reactor material
 - f. Develop construction installation specifications, bid the construction, evaluate bids, and award the construction contract for the shunt reactors.
7. **Substation Design:**
- a. Evaluate if there is existing room in the substation to install new equipment
 - b. Develop a plan and prepare drawings to incorporate needed modifications to the substation due to requirement for circuit breaker or shunt compensation
 - c. Evaluate requirement for sound/ballistic wall to mitigate against noise.
8. **Commissioning Tests:**
- a. Develop a plan and prepare specifications for performing commissioning tests on the completed underground transmission segment including shunt reactors. Typically, higher than rated voltage partial discharge tests are performed to determine if there are workmanship issues for the cable splices and terminations.
9. **Traffic and Transportation Plan:**
- a. Develop an overall traffic and transportation plan to coordinate all material and construction activities,
 - b. Interface with all public agencies to identify permits required to transport the material and personnel movement for the underground activities.
10. **Coordinate With Cities for Utilities Relocation (for underground in city street alternatives):**
- a. Discuss with the city the overall project concept
 - b. Identify existing and future city and private facilities that are in the street right of way (sewer, storm drain, electrical, telephone cable, *etc.*)
 - c. Work with the city and others to develop relocation plans for the city and private facilities, if possible.

7.0 Feasibility

In most cases, it is technically feasible to construct 230 kV underground transmission lines using XLPE insulated cable that has the same power transfer capability as overhead transmission lines. However, in most cases, it costs more to build the underground transmission line alternative. This is primarily due to the relative simplicity of overhead transmission lines compared to the preparation and infrastructure required for underground cables. Depending on the terrain and location, undergrounding may also result in greater environmental impacts (construction related impacts to traffic, air, noise, *etc.*, as well as biological impacts related to habitat losses).

8.0 Reliability

Outages on overhead lines are primarily caused by the following:

- Insulator flashovers³ due to lightning strikes;
- Accidental contact with the high voltage conductors; and
- Flashovers due to insulator contamination.

Most of the overhead line outages are of a temporary nature and service can usually be restored by automatic or manual reclosing of circuit breakers after the fault is cleared. Generally, repair times for outages that are not resolved by re-energizing the line could be about a day.⁴

On the other hand, outages on underground transmission cables are primarily caused by “dig-ins” (*i.e.* cable damage due to excavation in the vicinity of the underground line). Consequently, the damaged cables must be exposed and time-consuming repairs must be completed before the cables can be returned to service. Average repair times for unplanned or “forced” underground transmission outages are approximately 25 days for XLPE cable systems 230 kV and above.⁵

Typical forced outage rates for underground transmission lines are actually lower than those for overhead lines. This is because underground lines are not likely to be hit by vehicles or directly exposed to storms in the same ways aboveground lines are. However, the combined effects of forced outage rates and repair times are taken into account when comparing the overall reliability of different transmission line types. When forced outage rates and repair times are taken into account, overhead lines are typically found to be more reliable than underground lines. For example, the forced outage rates and repair times for 138kV HPFF cable systems reported by one utility are summarized in Table 2.

³ A “flashover” refers to a disruptive discharge through air around or over the surface of solid or liquid insulation, between parts of different potential or polarity, produced by the application of voltage wherein the breakdown path becomes sufficiently ionized to maintain an electric arc.

⁴ Virginia General Assembly. 2006 session. (2006, March 22). *House Joint Res. 100, Evaluation of Underground Electric Transmission Lines in Virginia*. [Online]. Available <http://jlarc.virginia.gov/Reports/Rpt343.pdf>

⁵ CIGRE TB 379, “Update of Service Experience of HV Underground and Submarine Cable Systems”, CIGRE Working Group B1-10, April 2009

Table 2: Typical Reliability Statistics for 138kV HPFF UG and 138kV OH Lines⁶

	Overhead	Underground
Forced Outage Rate (outages/yr./mi.)	0.005	0.00165
Mean Repair Time (days)	0.375	21
Mean Time Between Failures (yr.)	200	606
Unavailability (hours/year)	0.045	0.832

As a result of the much longer repair times for underground transmission lines, it is relatively common practice to design cable circuits with 100 percent redundancy. That is, two parallel cable circuits are often installed with each of the two cables having sufficient capacity to carry the rated load of the circuit for the duration of contingency (typically the mean repair time). For the RTRP underground alternatives, at the overhead to underground tap point, the riser poles would be designed to facilitate a quick restoration of the Mira Loma – Vista #1 230 kV transmission lines in the event the underground circuits fail.

⁶ Mallard, S.A. and V.C. Thomas, “A Method for Calculating Transmission System Reliability,” IEEE Transactions on Power Apparatus and Systems, Vol. 87, pp. 824-834, March 1968.

9.0 Electrical Capacity (Ampacity) Requirement

The future Mira Loma-Wildlife and Vista-Wildlife 230 kV transmission lines are designed for bundled 1590 kcmil aluminum-conductor steel-reinforced (ACSR) “lapwing” conductor. The conductor thermal rating for bundled “lapwing” is 3,230 amps under normal conditions and 4,360 amps under a 4-hours emergency situation. In 66 kV and 115 kV underground transmission lines, the underground cables are required to match the thermal rating for the overhead conductor. The reason for this is that an underground transmission line will be much more difficult to upgrade later on if additional electrical capacity is needed.

Generally, underground cable cannot match the ampacity of an overhead conductor of the same size. The reason for this is that the conductor of an underground cable is covered with a thick layer of insulation and placed in a duct. The heat generated from the flow of electricity is more difficult to dissipate for underground transmission lines. Because of this, for XLPE, as much as three cables per phase are required to match the ampacity of one bundled “lapwing” overhead conductor.

However, the existing thermal ratings of the Mira Loma-Vista #1 230 kV transmission line are 2,300 amps under normal condition and 3,110 amps under a 4 hours emergency situation. As indicated earlier, for RTRP the Mira Loma-Vista #1 230 kV transmission line would be broken into two transmission lines, the Mira Loma-Wildlife and Vista-Wildlife 230 kV transmission lines. At a minimum, the potential underground transmission lines are required to carry the existing ratings (normal and 4-hour emergency) of the transmission line it is replacing.

Besides meeting the electrical capacity of the overhead conductor, multiple cables per phase have the added benefit of increasing reliability. For example, in a two cables per phase alignment, if there is a failure, half of the circuit could potentially stay energized, providing an ampacity of 1,300 amps, while repairs are made to the other half. Furthermore, in the three cables per phase alignment, if there is a failure, 66% of the circuit could potentially stay energized, providing an ampacity of 2,600 amps, while repairs are made to the failed component.

For the purpose of this evaluation, it is assumed that a two cable per phase options could meet the electrical planning requirement of the future transmission lines. Table 1 compares the thermal rating of bundled 1590 ACSR, historical rating of the current Mira Loma-Vista #1 230 kV transmission line, a three cable per phase thermal rating, and a two cable per phase thermal rating. Figure 1 shows an example of an XLPE insulated segmental copper cable with copper corrugated sheath. A typical 230 kV 5000 kcmil segmental copper cable has an approximate diameter of 5.25 inches and weigh 25 pounds per foot.

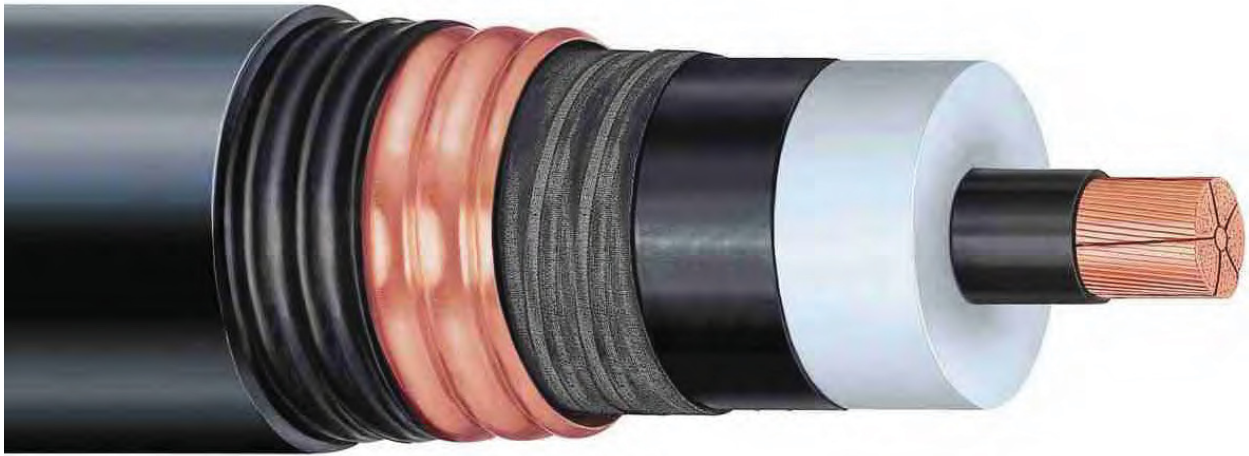


Figure 1: 230 kV Segmental Copper Cable with Copper Corrugated Sheath

Based on values listed in Table 3, the rating for three (3) 5000 kcmil segmental copper cable per phase is sufficient to match the thermal rating of a bundled 1590 ACSR overhead conductor. The rating for two (2) 5000 kcmil segmental copper cable per phase would be sufficient to match the planning rating of the Mira Loma – Vista #1 230 kV transmission line. Smaller conductor cable with less ampacity may be sufficient to match the planning rating but would require further study.

Table 3: 230 kV Thermal Rating Comparison

Rating in Amperes	Bundled 1590 ACSR (Thermal)	SCE Planned Ratings	Three (3) 5000 kcmil Segmental CU/phase	Two (2) 5000 kcmil Segmental CU/phase
Normal Rating	3,230	2,300	3,900	2,600
4 Hours Emergency	4,360	3,110	5,550	3,700

The above UG ampacities are calculated with assumed soil and ambient properties, burial depth, and loading condition, and are subject to change when more accurate measurement are taken.

10.0 Construction Methods

Because of the flat terrain of the underground routes considered here and assumed XPLE cable construction, conventional, open-trench construction is assumed to be applicable. Open-trench construction is used for the vast majority of underground transmission line installations because, as compared with trenchless construction methods, it is less complex, requires commonly available construction machinery and skills, and is less expensive in most cases. It is possible that further engineering could indicate a need for trenchless construction, but this study assumes no trenchless construction would be necessary.

There are two variations of open-trench construction for underground transmission lines. These are concrete encased duct bank installation (Figure 2) and direct buried installation (Figure 3). Concrete encased duct bank are the most commonly used construction for underground transmission lines in North America. In this type of construction, a relatively short (several hundred feet) section of trench is opened, conduits are placed in the trench with plastic spacers every 10 feet to maintain conduit spacing, concrete is poured around the cable ducts, and the trench is backfilled with native soil or a special thermal backfill.



Figure 2: Example of Concrete Encased Duct bank

The primary advantages of concrete encased duct bank construction are:

- Traffic disruptions can be minimized in city streets by opening relatively short lengths of trench;
- The concrete encasement provides good mechanical protection from dig-ins; and
- The ducts facilitate removal of the cable for repairs or future replacement with higher capacity transmission cables.

The disadvantages of concrete encased duct banks are:

- The airspace between the cables and the PVC ducts makes it more difficult to dissipate heat generated by the cables. As a result, the increased thermal resistance decreases the power transfer capability of the transmission cables;
- The unit cost for duct bank installations is generally higher than for direct buried cable installations; and

- Total construction time is longer for duct bank installations compared to direct buried installations.



Figure 3: Example of Direct Buried Cable Installation

Direct buried cable installations are commonly used for most transmission cables in Europe and the Near East, but their applications in North America are usually limited to rural areas with dedicated right-of-ways. In direct buried installations, relatively long trenches are dug, the bottom of the trench filled with bedding sand, the cables are laid or pulled into the trench, and the trench is backfilled with native soil or a special thermal backfill.

The primary advantages of the direct buried construction method are:

- Construction costs are lower than for concrete encased duct bank installations;
- The power transfer capability of a given cable size is higher, compared to concrete encased duct bank installations; and
- Project completion time is less than duct bank installations.

The disadvantages of the direct buried construction method are:

- Cable replacement for repair or circuit uprating is not economical because excavation and reconstruction of the entire segment between vaults would be required whereas cables in duct banks can be pulled out of their conduits requiring significantly less disturbance and cost;

- Dedicated right-of-way is generally required; and
- Long open trenches are required but difficult to obtain in most municipalities.

11.0 Operation and Maintenance Impacts and Requirements

According to the *Association of Edison Illuminating Companies' (AEIC) Specification for Extruded Insulation Power Cables and Their Accessories Rated Above 46kV through 345kVac (CS9-06)*, the projected undergrounding cable life is 40 years. This projection assumed that the various industry specifications are followed, installations are performed error free, and routine maintenance is performed on the system. This means that as the 40 year anniversary of operation approaches, an evaluation of the underground systems must be performed to determine if the cable and subsequence accessories must be replaced.

Qualified electrical workers must routinely inspect the vault to ensure its structural integrity. The check ensures both integrity for the cable and safety for the general public. For example, if the vault is filled with water, the water must be pumped out. If the vault deteriorates over time, the vault could require replacement resulting in forced outages.

Besides routine checks and maintenance to the vaults, SCE's qualified electrical workers must also check on the condition of the voltage limiting arresters, grounding connection, splices, terminations, lightning arresters, and condition of the cable. From time to time, jacket integrity testing is performed on the undergrounded cable. This is accomplished by applying high DC voltage across the cable jacket for one minute. Jacket defects or damage will cause the DC Hi-Pot test set to trip out before the test voltage can be increased to 5kV. It might also be required to de-energize the circuit every few years so that a cable systems assessment could be made. In this assessment, a voltage higher than the system voltage is applied to the transmission line to find any anomalies inside the cable system.

Additional operation constraints exist for an underground transmission line. One of these constraints is that the double circuit transmission lines could not be reclosed after a fault. Typically, for an overhead transmission line, SCE may reclose a circuit if the circuit breaker trips to restore power to the line. Unlike an overhead transmission line, where the fault could occur from a tree branch coming into contact with the conductor, a fault in the underground section would typically be more serious. Typically, a mode of failure for the underground circuit is either due to a dig in, splice, or termination failure. Closing the circuit breaker in this instance could cause further detrimental damages to adjacent cable, splices, terminations, and/or properties and life. Unless the fault is known to occur on the overhead section, SCE cannot restore power to this line by simply reclosing, which could result in longer forced outages.

12.0 Overview of the Three Underground Options for RTRP

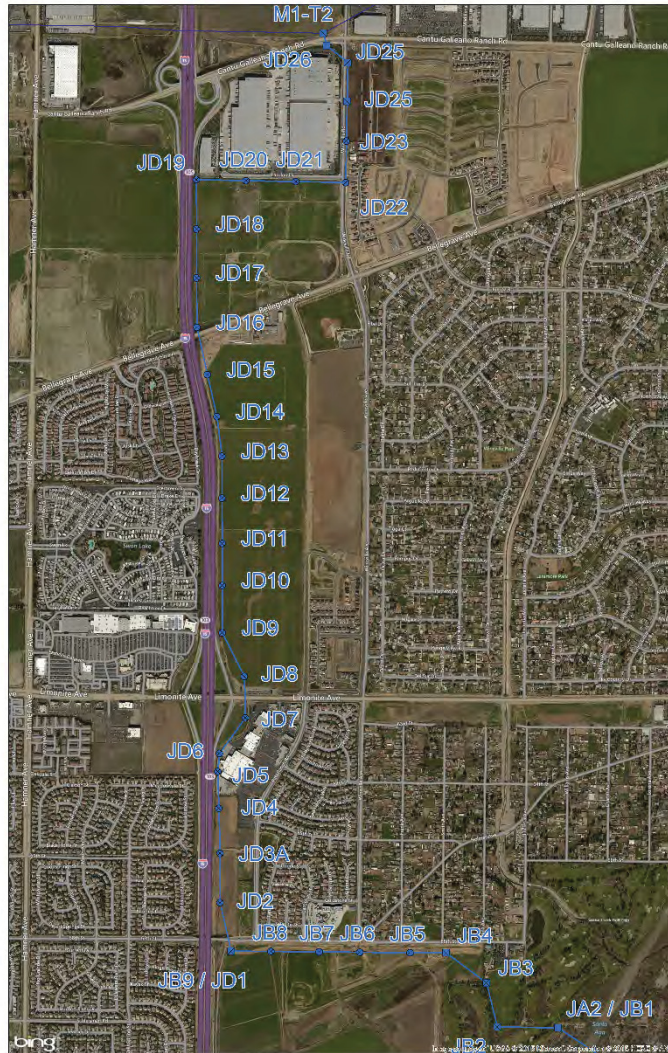


Figure 4: Map of overhead alignment.

SCE’s T&D Engineering department was requested to analyze undergrounding a portion of a new double circuit transmission line. The portion of the RTRP transmission line being replaced consists of approximately eight lattice structures and twenty five tubular steel poles (TSP). This equates to roughly 4.5 miles of overhead construction. Structures labeled JB2 to JD25 shown in Figure 4 correspond to the overhead portion which would be replaced. Not shown in Figure 4 is the remainder of the overhead transmission line that continues to the south and east, crossing the Santa Ana River and ending at the proposed Wildlife Substation (also not shown). The transmission line would remain overhead from structure JA2/JB1 to Wildlife Substation.

Figure 5 shows all three underground alternative routes superimposed on the same map for convenient reference. The three underground routes studied are shown in [Appendix B](#).



Figure 5: Map of alternative underground routes.

12.1 Underground Route Alternate A – EIR UG Route

This route is the longest of the three alternatives at nearly 4.5 miles long. Refer to [Appendix B](#) for an overview map of the EIR UG Route. It would consist of two trenches for the duct banks totaling approximately 48,000 ft. in length. Each trench would house an estimated six cables and three fiber cables. Each cable pull would be approximately 1,500 ft. in length and resulting in an estimated 62 splice vaults for both circuits. In total, approximately 287,000 ft. of cable (does not include contingency) would be required for this route. Common to all three route options are the requirement for an estimated 24

terminations⁷ and 4 riser poles. For maintenance purposes, the vaults would need to be placed in an open area. Unobstructed access to these vaults shall be required at all times.

The RTRP Final EIR Route follows the same alignment shown in Figure 5 and in [Appendix B](#). The majority of the route predominately parallels the I-15 freeway. Challenges on this route include, but are not limited to grading, providing access roads, boring through freeway grade separations, avoiding freeway grade separations, as well as trenching between I-15 freeway and the Vernola Market Place.

There are three major differences between this route and the RTRP Final EIR proposed overhead alignment. First, at the intersection of Bellegrave Avenue and the I-15 freeway, the underground route goes around the embankment instead of boring through it. Second, the overhead alignment is set back approximately 150 ft. south of 68th street while the underground route would go along the center of 68th street. This is due to the new housing development south of 68th street. Third, the overhead route cuts through the golf course with structures JB2, JB3, and JB4 as shown in Figure 4. Instead of following this alignment through the golf course the undergrounding would continue east on 68th street and turn south at Lucretia Avenue and continue south along the existing Mira Loma-Corona-Pedley 66 kV transmission line. The underground transmission line would then rise up approximately one quarter mile south of the intersection of 68th street and Lucretia Avenue.

Table 4: Underground Alternative A Approximate Quantity Requirement

UG Alternate A – EIR Route		
Items	Unit	Approximate Quantity
5000 kcmil XLPE Cable	Feet	287,000
Cable Pulling Segments	Each	189
Splice Vaults	Each	62
Telecom Vaults	Each	31
Cable Splices	Each	186
Cable Terminations	Each	24
Duct bank	Linear Feet	48,000
Permanent Land Disturbances	Acres	6.5
Temporary Land Disturbances	Acres	1.5
Total Construction Disturbances	Acres	8

12.2 Underground Route Alternate B – Pats Ranch Road Route

This route is most frequently referred to in protest letters as the Pats Ranch Road route. Refer to [Appendix B](#) for an overview map of the Pats Ranch Road Route.

⁷ A termination is a terminal component in an underground systems that provides the connection from underground cable to overhead conductor.

It would consist of two trenches for the duct banks totaling approximately 43,000 ft. in length. Each trench would house an estimated six cables and three fiber cables. Each cable pull would be approximately 1,500 ft. in length and resulting in an estimated 56 splice vaults for both circuits. In total, approximately 255,000 ft. of cable (does not include contingency) would be required for this route. As in the RTRP Final EIR route, an estimated 24 terminations and 4 riser poles are required. Also, for maintenance purposes, the vaults would need to be placed in an open area with unobstructed access.

The Pats Ranch Road route is nearly 4.1 miles long. One end of this route begins on the northwest corner of Cantu-Galleano Ranch Road and Wineville Avenue. The route would head south on Wineville Avenue for approximately three quarters of a mile where it would turn west on Bellegrave Avenue then south on Pats Ranch Road. Currently, the portion of Pats Ranch Road north of Limonite Avenue is being constructed as part of a new housing development. Once the underground route reaches 68th street, the alignment would turn East on 68th street and continue through Goose Creek Golf Course just as in the EIR route described above.

It is anticipated that most of this route would be trenched through paved road. However, the segment between limonite and Bellegrave Avenue is currently being developed. As expressed previously, there is the risk that excavation and construction activities may damage the proposed duct banks. In addition to this concern, other challenges identified on this route include trenching through paved roads and identifying existing underground utilities. This route is presents fewer technical challenges than the referenced RTRP Final EIR route, but is preliminarily thought to be less feasible than the Wineville Avenue Route described in the next section.

Table 5: Underground Alternative B Approximate Quantity Requirement

UG Alternate B – Pat Ranch Route		
Items	Unit	Approximate Quantity
5000 kcmil XLPE Cable	Feet	255,000
Cable Pulling Segments	Each	171
Splice Vaults	Each	56
Telecom Vaults	Each	28
Cable Splices	Each	168
Cable Terminations	Each	24
Duct bank	Linear Feet	43,000
Permanent Land Disturbances	Acres	4.5
Temporary Land Disturbances	Acres	1.5
Total Construction Disturbances	Acres	6

12.3 Underground Route Alternate C – Wineville Route

This is the shortest and most direct of the routes at nearly 3.6 miles. Refer to [Appendix B](#) for an overview map of the Wineville Route.

It would consist of two trenches for the duct banks totaling approximately 38,000 ft. in length. Each trench would house an estimated six cables and three fiber cables. Each cable pull would be approximately 1,500 ft. in length and resulting in an estimated 50 splice vaults for both circuits. In total, approximately 227,000 ft. of cable (does not include contingency) would be required for this route. As in the RTRP Final EIR route, an estimated 24 terminators and 4 riser poles are required. Also, for maintenance purposes, the vaults would need to be placed in an open area with unobstructed access.

The Wineville Avenue route is predominantly on paved roads. One end of this route begins on the northwest corner of Cantu-Galleano Ranch Road and Wineville Avenue. The route continues south on Wineville Avenue for approximately 2.75 miles until it reaches 68th street. It then turns east on 68th street and continues in the same fashion as the other two routes ending at two riser poles in the golf course.

Some of the challenges identified on this route include, but are not limited to trenching on paved roads and identifying underground utilities. There has been no survey of underground utilities completed. When the information on existing underground utilities becomes available, the estimated feasibility of this alternative may change. Preliminarily however, this route is estimated to present the fewest technical challenges to construction.

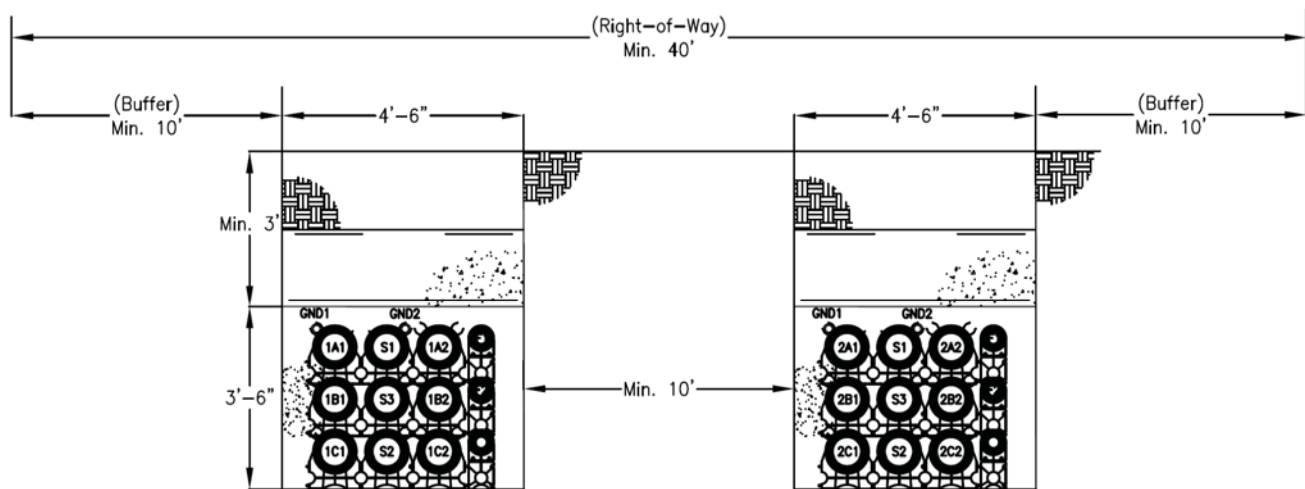
Table 6: Underground Alternative C Approximate Quantity Requirement

UG Alternate C – Wineville Route		
Items	Unit	Approximate Quantity
5000 kcmil XLPE Cable	Feet	227,000
Cable Pulling Segments	Each	153
Splice Vaults	Each	50
Telecom Vaults	Each	25
Cable Splices	Each	150
Cable Terminations	Each	24
Duct bank	Linear Feet	38,000
Permanent Land Disturbances	Acres	4
Temporary Land Disturbances	Acres	1.5
Total Construction Disturbances	Acres	5.5

12.4 Requirements Common to all Underground Alternatives

To achieve the required power transfer capabilities for all underground route options, the two duct banks would be spaced at least 10 ft. apart from the inside edge of the encasement. On the outside edge of the encasement, a 10 ft. separation shall be maintained from all heat sources. Because of these separations and the 4 ft. 6 in. width of the duct banks, the underground right of way would be up to approximately 50 ft. (no less than 40 ft.).

Thermal rating studies indicate that a bundled 230 kV 5000 kcmil segmental copper XLPE cable is sufficient to carry the planning projected amount of power for the new double circuit transmission line. Hence, six cables are estimated to be required per circuit. However, for reliability purposes, each underground circuit would be constructed in a concrete encased duct bank with three spare ducts. Each duct bank substructure would be nearly 4 ft. 6 in. wide and 3 ft. 6 in. high and have nine 8 in. schedule 40 PVC conduits. Each duct bank would also have three 5 in. schedule 40 PVC conduits for communication cables. Figure 6 illustrates this typical duct bank construction along the alignments.



Double Circuit 220kV Duct Bank
(Typical)

Figure 6: Typical Concrete Encased Duct Bank for the Double Circuit

Underground materials (*i.e.* cable, splices, terminations, etc.) require extensive procurement lead times. In the event of an emergency, SCE anticipates it would be very difficult to timely acquire components necessary to make repairs. The worst case scenario would consist of an entire duct bank structure being damaged or dug up. For these reasons, replacement equipment to rebuild at least one underground span between both: (a) the longest vault to vault distance; and (b) the longest vault to riser pole section distance are needed.

12.5 Riser Poles

For all underground route options presented here, a set of two riser poles would be installed at each end of the underground route. A riser pole is a dead-end engineered steel pole that has special attachments for connecting the underground cable to the overhead conductor. Figure 7 shows an existing set of riser pole construction similar to what would be utilized for this alternative.



Figure 7: SDG&E Transmission Riser Poles (165 ft. tall and spaced approximately 90 ft. apart)

SCE estimates that in the case of RTRP the riser poles that would be similar to the ones in figure 7 would require additional easement, careful sagging, and possible insulator weights. This is due to the phase spacing being over 20 feet. This spacing might create excessive line angles and blow out onto the Mira Loma-Vista #2 T/L. Typical spacing compatible with SCE hardware is 18 inches. The riser pole in Figure 7 would be adapted as shown in Figure 8 to space the conductors to at least 18 inches and mitigate some of the challenges discussed above.⁸ The riser pole would have an approximate height of 165 ft. and an approximate weight of 80,000 lbs.

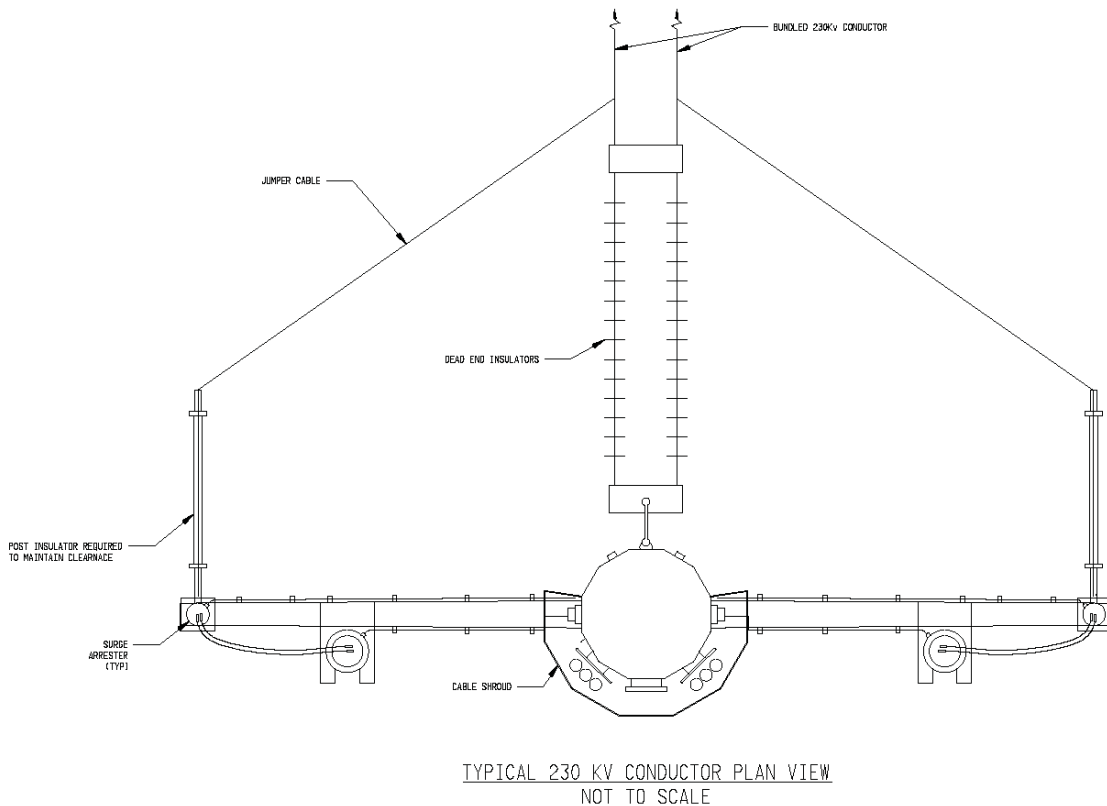


Figure 8: Conceptual Transmission Riser Pole Modified to Bundle Overhead Conductor (see [Appendix E](#))

At the northwest corner of Cantu-Galleano Ranch Road and Wineville Avenue, the riser poles would be spaced approximately 150 ft. apart. The westernmost riser pole would span to M1-T1 of the Mira Loma-Vista #1 230 kV T/L while the other riser pole would span to M1-T3. The southernmost circuit of M1-T2 would be undisturbed during construction and after construction it would remain vacant. This vacant position could be used to reconnect Mira Loma Substation and Vista Substation in the event of an extended outage caused by the underground portion of the line. At the other end of the underground route near the golf course, one riser pole would span to one side of the proposed lattice structure while the other riser pole would span to the other side of that same lattice structure. In total, four riser poles are estimated to be required for each underground route.

⁸ This study places the riser poles on existing ROW, but additional ROW may be required.

For 69kV and 115 kV, SCE’s construction practice is to pull the cable up inside the riser poles. However, after interviewing engineers from Pacific Gas and Electric, San Diego Gas and Electric, Los Angeles Department of Power and Water, Arizona Public Services, and various cable manufacturers, for 230 kV construction, SCE is informed that it is a common installation practice to run large diameter cable on the outside of the riser poles. A shroud made of thick sheet metal typically provides a protective barrier for the cable from the base of the riser pole up to about 30 ft. as depicted in Figure 9.



Figure 9: PG&E Riser Pole Shroud

12.6 Vaults

Vaults are underground facilities that enclose cable splices. Vault locations are determined by underground cable reel size and allowable pulling tensions. For this study, vaults would be spaced in

approximately 1500 ft. increments. Figure 10 shows a 230 kV vault being installed for SDG&E in city streets. Similarly, figure 11 shows a SCE 500 kV vault being set into place.

For the 69kV and 115 kV installation, SCE uses a 10 ft. wide by 20 ft. long by 9 ft.-6 in. high vaults. For the proposed 230 kV installation, a larger vault would most likely be required. As an example, for SCE's 500 kV underground transmission line, a vault's typical inside dimensions are 62 ft. long by 8 ft. wide by 8 feet. For this 230 kV alternative, the approximate inside dimensions of these vaults is estimated to be 48 ft. long by 8 ft. wide by 8 ft. tall.



Figure 10: SDG&E 230 kV Vault Installation



Figure 11: SCE 500 kV Vault Installation

With a vault installed, one section of the cable is pulled into the vault. There are duct openings built into the vault that allow the cable to enter. Figure 12 and Appendix F shows how the duct bank would be configured as it enters the vault. The nine polyvinyl chloride (PVC) ducts will transition from a typical duct bank and split into two vaults. Figure 13 shows an inside view of how the cables would enter a vault.

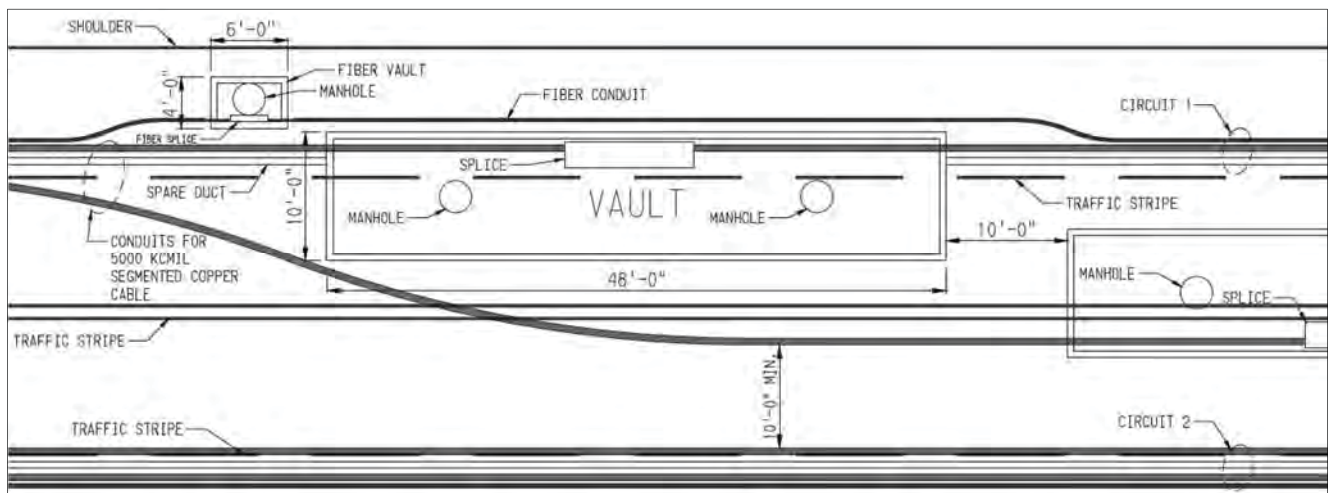


Figure 12: Duct Bank Transition



Figure 13: Inside LADWP 230 kV Vault

Once the cables are pulled into the vault, it must be spliced together to form a continuous cable. Figure 14 shows a completed 230 kV splice.



Figure 14: Example of a Completed 230 kV Splice

12.7 Shunt Compensation

The electrical capacitance per unit length of the underground transmission line is significantly higher than the capacitance for overhead transmission lines. This is because: (a) the dielectric constant of solid insulations is several times higher than that of air and (b) ground potential for high voltage cables (the cable shield) is much closer than for overhead lines (the surface of the ground).

The high capacitance of underground cables per unit of length results in the relatively high charging current requirements. The reactive mega volt-amperes (MVAR) associated with the cable charging current must either be absorbed by the power system or shunt reactors may be required at one or more locations along the cable circuits.

While a system study to determine the shunt compensation requirements to support the underground portion of the line has not been performed, the 3.6 to 4.5-mile RTRP lines would likely need shunt reactive compensation to absorb capacitive charging current produced by the cables during light load periods. This assumption is based on a recent 500 kV underground project with similar length. After a study was performed, the 500 kV underground line required 346 MVAR to be installed per circuit. Because this line is a lower voltage, it was assumed that 173 MVAR, half of the requirement for the 500 kV underground line, would be installed per circuit. Most likely, the shunt reactors would be installed at Wildlife Substation. The installation of shunt reactors at Wildlife Substation would require



T&D Engineering

modifications to the substation's layout and size which would be determined based upon further engineering analysis.

13.0 Technical Scope

The following tables summarize the technical scope for each alternative analyzed in this report. Please refer to Appendix G for the civil earth work quantities. It should be noted that the limitations of this report listed in section 2 may impact the technical scope substantially.

Table 7: Estimated Engineering Scope for UG EIR Route Alternative

EIR Route Alternative: Cable Installed In Encased Duct Bank and Buried Splice Vaults			
Estimated Scope: Construct 4.5 miles of double circuit underground 230 kV duct bank with cable and accessories following the current EIR overhead route option.			
Double Circuit Route Length (ft.)	24,000	Circuits	2
Trench/Duct Bank Length (ft.)	48,000	Cables Per Phase	2
Cables Per Trench	6	Splices	186
Riser Pole Height (ft.)	165	Terminations	24
Riser Pole Required	4	Splice Vaults (8' x 8' x 48' inside)	62
Cable Length w/ no Spare (ft.)	287,000	Duct bank Width (ft.)	4.5
Item	Unit	Quantity	
Duct Bank and Structures Scope of Work			
ROW Prep.	FT	24,000	
Trench Excavation	FT	48,000	
Spoil Disposal	CU YD	75,000	
8" SCH 40 PVC Conduit	FT	428,000	
Clean Backfill	CU YD	12,000	
Fluidized Thermal Backfill	CU YD	52,000	
Concrete Cap	Cu YD	12,000	
Trench Repair	SQ FT	309,000	
Riser Poles	EA	4	
Footing for Riser Poles	EA	4	
Splice Vaults	EA	62	
Electrical Scope of Work			
220 kV XLPE 5000 Segmental Cable	FT	287,000	
220 kV Terminations	EA	24	
220 kV Splices	EA	186	
Link Boxes	EA	372	
Line Arresters	EA	48	
Construction Supervision	Weeks	124	
Cable Pull	Days	50	
Subcontractor Installation (100 weeks)	LOT	1	
Field Testing & Energization	LOT	1	

Table 8: Estimated Engineering Scope for Pats Ranch Road Alternative

Pats Ranch Road Route Alternative: Cable Installed In Encased Duct Bank and Buried Splice Vaults			
Estimated Scope: Construct 4.1 miles of double circuit underground 230 kV duct Bank with cable and accessories following Pats Ranch Road.			
Double Circuit Route Length (ft.)	22,000	Circuits	2
Trench/Duct Bank Length (ft.)	43,000	Cables Per Phase	2
Cables Per Trench	6	Splices	168
Riser Pole Height (ft.)	165	Terminations	24
Riser Pole Required	4	Splice Vaults (8' x 8' x 48' inside)	56
Cable Length w/ no Spare (ft.)	255,000	Duct bank Width (ft.)	4.5
Item	Unit	Quantity	
Duct Bank and Structures Scope of Work			
ROW Prep.	FT	22,000	
Trench Excavation	FT	43,000	
Spoil Disposal	CU YD	66,500	
8" SCH 40 PVC Conduit	FT	380,500	
Clean Backfill	CU YD	10,500	
Fluidized Thermal Backfill	CU YD	46,000	
Concrete Cap	Cu YD	10,500	
Trench Repair	SQ FT	275,000	
Riser Poles	EA	4	
Footing for Riser Poles	EA	4	
Splice Vaults	EA	56	
Electrical Scope of Work			
220 kV XLPE 5000 Segmental Cable	FT	255,000	
220 kV Terminations	EA	24	
220 kV Splices	EA	168	
Link Boxes	EA	336	
Line Arresters	EA	48	
Construction Supervision	Weeks	112	
Cable Pull	Days	50	
Subcontractor Installation (100 weeks)	LOT	1	
Field Testing & Energization	LOT	1	

Table 9: Estimated Engineering Scope for Wineville Avenue Alternative

Wineville Avenue Route Alternative: Cable Installed In Encased Duct Bank and Buried Splice Vaults			
Estimated Scope: Construct 3.6 miles of double circuit underground 230 kV duct bank with cable and accessories following Wineville Avenue.			
Double Circuit Route Length (ft.)	19,000	Circuits	2
Trench/Duct Bank Length (ft.)	38,000	Cables Per Phase	2
Cables Per Trench	6	Splices	150
Riser Pole Height (ft.)	165	Terminations	24
Riser Pole Required	4	Splice Vaults (8' x 8' x 48' inside)	50
Cable Length w/ no Spare (ft.)	227,000	Duct bank Width (ft.)	4.5
Item	Unit	Quantity	
Duct Bank and Structures Scope of Work			
ROW Prep.	FT	19,000	
Trench Excavation	FT	38,000	
Spoil Disposal	CU YD	59,000	
8" SCH 40 PVC Conduit	FT	339,000	
Clean Backfill	CU YD	9,500	
Fluidized Thermal Backfill	CU YD	41,000	
Concrete Cap	Cu YD	9,500	
Trench Repair	SQ FT	245,000	
Riser Poles	EA	4	
Footing for Riser Poles	EA	4	
Splice Vaults	EA	50	
Electrical Scope of Work			
220 kV XLPE 5000 Segmental Cable	FT	227,000	
220 kV Terminations	EA	24	
220 kV Splices	EA	150	
Link Boxes	EA	300	
Line Arresters	EA	48	
Construction Supervision	Weeks	100	
Cable Pull	Days	50	
Subcontractor Installation (100 weeks)	LOT	1	
Field Testing & Energization	LOT	1	

14.0 Appendices

Appendix A – Public Utilities Commission Deficiency Letter

Appendix B – Underground Alternative Routes:

- EIR UG Route
- Pats Ranch Road Route
- Wineville Avenue Route

Appendix C – Dismissed Underground Alternatives

Appendix D – Overhead EIR Route

Appendix E – RTRP Conceptual 230 kV Riser

Appendix F – Duct Bank Transition

Appendix G – Civil Earth Work Quantities

Appendix A

Public Utilities Commission Deficiency Letter

PUBLIC UTILITIES COMMISSION

505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298



May 22, 2015

Ian Forrest, Senior Attorney
Southern California Edison Company
Post Office Box 800
Rosemead, CA 91770
Email: ian.forrest@sce.com

**RE: Application Deficiency - Certificate of Public Convenience and Necessity for the
Riverside Transmission Reliability Project – Application No. A.15-04-013**

Dear Mr. Forrest,

The California Public Utilities Commission's (CPUC) Energy Division CEQA Unit has completed its review of Southern California Edison's (SCE's) Application (A. 15-04-013) for a Certificate of Public Convenience and Necessity (CPCN) for the Riverside Transmission Reliability Project (RTRP). The CPUC has also reviewed the Final Environmental Impact Report (EIR) prepared by the City of Riverside pursuant to the California Environmental Quality Act (CEQA) and the associated administrative record. The City of Riverside is the Lead Agency under CEQA, responsible for preparation of the EIR. The CPUC is a Responsible Agency under CEQA, responsible for the certification of the CPCN.

City of Riverside Final EIR

The City of Riverside certified the Final EIR for the RTRP in October 2013 and filed the Notice of Determination on February 6, 2013. The Final EIR certified by the City of Riverside, along with the entire administrative record of the proceeding before Riverside were filed with the Application as information equivalent to a Proponent's Environmental Assessment.

In March 2013, Jurupa Valley filed a CEQA lawsuit in Superior Court challenging Riverside's approval of RTRP. On May 1, 2014, the Los Angeles Superior Court denied Jurupa Valley's challenge and upheld the Final EIR and Riverside's approval of the Project. Jurupa Valley appealed that decision and the appellate case is currently pending.

Changed Conditions in the Project Alignment

Subsequent to the certification of the EIR and approval of the RTRP, the City of Jurupa Valley certified an Initial Study/Mitigated Negative Declaration (IS/MND) and approved the Riverbend housing project, a 466-unit subdivision at the southeast corner of Wineville Avenue and Cantu-Galleano Ranch Road. The project would be located on a 36.6-acre parcel over approximately 1 mile of the length of the proposed RTRP transmission line alignment. The approved vested tentative map and zoning and development plan for the subdivision did not include a right-of-way alignment for the RTRP route. The Project has been purchased by Lennar Homes, Inc. Lennar has graded the site and purportedly made other improvements.

In addition, the City of Jurupa Valley certified an IS/MND and approved the Vernola Marketplace Apartments Project at the northwest corner of 68th Street and Pats Ranch Road in Jurupa Valley. The Notice of Determination was filed on March 20, 2015. The project includes development of 25 apartment buildings, with 397 residential units, on a 17.4-acre property. The project site is within the proposed alignment for the RTRP; the IS/MND did not consider the RTRP and the effects on the proposed apartments.

The approved subdivisions within the RTRP route are considered a substantial change in circumstances, which will require the CPUC to prepare a Subsequent EIR to address new significant environmental effects pursuant to CEQA Guidelines Section 15162.

Application Incomplete

After review of SCE's application for the RTRP, the Energy Division finds that the information contained in the Application and Final EIR is incomplete. The attached report identifies the portions of the application found to be deficient.

Information provided by SCE in response to the Energy Division's finding of deficiency should be filed as supplements to Application A. 15-04-013. One set of responses should be sent to the Energy Division and one to our consultant Panorama Environmental, in both hardcopy and electronic format. We request that SCE respond to this report no later than July 21, 2015.

We will review the information within 30 days and determine if it is adequate to accept the application as complete. We will be available to meet with you at your convenience to discuss these items.

The Energy Division reserves the right to request additional information at any point in the application proceeding and during subsequent construction of the project should SCE's CPCN be approved.

Please direct questions related to this application to me at (415) 703-5484 or Jensen.Uchida@cpuc.ca.gov.

Sincerely,



Jensen Uchida
Project Manager
Energy Division, CEQA Unit

cc: ALJ
Mary Jo Borak, Supervisor
Molly Sterkel, Program Manager
Jack Mulligan, CPUC Attorney
Jeff Thomas, Project Manager, Panorama Environmental, Inc.

DEFICIENCY REPORT FOR THE RIVERSIDE TRANSMISSION RELIABILITY PROJECT APPLICATION (A. 15-04-013)

REPORT OVERVIEW

The California Public Utilities Commission (CPUC) has identified deficiencies in Southern California Edison's (SCE's) Application (A.15-04-013) for a Certificate of Public Convenience and Necessity for the Riverside Transmission Reliability Project (RTRP). Deficiencies were identified according to requirements of the CEQA (Public Resources Code Section 21000 *et seq.*) General Order 131-D and the Commission's Rules of Practice and Procedure for a CPCN. Deficiencies are presented in Table 1.

Table 1: SCE Riverside Transmission Reliability Project Application 15-04-013 Deficiencies

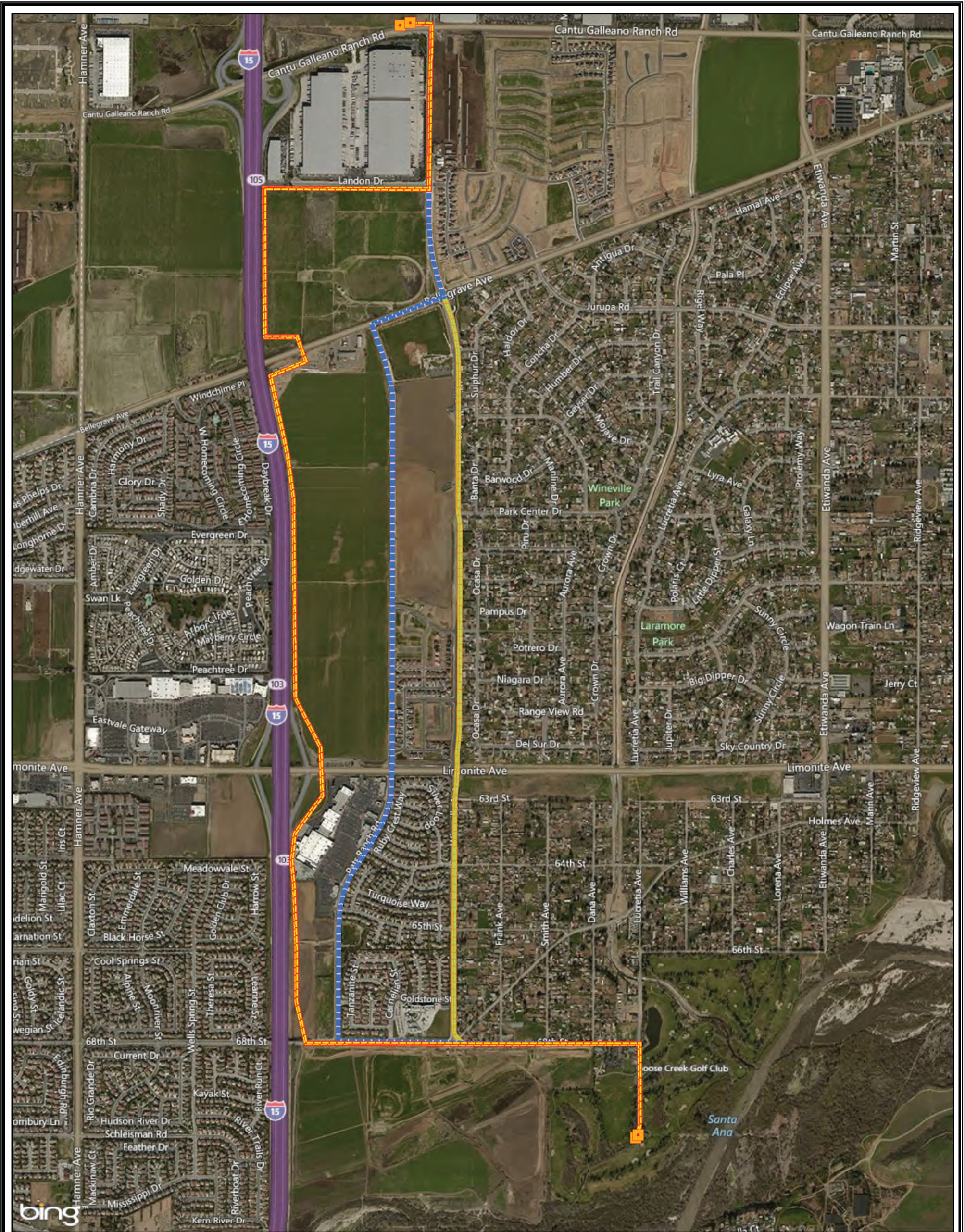
Number	Deficiency
1	<p>SCE's Application, Final EIR, and Administrative Record do not contain adequate information to document the change in circumstances since Riverside certification of the Final EIR. Additional information is required regarding the Riverbend housing project and Vernola Marketplace Apartment Community to document the current baseline conditions in the proposed RTRP alignment. This information should include modifications to the environmental setting in the EIR to reflect the conditions in the transmission corridor resulting from the approved subdivisions consistent with the requirements of the CPUC PEA Checklist for Transmission Line Projects (October 2008) including:</p> <ol style="list-style-type: none"> 1. Documentation of baseline aesthetic conditions at the approved housing developments. 2. Updated agricultural setting to reflect the Riverbend housing project within an area that was previously Williamson Act farmland. 3. Updated habitat acreages within the transmission corridor to reflect grading and other habitat modifications since the filing of the EIR. 4. Updated land use and zoning designations to reflect the approved residential developments. 5. Updated transportation and traffic conditions to reflect the approved residential developments and current traffic volumes.
2	<p>SCE's Application, Final EIR, and Administrative Record do not provide an assessment of the environmental impacts of the RTRP on the Riverbend housing project (466 single family lots) and the Vernola Marketplace Apartment Community. The following information is needed to evaluate impacts on the residential developments, consistent with the CPUC PEA Checklist for Transmission Line Projects (October 2008):</p> <ol style="list-style-type: none"> 1. A visual simulation of the RTRP with the proposed housing development and analysis of cumulative aesthetic impacts from the housing developments and the RTRP. 2. Revisions to the area of agricultural impacts provided in the EIR to reflect the conversion of Williamson Act farmland at the Riverbend housing project to a residential development.

Table 1: SCE Riverside Transmission Reliability Project Application 15-04-013 Deficiencies





Number	Deficiency
	<ol style="list-style-type: none"> 3. Updates to the habitat impact acreages in the EIR to reflect grading of the Riverbend project and any other changes in baseline conditions since publication of the EIR. 4. Description of hazards associated with construction and operation of the proposed project within the approved residential developments. 5. Land use impacts associated with conflicts between the proposed project transmission alignment and the approved residential developments. 6. Increased noise impacts from construction within residential subdivisions and long-term corona noise impacts on the subdivision. 7. Impacts from construction and operation of the proposed project on transportation and traffic considering the roads that are proposed within the approved subdivisions. 8. Impacts of the proposed project on population and housing. 9. Cumulative impacts of the proposed project with other cumulative projects that are currently planned in the area.
3	<p>CEQA requires consideration of alternatives that are capable of substantially reducing or eliminating significant environmental effects (CEQA Guidelines Section 15126.6(a)). Define alternatives that meet the project objectives and reduce or avoid potentially significant impacts of the proposed project on the approved Riverbend housing project and Vernola Marketplace Apartment Community. This may include local routing alternatives or electrical system alternatives.</p>
4	<p>Provide the total volume of water that will be required for construction of the project. The City of Riverside Final EIR and response to comments state that a maximum of 40,000 gallons of water would be applied per mile per day. This volume of water does not equate to a total volume required for the project. Specify a total maximum volume of water needed for the project and the source of water.</p>
5	<p>Define the proposed location for disposal of hazardous waste and treated wood poles that would be removed by the proposed project.</p>

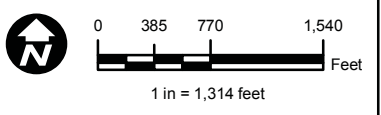
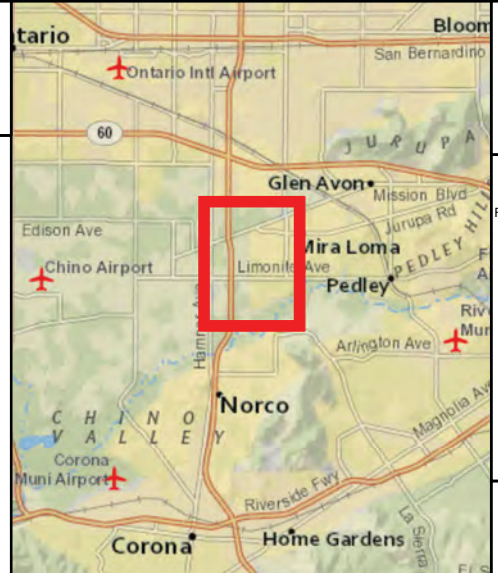
Appendix B

Underground Alternative Routes: EIR UG Route; Pats Ranch Road Route; and Wineville Avenue Route



RTRP Underground Routes Evaluated Overview Map

-  Riser
-  EIR Route (Modified 68th St)
-  Pats Ranch Road Route
-  Wineville Avenue Route



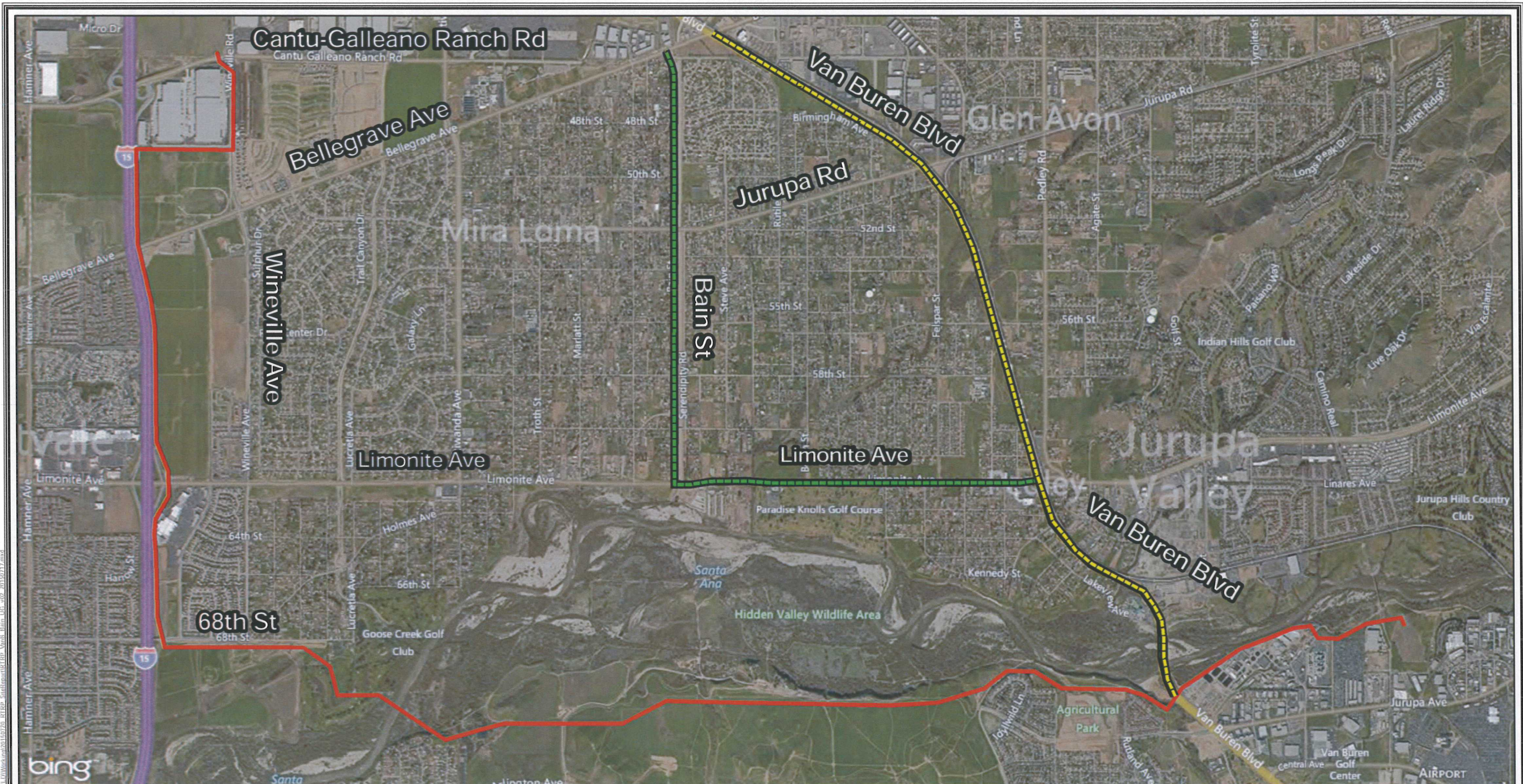
Notification #: 201864893
Date: 7/23/2015
File Name: RTRP_UndergroundRoutesEvaluated_20150723.mxd
Version #: 01

Features depicted herein are planning level accuracy, and intended for informational purposes only. Distances and locations may be distorted at this scale. Always consult with the proper legal documents or agencies regarding such features. Real Properties Department
Thomas Bros. Maps is a registered trademark of Rand McNally & Company. Reproduced with permission granted by Rand McNally & Company. All rights reserved.
Service Layer Credits: Image courtesy of USGS © 2015 Microsoft Corporation © 2015 HERE © AND Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC.



Appendix C

Dismissed Underground Alternatives



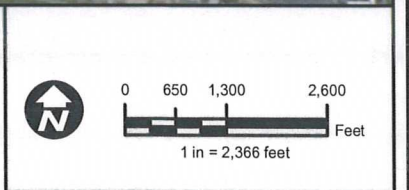
RTRP Underground 220 kV Alternative Routes Dismissed
Bain Street and Van Buren Boulevard

- Final EIR Overhead Route (For reference)
- - - Van Buren Underground Route Alternative
- - - Bain Underground Route Alternative



Notification #: 201864893
 Date: 7/23/2015
 File Name: RTRP_VanB_Bain_UG_v02_20150717.mxd
 Version #: 1

Features depicted herein are planning level accuracy, and intended for informational purposes only. Distances and locations may be distorted at this scale. Always consult with the proper legal documents or agencies regarding such features. Real Properties Department Thomas Bros. Maps is a registered trademark of Rand McNally & Company. Reproduced with permission granted by Rand McNally & Company. © Rand McNally & Company. All rights reserved. Service Layer Credits: Image courtesy of USGS © 2015 Microsoft Corporation © 2015 HERE © AND Content may not reflect National Geographic's current map policy. Source: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

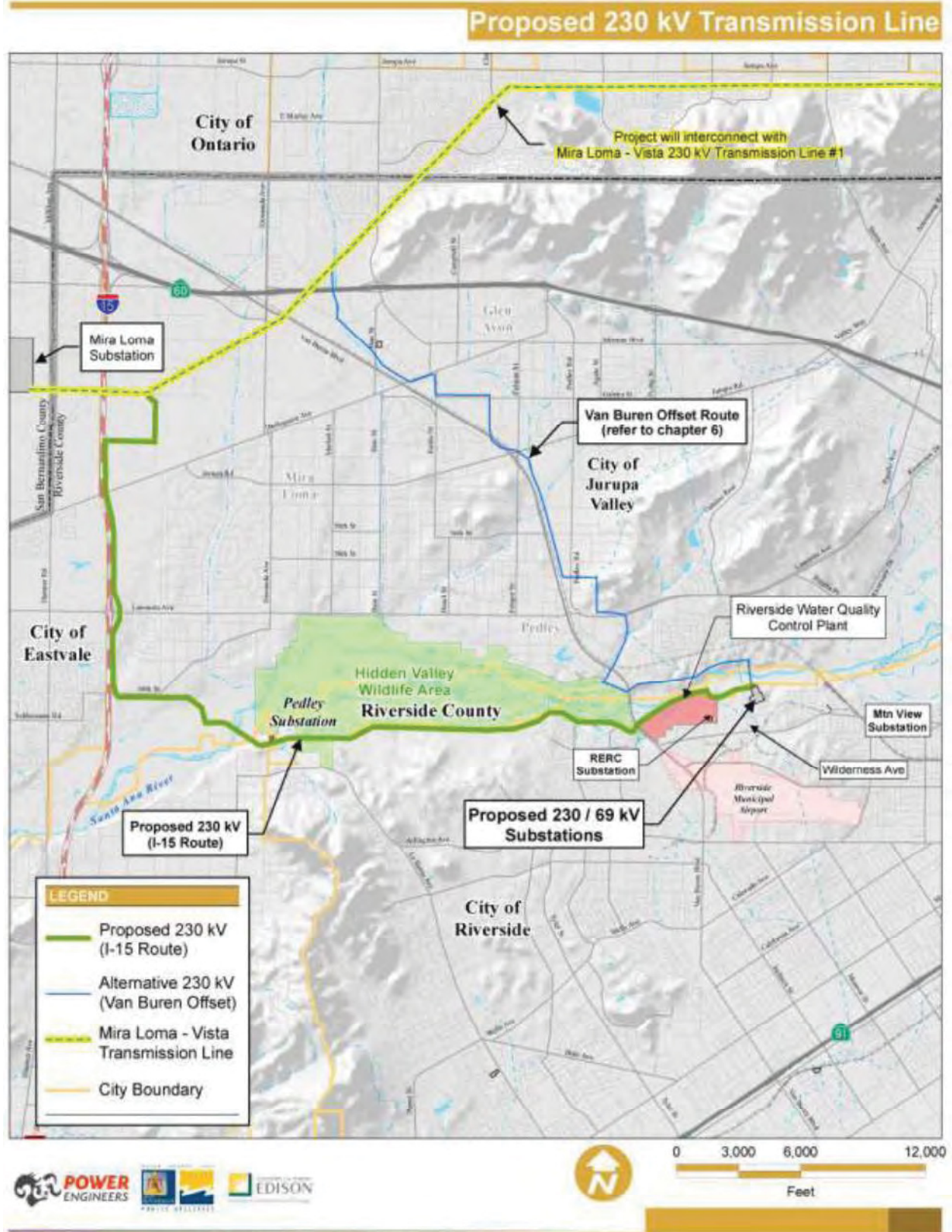


File: R:\RTRP\GIS\MapDocs\BainStreetTransmission\BainStreetTransmission.mxd; Path: R:\RTRP\GIS\MapDocs\BainStreetTransmission\BainStreetTransmission.mxd; Date: 7/23/2015 10:17:17 AM; User: jgibson

Appendix D

Overhead EIR Route

FIGURE 2.3-3. PROPOSED 230 kV TRANSMISSION LINE (REVISED)

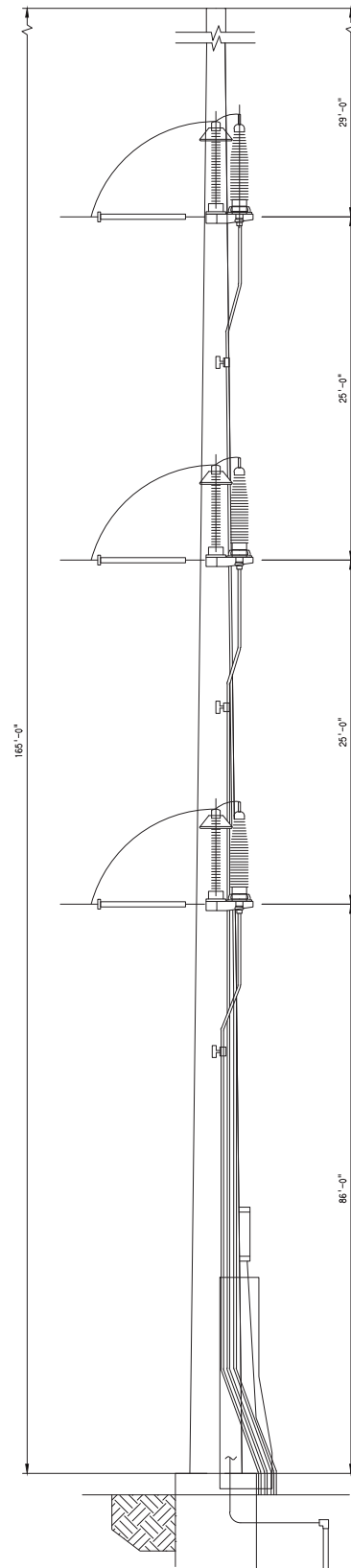


RIVERSIDE TRANSMISSION RELIABILITY PROJECT

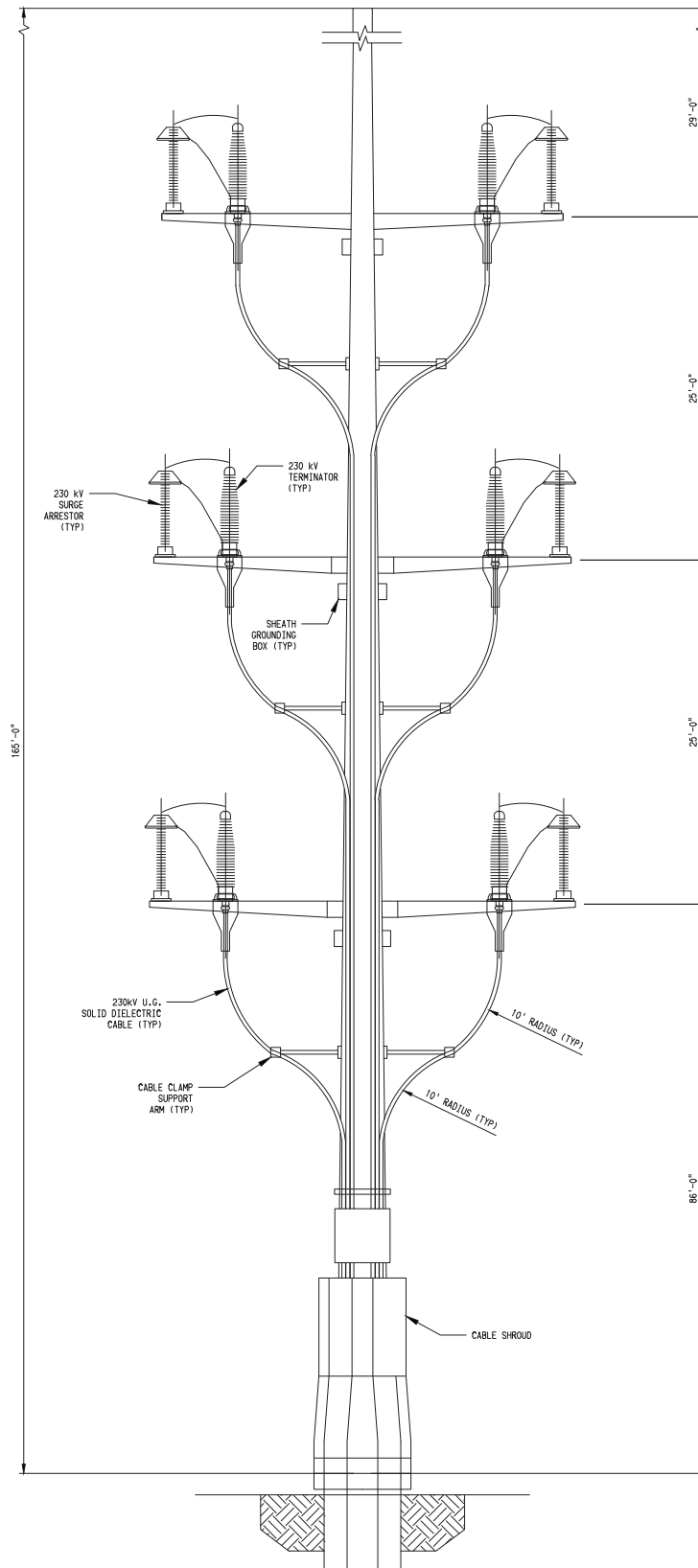
Appendix E

RTRP Conceptual 230 kV Riser

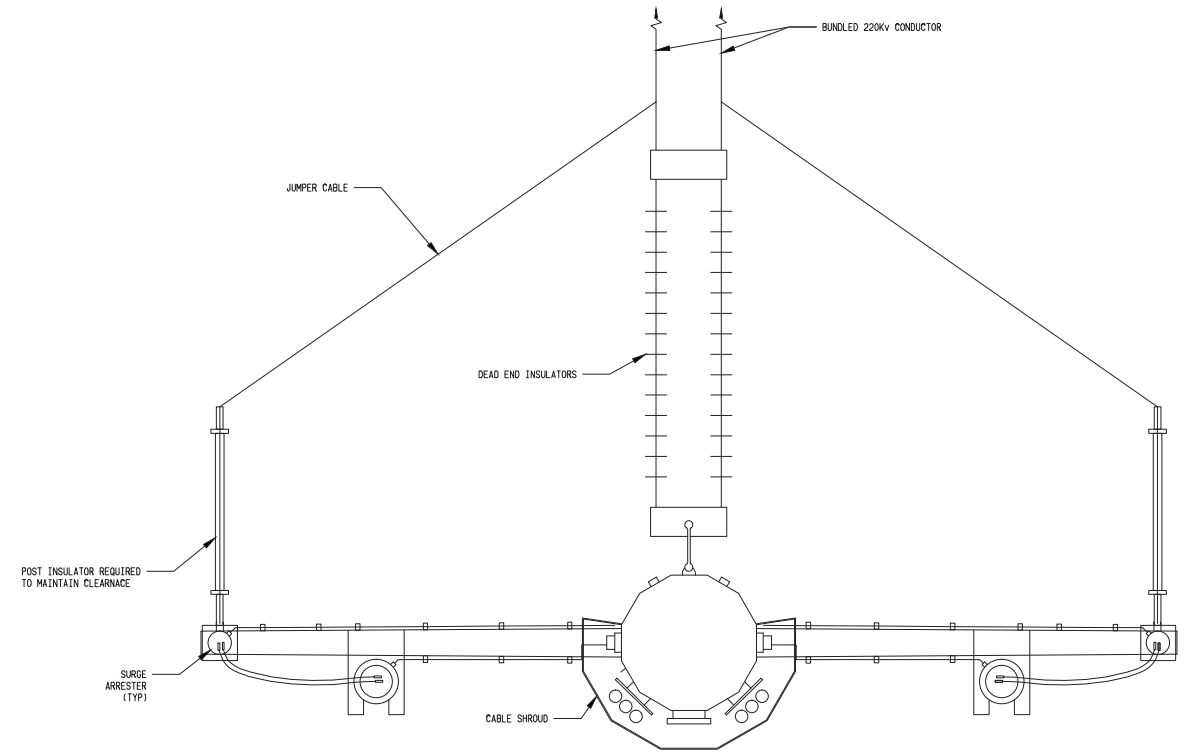
CONCEPTUAL DESIGN OF 220KV RISER TUBULAR STEEL POLE. DIMENSIONS AND ARRANGEMENT SUBJECT TO FINAL ENGINEERING.



LONGITUDINAL VIEW
NOT TO SCALE



TRANSVERSE VIEW
NOT TO SCALE



TYPICAL 220 KV CONDUCTOR PLAN VIEW
NOT TO SCALE

* REVISE ON AUTOCAD SYSTEM ONLY *

NO.	REVISIONS	DATE	SAP NO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.	NO.	REVISIONS	DATE	SAP NO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.	

LOCATION: RTRP U.G. STUDY	SHEET NO.
RTRP CONCEPTUAL 230KV RISER TUBULAR STEEL POLE DESIGN	SCALE: _____
SOUTHERN CALIFORNIA EDISON An EDISON INTERNATIONAL Company	_____ OF _____ SHTS.

Appendix F

Duct Bank Transition

Appendix G

Civil Earth Work Quantities

RTRP Underground Alternatives Civil Engineering Quantity Estimate
 Prepared on: 07/22/2015

		EIR ROUTE	WINEVILLE-PATS ROAD	WINEVILLE	OVERHEAD PORTION
Underground Excavation	Duct Excavation	52,000 CY	46,000 CY	41,000 CY	0 CY
	Vault Excavation	22,100 CY	20,000 CY	18,000 CY	0 CY
	Manhole Excavation	600 CY	500 CY	500 CY	0 CY
	Over-Ex and Recompact	8,000 CY	7,100 CY	6,300 CY	0 CY
	Thermal Backfill	52,000 CY	46,000 CY	41,000 CY	0 CY
Paved Roads	Asphalt - 4" Thickness	64,500 SQ FT	192,000 SQ FT	164,000 SQ FT	0 SQ FT
	Class II Base - 6" Thickness	64,500 SQ FT	192,000 SQ FT	164,000 SQ FT	0 SQ FT
	Over-Ex and Recompact - 12" Thickness	64,500 SQ FT	192,000 SQ FT	164,000 SQ FT	0 SQ FT
Transmission Access Roads	Length of Access Road	15,000 LFT	0 LFT	0 LFT	19,000 LFT
	Cut	2,500 CY	0 CY	0 CY	2,500 CY
	Fill	2,500 CY	0 CY	0 CY	2,500 CY
	Over-Ex and Recompact	8,500 CY	0 CY	0 CY	11,000 CY
	Export	0 CY	0 CY	0 CY	0 CY
	Import	0 CY	0 CY	0 CY	0 CY
Land Disturbance	Permanent Land Disturbance	6.5 AC	4.5 AC	4 AC	2 AC
	Temporary Land Disturbance	1.5 AC	1.5 AC	1.5 AC	6.5 AC
	Total Land Disturbance	8 AC	6 AC	5.5 AC	8.5 AC

Appendix G - Civil Earth Work Quantities

Note: Estimated values are based on preliminary evaluations and are subject to change based on confirmed field conditions and final engineering. The presence of existing underground utilities would likely impact the technical and environmental challenges associated with each undergrounding alternative