Appendix F

Appendix F

FIELD MANAGEMENT PLAN

FOR

EL CASCO SYSTEM PROJECT

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FOR

EL CASCO SYSTEM PROJECT

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I. EXECUTIVE SUMMARY

This document is Southern California Edison Company's (SCE) Field Management Plan (FMP) for the Proposed El Casco System Project (Proposed Project). SCE proposes to construct, operate, and maintain a new El Casco 220/115/12 kilovolt (kV) Substation (Proposed Substation) with three 115 kV subtransmission lines[1] (Proposed Subtransmission Lines) and five 12 kV distribution lines to serve forecasted demand in Calimesa, Beaumont, and the surrounding areas of unincorporated northern Riverside County, and to maintain safe and reliable service to customers in this area. The Proposed Substation would be located within the Norton Younglove Reserve adjacent to San Timoteo Canyon Road. The Proposed Substation would be served by the existing Devers–San Bernardino No. 2 220 kV Transmission Line by forming a transmission line loop into the Proposed Substation. The Proposed Project also includes constructing limited improvements at SCE's existing Zanja and Banning substations to accommodate the Proposed Project.

The "no-cost and low-cost" magnetic field reduction measures that are incorporated into the design of the Proposed Project are:

- Using taller poles for the proposed 115 kV subtransmission lines;
- Using a "double-circuit" pole-head configuration for the double-circuit portion of the Proposed 115 kV Subtransmission Lines;
- Using a "triangular" type pole-head configuration for the single-circuit portion of the Proposed 115 kV Subtransmission Lines; and

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1 Two of them are SCE's existing 115 kV subtransmission lines, and the remaining one is the new Proposed Subtransmission Line.

- Phasing the Proposed 115 kV Subtransmission Line with respect to the adjacent existing subtransmission lines.
- Phasing the looped 220 kV transmission lines into the Proposed Substation.
- Placing major substation electric equipment (such as transformers, capacitor banks, switchracks, etc) away from the substation property lines.

SCE's plan for applying the above "no-cost" and "low-cost" magnetic field reduction measures uniformly and equitably for the entire Project Area is consistent with CPUC policy and with the direction of leading national and international health agencies. Furthermore, the plan complies with SCE's EMF Design Guidelines[2] as well as all applicable national and state safety standards for new electric facilities.

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[2] SCE filed the EMF Design Guidelines with the CPUC on July 26, 2006.

II. BACKGROUND REGARDING EMF AND PUBLIC HEALTH RESEARCH ON EMF

There are many sources of power frequency electric and magnetic fields, including internal household and building wiring, electrical appliances, and electric power transmission and distribution lines. There have been numerous scientific studies about the potential health effects of EMF. After many years of research, the scientific community has been unable to determine if exposures to EMF cause health hazards. State and federal public health regulatory agencies have determined that setting numeric exposure limits is not appropriate.[3]

Many of the questions about possible connections between EMF exposures and specific diseases have been successfully resolved due to an aggressive international research program. However, potentially important public health questions remain about whether there is a link between EMF exposures and certain diseases, including childhood leukemia and a variety of adult diseases (e.g., adult cancers and miscarriages). As a result, some health authorities have identified magnetic field exposures as a possible human carcinogen. As summarized in greater detail below, these conclusions are consistent with the following published reports: the National Institute of Environmental Health Sciences (NIEHS) 1999[4], the National Radiation Protection Board (NRPB) 2001[5], the International Commission on non-Ionizing Radiation Protection (ICNIRP) 2001, the

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3 CPUC Decision 06-01-042, p. 6, footnote 10

4 National Institute of Environmental Health Sciences' Report on Health Effects from Exposures to Power-Line frequency Electric and Magnetic Fields, NIH Publication No. 99-4493, June 1999.

5 National Radiological Protection Board, Electromagnetic Fields and the Risk of Cancer, Report of an Advisory Group on Non-ionizing Radiation, Chilton, U.K. 2001

California Department of Health Services (CDHS) 2002[6], and the International Agency for Research on Cancer (IARC) 2002[7].

The federal government conducted EMF research as a part of a $45-million research program managed by the NIEHS. This program, known as the EMF RAPID (Research and Public Information Dissemination), submitted its final report to the U.S. Congress on June 15, 1999. The report concluded that:

- "The scientific evidence suggesting that ELF-EMF exposures pose any health risk is weak."[8]
- "The NIEHS concludes that ELF-EMF exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard."[9]
- "The NIEHS suggests that the level and strength of evidence supporting ELF-EMF exposure as a human health hazard are insufficient to warrant aggressive regulatory actions; thus, we do not recommend actions such as stringent standards on electric appliances and a national program to bury all transmission and distribution lines. Instead, the evidence suggests passive measures such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. NIEHS suggests that the power industry continue its current practice of siting power lines to reduce exposures and continue to explore ways to reduce the creation of magnetic fields around transmission and distribution lines without creating new hazards."[10]

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6 California Department of Health Services, An Evaluation of the Possible Risks from Electric and Magnetic Fields from Power Lines, Internal Wiring, Electrical Occupations, and Appliances, June 2002.

7 World Health Organization / International Agency for Research on Cancer, IARC Monographs on the evaluation of carcinogenic risks to humans (2002), Non-ionizing radiation, Part 1: Static and extremely low-frequency (ELF) electric and magnetic fields, IARCPress, Lyon, France: International Agency for Research on Cancer, Monograph, vol. 80, p. 338, 20022

8 National Institute of Environmental Health Sciences, NIEHS Report on Health Effects from Exposures to Power-Frequency Electric and Magnetic Fields, NIH Publication No. 99-4493, 1999

9 *ibid.*, p. 10

10 *ibid.*, p. 37 - 39

In 2001, Britain's NRPB arrived at a similar conclusion:

"After a wide-ranging and thorough review of scientific research, an independent Advisory Group to the Board of NRPB has concluded that the power frequency electromagnetic fields that exist in the vast majority of homes are not a cause of cancer in general. However, some epidemiological studies do indicate a possible small risk of childhood leukemia associated with exposures to unusually high levels of power frequency magnetic fields."[11]

In 2002, three scientists for CDHS concluded:

> "To one degree or another, all three of the [C]DHS scientists are inclined to believe that EMFs can cause some degree of increased risk of childhood leukemia, adult brain cancer, Lou Gehrig's Disease, and miscarriage.
>
> They [CDHS] strongly believe that EMFs do not increase the risk of birth defects, or low birth weight.
>
> They [CDHS] strongly believe that EMFs are not universal carcinogens, since there are a number of cancer types that are not associated with EMF exposure.
>
> To one degree or another, they [CDHS] are inclined to believe that EMFs do not cause an increased risk of breast cancer, heart disease, Alzheimer's disease, depression, or symptoms attributed by some to sensitivity to EMFs. However, all three scientists had judgments that were "close to the dividing line between believing and not believing" that EMFs cause some degree of increased risk of suicide, or
>
> For adult leukemia, two of the scientists are 'close to the dividing line between believing or not believing' and one was 'prone to believe' that EMFs cause some degree of increased risk."[12]

Also in 2002, the World Health Organization's IARC concluded:

"ELF magnetic fields are possibly carcinogenic to humans"[13], based on consistent statistical associations of high-level residential magnetic fields with a doubling of risk of childhood leukemia... Children who are exposed to residential ELF

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[11] NRPB, <u>NRPB Advisory Group on Non-ionizing Radiation Power Frequency Electromagnetic Fields and the Risk of Cancer</u>, NRPB Press Release May 2001

[12] CDHS, <u>An Evaluation of the Possible Risks From Electric and Magnetic Fields (EMFs) From Power Lines, Internal Wiring, Electrical Occupations and Appliances,</u> p. 3, 2002

[13] IARC, <u>Monographs</u>, Part I, Vol. 80, p. 338

> magnetic fields less than 0.4 microTesla (4.0 milliGauss) have no increased risk for leukemia.... In contrast, no consistent evidence was found that childhood exposures to ELF electric or magnetic fields are associated with brain tumors or any other kinds of solid tumors. No consistent evidence was found that residential or occupational exposures of adults to ELF magnetic fields increase risk for any kind of cancer."[14]

III. APPLICATION OF THE CPUC'S NO-COST AND LOW-COST EMF POLICY TO THIS PROJECT

Recognizing the scientific uncertainty over the connection between EMF exposures and health effects, the CPUC adopted a policy that addresses public concern over EMF with a combination of education, information, and precaution-based approaches. Specifically, Decision 93-11-013 established a "no-cost and low-cost" EMF policy for California's regulated electric utilities based on recognition that scientific research had not demonstrated that exposures to EMF cause health hazards and that it was inappropriate to set numeric standards that would limit exposure.

In 2006, the CPUC completed its review and update of its EMF Policy in Decision 06-01-042. This decision reaffirmed the finding that state and federal public health regulatory agencies have not established a direct link between exposure to EMF and human health effects,[15] and the policy direction that (1) use of numeric exposure limits was not appropriate in setting utility design guidelines to address EMF,[16] and (2) existing no-cost and low-cost precautionary-based EMF policy should be continued for proposed electrical facilities. The decision also reaffirmed that EMF concerns brought up

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[14] *ibid.*, p. 332 - 334

[15] CPUC Decision 06-01-042, Conclusion of Law No. 5, mimeo. p. 19 ("As discussed in the rulemaking, a direct link between exposure to EMF and human health effects has yet to be proven despite numerous studies including a study ordered by this Commission and conducted by DHS.").

[16] CPUC Decision 06-01-042, mimeo. p. 17 - 18 ("Furthermore, we do not request that utilities include non-routine mitigation measures, or other mitigation measures that are based on numeric values of EMF exposure, in revised design guidelines or apply mitigation measures to reconfigurations or relocations of less than 2,000 feet, the distance under which exemptions apply under GO 131-D. Non-routine mitigation measures should only be considered under unique circumstances.").

during Certificate of Public Convenience and Necessity (CPCN) and Permit to Construct (PTC) proceedings for electric and transmission and substation facilities should be limited to the utility's compliance with the CPUC's low-cost/no-cost policies.[17]

The decision directed regulated utilities to hold a workshop to develop standard approaches for EMF Design Guidelines and such a workshop was held on February 21, 2006. Consistent guidelines have been developed that describe the routine magnetic field reduction measures that regulated California electric utilities consider for new and upgraded transmission line and transmission substation projects. SCE filed its revised EMF Design Guidelines with the CPUC on July 26, 2006.

No cost and low cost measures to reduce magnetic fields would be implemented for this project in accordance with SCE's EMF Design Guidelines. In summary, the process of evaluating no-cost and low-cost magnetic field reduction measures and prioritizing within and between land usage classes considers the following:

1. SCE's priority in the design of any electrical facility is public and employee safety. Without exception, design and construction of an electric power system must comply with all applicable federal, state, and local regulations, applicable safety codes, and each electric utility's construction standards. Furthermore, transmission and subtransmission lines and substations must be constructed so that they can operate reliably at their design capacity. Their design must be compatible with other facilities in the area and the cost to operate and maintain the facilities must be reasonable. These, and other requirements, are in existing CPUC regulations and SCE's construction standards.

[17] CPUC Decision 06-01-042, Conclusion of Law No. 2 ("EMF concerns in future CPCN and PTC proceedings for electric and transmission and substation facilities should be limited to the utility's compliance with the Commission's low-cost/no-cost policies.").

2. As a supplement to Step 1, SCE follows the CPUC's direction to undertake "no-cost and low-cost" magnetic field reduction measures for new and upgraded electrical facilities. Any proposed "no-cost and low-cost" magnetic field measures, must, however, meet the requirements described in Step 1 above. The CPUC defines no-cost and low-cost measures as follows:

- Low-cost measures, in aggregate, would:
  - Cost in the range of 4% of the total project cost.
  - For low cost mitigation, the "EMF reductions will be 15% or greater at the utility ROW [right-of-way]..."[18]

The CPUC Decision stated,

"We direct the utilities to use 4 percent as a benchmark in developing their EMF mitigation guidelines. We will not establish 4 percent as an absolute cap at this time because we do not want to arbitrarily eliminate a potential measure that might be available but costs more than the 4 percent figure. Conversely, the utilities are encouraged to use effective measures that cost less than 4 percent."[19]

3. The CPUC provided further policy direction in Decision 06-01-042, stating that, "[a]lthough equal mitigation for an entire class is a desirable goal, we will not limit the spending of EMF mitigation to zero on the basis that not all class members can benefit."[20] While Decision 06-01-042 directs the utilities to favor schools, day-care facilities and hospitals over residential areas when applying low-cost magnetic field reduction measures, prioritization within a class can be difficult on a project case-by-case basis because schools, day-care facilities, and hospitals are often integrated into residential areas, and many licensed day-care facilities are

[18] CPUC Decision 06-01-042, p. 10
[19] CPUC Decision 93-11-013, § 3.3.2, p.10.
[20] CPUC Decision 06-01-042, p. 10

housed in private homes, and can be easily moved from one location to another. Therefore, it may be practical for public schools, licensed day-care centers, hospitals, and residential land uses to be grouped together to receive highest prioritization for low-cost magnetic field reduction measures. Commercial and industrial areas may be grouped as a second priority group, followed by recreational and agricultural areas as the third group. Low-cost magnetic field reduction measures will not be considered for undeveloped land, such as open space, state and national parks, and Bureau of Land Management and U.S. Forest Service lands. When spending for low-cost measures would otherwise disallow equitable magnetic field reduction for all areas within a single land-use class, prioritization can be achieved by considering location and/or density of permanently occupied structures on lands adjacent to the projects, as appropriate.

This FMP contains descriptions of various magnetic field models and the calculated results of magnetic field levels based on those models. These calculated results are provided only for purposes of identifying the relative differences in magnetic field levels among various transmission or subtransmission line design alternatives under a specific set of modeling assumptions and determining whether particular design alternatives can achieve magnetic field level reductions of 15% or more. The calculated results are not intended to be predictors of the actual magnetic field levels at any given time or at any specific location if and when the project is constructed. This is because magnetic field levels depend upon a variety of variables, including load growth, customer electricity usage, and other factors beyond SCE's control. The CPUC affirmed this in D. 06-01-042 stating:

"Our [CPUC] review of the modeling methodology provided in the utility design guidelines indicates that it accomplishes its purpose, which is to measure the relative differences between alternative mitigation measures. Thus, the modeling indicates relative differences in magnetic field reductions between different transmission line construction methods, but does not measure actual environmental magnetic fields."[21]

IV. PROJECT DESCRIPTION

SCE proposes to construct, operate, and maintain the new El Casco 220/115/12 kilovolt (kV) Substation with three 115 kV subtransmission lines and five 12 kV distribution lines to serve forecasted demand in Calimesa, Beaumont, and the surrounding areas of unincorporated northern Riverside County and to maintain safe and reliable service to customers in this area. The Proposed Substation would be located within the Norton Younglove Reserve adjacent to San Timoteo Canyon Road. The Proposed Substation would be served by the existing Devers-San Bernardino No. 2 220 kV Transmission Line by forming a transmission line loop into the Proposed Substation. The Proposed Project also includes constructing limited improvements at existing SCE's Zanja and Banning substations to accommodate the Proposed Project. More specifically, the Proposed Project includes construction of the following:

- Construction of a new El Casco 220/115/12 kV Substation.
- Construction of a 220 kV interconnection from the existing Devers–San Bernardino No. 2 220 kV transmission line to the Proposed Substation; thus, forming "Devers–El Casco" and "El Casco–San Bernardino" 220 kV Transmission Lines.
- Replacement of existing single-circuit 115 kV subtransmission lines with new double-circuit 115 kV subtransmission lines within existing SCE rights-of-way (ROW). The existing "San Bernardino–Maraschino" 115 kV subtransmission line would be looped into the Proposed Substation,

[21] *ibid.*, p. 11

therefore, forming "El Casco-San Bernardino" and "Maraschino-El Casco" 115 kV subtransmission lines. The "Banning–El Casco" 115 kV subtransmission line is a new proposed line connecting the Proposed Substation to the existing Banning Substation. This subtransmission line would be placed on the same poles with the "Maraschino–El Casco" and "Banning-Maraschino" 115 kV subtransmission lines.

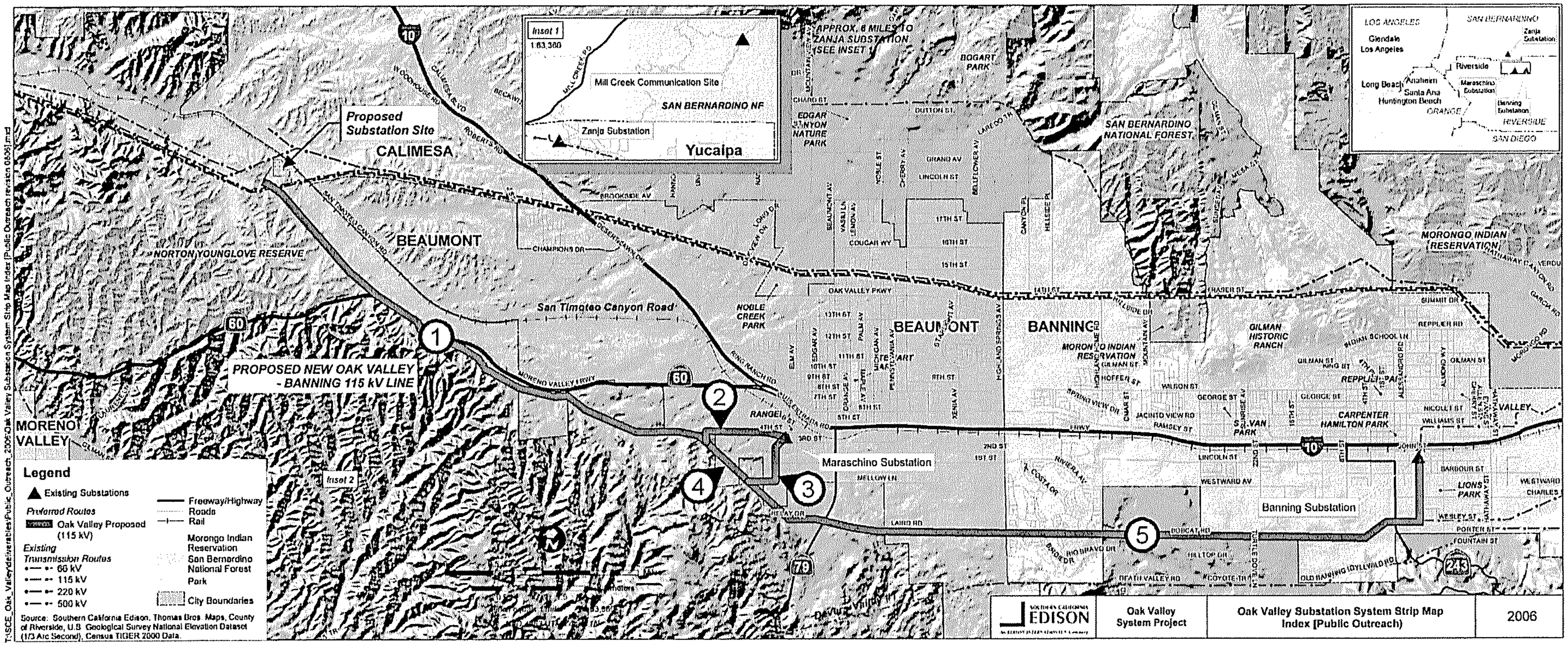
The total cost of this project is approximately $92 million. Four percent of the Proposed Project cost is $3.7 million. SCE engineers added magnetic field reduction measures early in the design phase for this project. The total project cost, therefore, already includes "low-cost" magnetic field reduction measures in the proposed designs.

For the purpose of evaluating no-cost and low-cost magnetic field reduction measures, the Proposed Subtransmission Line route[22] is divided into five line segments as shown on Figure 1. These five line segments, in terms of nearest crossing streets, are described as follows:

- **Line Segment 1**: From the Proposed Substation to 4th Avenue and existing ROW.
- **Line Segment 2**: From 4th Avenue and existing ROW to the existing Maraschino Substation along 4th Ave.
- **Line Segment 3**: From the existing Maraschino Substation to Westward Ave & David Mountain Road along Vielle Ave and then Westward Ave.
- **Line Segment 4**: This segment connects Line Segments 1 and 2.
- **Line Segment 5**: From Westward Ave and David Mountain Road to the existing Banning Substation

[22] The Proposed Subtransmission Line routes follow the existing 115 kV subtransmission line routes.

Figure 1. Proposed Subtransmission Line Routes in Five Segments and Proposed Substation Site



Currently, there are no schools along the Proposed Subtransmission Line route located within the California Department of Education's EMF setback requirements[23], as shown on Figure 1 above.

V. EVALUATION OF NO-COST AND LOW-COST MAGNETIC FIELD REDUCTION MEASURES FOR PROPOSED SUBTRANSMISSION LINES

The following magnetic field reduction methods are applicable for overhead 115 kV subtransmission line designs:

1. Selecting taller poles;
2. Selecting pole-head configurations with less phase-to-phase distance or circuit-to-circuit distance;
3. Phasing proposed 115 kV subtransmission lines with respect to the adjacent subtransmission line(s).

After ten years of evaluating and implementing no-cost and low-cost magnetic field reduction measures for subtransmission line designs, SCE established "preferred" overhead 66 kV and 115 kV subtransmission line designs in 2004. These "preferred" designs incorporate the most effective "no-cost and low-cost" magnetic field reduction measures (such as pole-head configurations and taller poles).

[23] Power Line Setback Exemption Guidance - May 2006, California Department of Education.

For overhead 115 kV subtransmission lines, SCE's "preferred" designs are as follows:

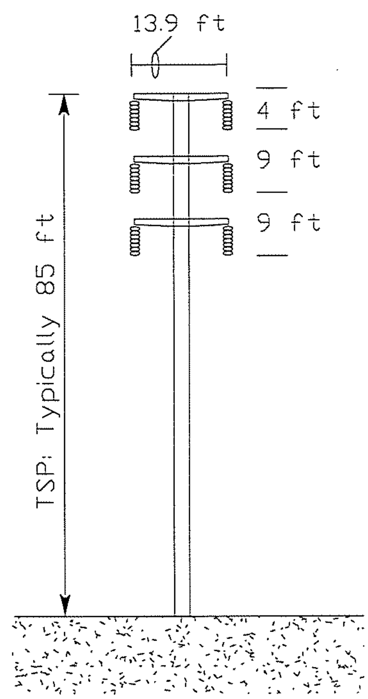
Table 1. Preferred Overhead 115 kV Subtransmission Line Designs with Most Effective Magnetic Field Reduction Options Incorporated

	115 kV Overhead Construction	
	Single Circuit Design	**Double Circuit Design**
Base Pole Height[24]	70 feet	75 feet
Base Pole-head Configuration	"Triangular" Type	"Double-Circuit" Type
Minimum Clearance	35 feet	35 feet

The proposed double-circuit overhead 115 kV subtransmission line design ("Proposed Double-Circuit Design") with no-cost and low-cost magnetic field reduction measures added (i.e. using taller poles and selecting "double-circuit" pole-head configuration) is shown on Figure 2 and Figure 3. These designs meet or exceed the "preferred" double-circuit design as listed on Table 1.

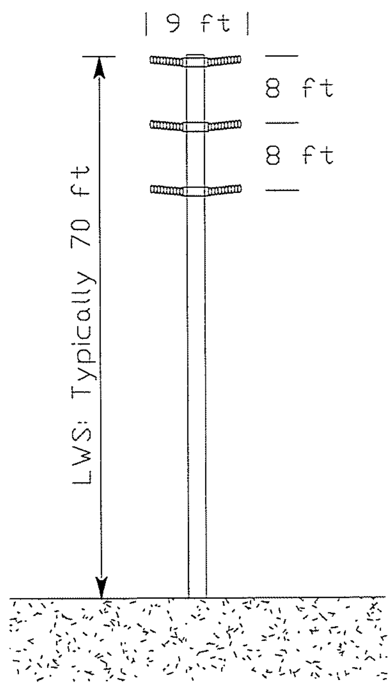
[24] The base pole height includes the buried portion of the pole (typically 9 to 10 feet below the ground). Exceptions to the "preferred design" are recommended by the primary designer based on engineering and safety requirements. For example, if the proposed line needs to cross underneath existing power lines, the pole height and pole-head configuration may be changed from the preferred design."

Figure 2. Proposed Tubular Steel Pole (TSP) Double-Circuit 115 kV Design



The "Proposed TSP Double-Circuit 115 kV Design," as shown on Figure 2 would be the typical design for Line Segment 1. The "Proposed LWS Pole Double-Circuit 115 kV Design," as shown on Figure 3 would be the typical design for Line Segment 5.

Figure 3. Proposed Light Weight Steel (LWS) Pole Double-Circuit 115 kV Design



In addition to the Proposed Double-Circuit Design for Line Segments 1 and 5, existing 115 kV single-circuit poles (or structures) in Line Segments 3, 2[25], and 4 would be rebuilt with the proposed single-circuit overhead 115 kV subtransmission line design (hereinafter "Proposed Single-Circuit Design") as shown on Figure 4. The Proposed Single-Circuit Design has added no-cost and low-cost magnetic reduction measures as well (i.e. using taller poles and selecting "triangular" pole-head configuration). Therefore, this design also meets or exceeds the "preferred" single-circuit 115 kV design as listed on Table 1. The Proposed Single-Circuit Design would be mainly LWS poles.

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[25] For Line Segment 3 only, approximately 0.5 miles of existing poles would be rebuilt with the Proposed Single Circuit Design while other existing wood poles would be remained.

Figure 4. Proposed LWS Pole Single-Circuit 115 kV Design

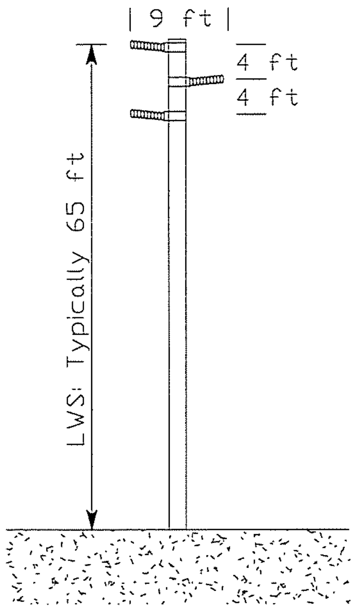
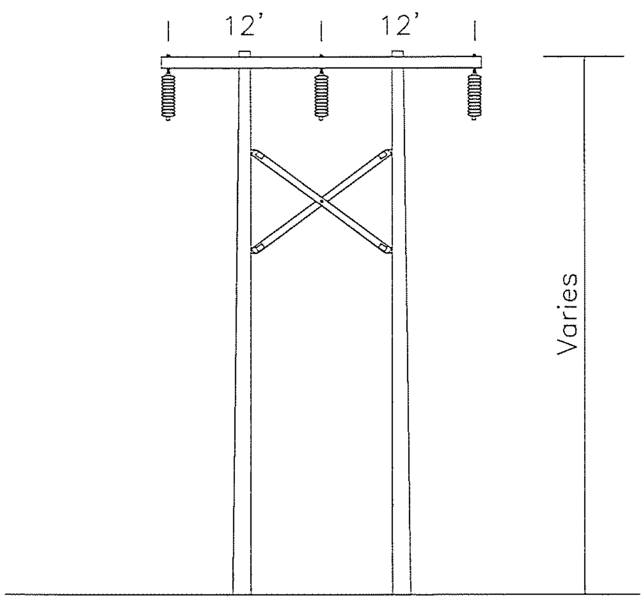


Figure 5. Existing 115 kV "H-Frame" Structure[26]



[26] Typical existing H-Frame height is about 60 to 70 ft. For the purpose of this FMP only, a 70 ft height (9 ft below the ground) is used for magnetic field models.

The typical existing overhead 115 kV structure is a "H-Frame" for Line Segments 1, 4, and 5, and it is shown on Figure 5 above. For Line Segments 2 and 3, the typical existing wood pole is shown on Figure 6 below. As an illustration of comparing designs, both Proposed Single-Circuit and Double-Circuit Designs are better designs then existing designs in the context of producing lower magnetic fields.

Figure 6. Existing 115 kV Single Circuit Wood Pole

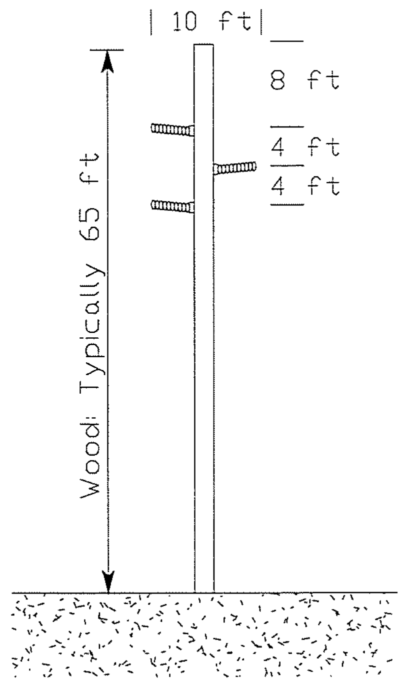
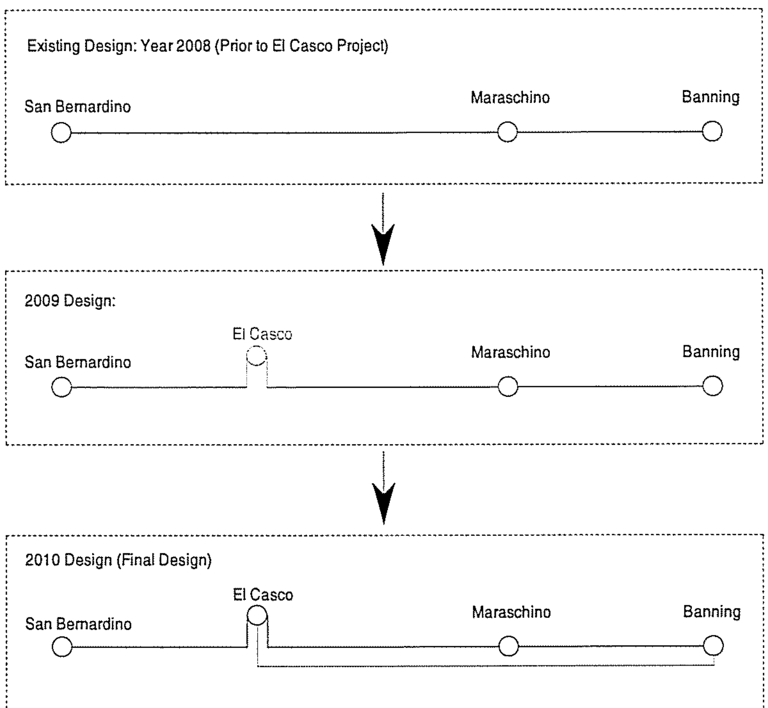


Figure 7 shows the various construction stages of the Proposed Project. The "Existing Design" shows the existing system prior to the Proposed Project. The "2009 Design" reflects a portion of the Proposed Substation being energized, and the existing "San Bernardino – Maraschino" 115 kV Subtransmission Line being looped in to the Proposed Substation; thus forming the "El Casco-San Bernardino" and "Maraschino-El Casco" 115 kV Subtransmission Lines. Except for the looped portion of the 115 kV subtransmission lines into the Proposed Substation, the existing 115 kV structures or poles would be unchanged until the final phase of the Proposed Project. The construction of the Proposed Single-Circuit Design and Double-Circuit Design would start in the year 2009 and would be completed in the year 2010. Therefore, the "2010 Design" (i.e. the completion of the Proposed Project) reflects having both Proposed Single-Circuit and Double-Circuit Designs completed along the Proposed Subtransmission Line routes.

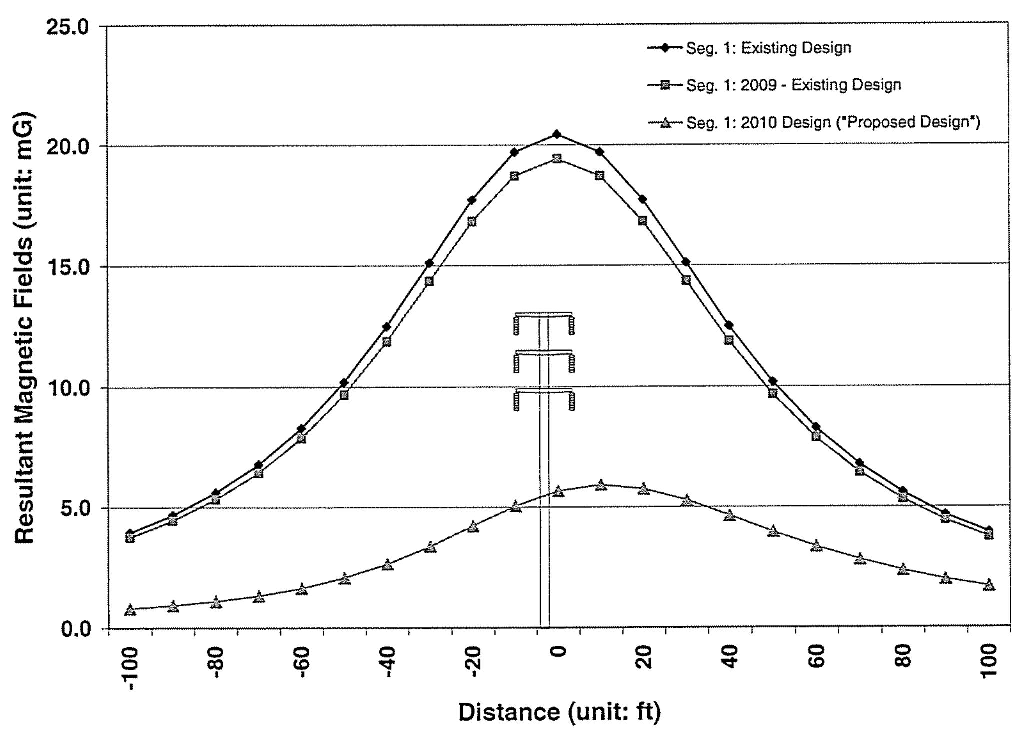
Figure 7. Construction States showing the "Existing Design," "2009 Design," and "2010 Design (Final Design)"



Appendix B contains two-dimensional (2D) magnetic field models for the Proposed Project. The magnetic field models are based upon various forecasted peak loading conditions (See Appendix B for more detailed information about the calculation assumptions and loading conditions).

In addition to magnetic field reduction from using taller poles and the double-circuit pole-head configuration, the Proposed Double-Circuit Design can reduce magnetic field levels further by considering phase arrangement options relative to the adjacent existing subtransmission lines. For Line Segment 1, the Proposed Subtransmission Line (Banning–El Casco 115 kV) would parallel the existing "San Bernardino-Maraschino 115 kV"[27] subtransmission line. Thus, the proposed 115 kV subtransmission line can be phased, with respect to the existing 115 kV subtransmission line, to reduce the magnetic field levels. Figure 8 shows a comparison of magnetic field levels between the existing design (i.e. typical existing H-frame design) versus the Proposed Double-Circuit Design (including the phasing option along the Line Segment 1).

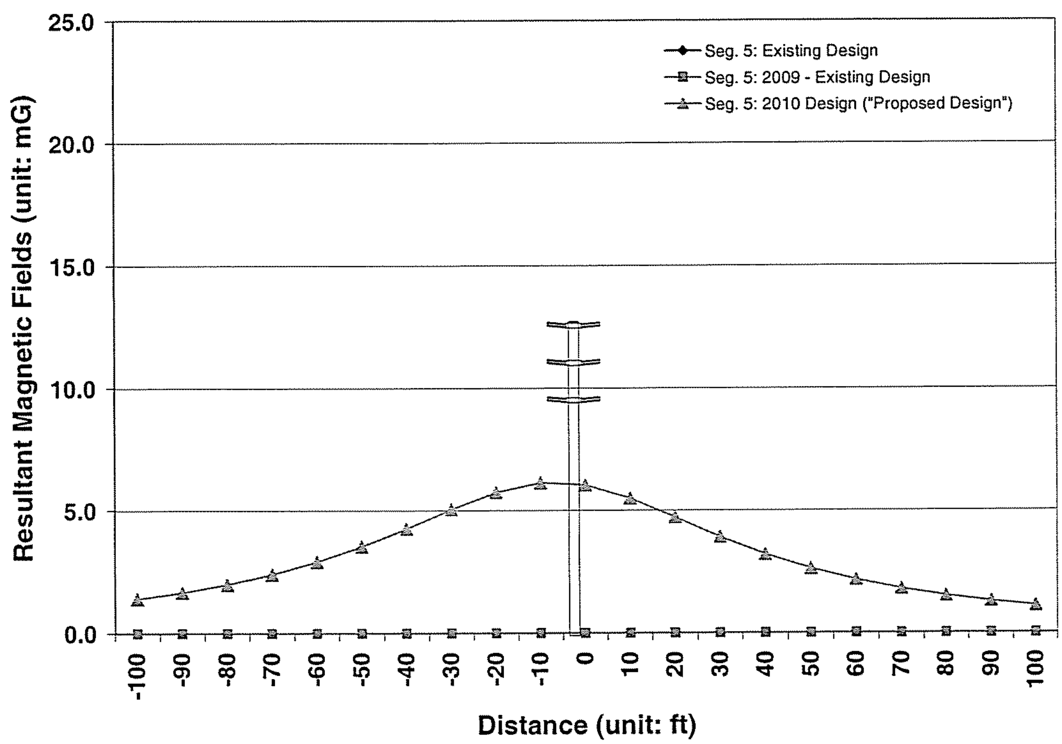
Figure 8. Magnetic Fields for Line Segment 1



[27] As a result of this project, this existing line will be looped into the Proposed Substation, therefore, the existing subtransmission line will form two subtransmission lines (i.e. "El Casco–San Bernardino" and "El Casco–Maraschino" 115 kV subtransmission lines)

As Figure 8 illustrates, the Proposed Double-Circuit Design (with optimal phasing measures added) would produce lower magnetic fields as compared to the existing design. There are no significant design changes from the "Existing" Design to the "2009 Design" as there would be no pole or structure changes made and no significant changes in forecasted loading conditions.

Figure 9. Magnetic Fields for Line Segment 5



For Line Segment 5, the Proposed Subtransmission Line would be placed on the same poles with the existing Banning-Maraschino 115 kV subtransmission line. Thus, the Proposed 115 kV Subtransmission Line can be phased to further reduce magnetic field levels as well. Figure 9 above shows the Proposed 115 kV Subtransmission Line with the existing 115 kV subtransmission line on the Proposed Double-Circuit Design with the additional phasing option added.

The existing Banning–Maraschino 115 kV transmission line would remain as a normally open circuit until the year 2010, and would therefore carry no load until that year. Thus, magnetic field levels for this segment of the existing 115 kV subtransmission line would be zero until the completion of the Proposed Project. Figure 9, therefore, illustrates these conditions (i.e. zero magnetic field level until the Proposed Subtransmission Line and the existing substation become operational in year 2010).

The Proposed Single-Circuit and Double-Circuit Designs meet or exceed the "preferred" double-circuit design as listed on Table 1. Furthermore, this Proposed Design (with optimal phasing measures added for Line Segment 1 and 5) can be uniformly and equitably applied to the entire Proposed Subtransmission Line routes (i.e. no-cost and low-cost magnetic field reduction measures can be applied to the entire Proposed Subtransmission Line routes); therefore, the Proposed Single-Circuit and Double-Circuit Design incorporate no-cost and low-cost magnetic field reduction measures as specified in SCE's EMF Design Guidelines.

Table 2 on page 26 summarizes "no-cost and low-cost" magnetic field reduction measures considered for the proposed line routes.

Table 2. No-Cost and Low-Cost Magnetic Field Reduction Measures Along the Proposed Line Route in Three Segments

Line Segment No.	Location	Adjacent Land Use[28]	MF Reduction Measures Considered	Estimated Cost to Adopt	Measure(s) Adopted? (Yes/No)	Reason(s) if not adopted
1	From the Proposed Substation to 4th Avenue & existing ROW.	2, 6 (See Note 1)	• Taller poles • Pole-head configuration • Phase 115 kV Circuits	• Low-Cost • No-Cost • No-Cost	• Yes • Yes • Yes	
2	From 4th Avenue & existing ROW to the existing Maraschino Substation along the 4th Ave.	3	• Taller poles • Pole-head configuration	• Low-Cost • No-Cost	• Yes • Yes	
3	From the existing Maraschino Substation to Westward Ave & David Mountain Road along Viele Ave and then Westward Ave.	2, 3	• Taller poles • Pole-head configuration	• Low-Cost • No-Cost	• Yes • Yes	
4	This segment connects Line Segments 1 and 5	2, 5, 6	• Taller poles • Pole-head configuration	• Low-Cost • No-Cost	• Yes • Yes	
5	From Westward Ave & David Mountain Road to the existing Banning Substation	2, 3, 5, 6 (See Note 2)	• Taller poles, • Pole-head configuration • Phase 115 kV Circuits	• Low-Cost • No-Cost • No-Cost	• Yes • Yes • Yes	
Substation Area	Near El Casco Substation Areas	6 (See Note 3)	See Table 3 on page 28 for no-cost and low-cost magnetic field reduction checklist for the Proposed Substation.			

Note:

1. SCE's existing ROW is adjacent to few scattered homes in this segment.
2. There are established residential communities (such as "Sun Lakes") and homes under development (such as "Four Seasons") in this segment. There are scattered homes and agricultural areas in this segment as well. Banning High School is located adjacent to the Segment 5; however, it meets the California Department of Education's 100-foot setback requirement from overhead 115 kV subtransmission lines.
3. The Proposed Substation is located within the state park area. Thus, only no-cost option of phasing 220 kV transmission and 115 kV subtransmission lines entering and exiting the Proposed Substation would be considered. See Section VI for recommended phasing arrangements.

28 Land usage codes are as follows: 1) schools, licensed day-cares, and hospitals, 2) residential, 3) commercial/industrial, 4) recreational, 5) agricultural, and 6) undeveloped land.

This document includes only no-cost and low-cost magnetic field reduction measures for the proposed line route. The Proponent's Environmental Assessment (PEA) contains various project alternatives, including an alternative line route. The proposed 115 kV overhead subtransmission line designs can be applied to the alternative line route. If the alternative route is chosen for this project, a supplemental FMP would be prepared with a detailed engineering design.

VI. EVALUATION OF NO-COST AND LOW-COST MAGNETIC FIELD REDUCTION MEASURES FOR PROPOSED SUBSTATION

Generally, magnetic field values along the substation perimeter are low compared to the substation interior because of the distance from the perimeter to the energized equipment. Normally, the highest magnetic field values around the perimeter of a substation result from overhead power lines and underground duct banks entering and leaving the substation, and are not caused by substation equipment. Therefore, the magnetic field reduction measures generally applicable to a substation project are as follows:

- Site selection for a new substation;
- Setback of substation structures and major substation equipment (such as bus, transformers, and underground cable duct banks, etc.) from perimeter;
- Lines entering and exiting the substation.

The Substation Checklist, as shown on Table 3, is used for evaluating the no-cost and low-cost measures considered for the substation project, the measures adopted, and reasons that certain measures were not adopted.

Table 3. Substation Checklist for Examining No-Cost and Low-Cost Magnetic Field Reduction Measures			
No.	**No-Cost and Low-Cost Magnetic Field Reduction Measures Evaluated for a Substation Project**	**Measures Adopted? (Yes/No)**	**Reason(s) if not Adopted**
1	Are transformers and air-core reactors > "X" feet from the substation property line? "X" = 15 ft for 115 kV rated = 50 ft for 220 kV rated	Yes	
2	Are switch-racks, capacitor banks & bus > "Y" feet from substation property line? "Y" = 8 ft for 115 kV rated = 40 ft for 220 kV rated	Yes	
3	Are distribution underground cable duct banks greater than 12 feet from side of the substation property line?	Yes	

The Proposed Substation is located within the state park area; which is undeveloped land. The CPUC Decision 06-01-042 stated that "Low-cost EMF mitigation is not necessary in agricultural and undeveloped land except for permanently occupied residences, schools or hospitals located on these lands."[29] Accordingly, SCE would consider selecting phasing arrangements for 220 kV transmission and 115 kV subtransmission lines entering and leaving the Proposed Substation in the following order of priority; 1) Line Segment 1 and Line Segment 5, and 2) the vicinity of the Proposed Substation.

The following recommended phasing arrangements[30] would benefit Line Segments 1 and 5 as well as the vicinity of the Proposed Substation:.

- Devers–El Casco and El Casco–San Bernardino 220 kV Transmission Lines: C-A-B and C-A-B (or equivalent): top-to-bottom at the getaway structure(s).

[29] CPUC Decision 06-01-042, p. 20.
[30] Equivalent phasing arrangements can be applied during the construction.

- Banning–El Casco and Maraschino–El Casco 115 kV Subtransmission Lines: C-B-A and A-B-C (or equivalent): top-to-bottom at the getaway pole(s).

The Proposed Substation Plot Pan is shown in Appendix C. This document includes only no-cost and low-cost magnetic field reduction measures for SCE's Proposed Substation site. SCE's Proponent's Environmental Assessment (PEA) contains various project alternatives, including various alternative substation sites. This FMP has been prepared based on SCE's Proposed Substation site. If an alternative substation site is chosen for this project, a supplemental FMP will be prepared, along with more detailed engineering design(s).

VII. FINAL RECOMMENDATIONS FOR IMPLEMENTING NO-COST AND LOW-COST MAGNETIC FIELD REDUCTION MEASURES

In accordance with SCE's EMF Design Guidelines, filed with the CPUC in compliance with CPUC Decisions 93-11-013 and 06-01-042, SCE would implement the following no-cost and low-cost magnetic field reduction measures for this project. These recommended magnetic field reduction measures would be uniformly and equitably applied to the entire project:

For Line Segments 1 and 5:

- Use taller poles (typically 85 feet above the ground for Line Segment 1 and 70 feet above the ground for Line Segment 5);
- Use a double-circuit pole-head configuration as shown on Figure 2 and Figure 3; and
- Phase the proposed 115 kV subtransmission line with respect to the existing 115 kV subtransmission lines:

- o Banning–El Casco and Maraschino–El Casco 115 kV: C-B-A and A-B-C (or equivalent): top-to-bottom
- o Banning–El Casco and Banning-Maraschino 115 kV: C-B-A and A-B-C (or equivalent): top-to-bottom

For Line Segment 2, 3, and 4:

- Use taller poles (typically 65 feet above the ground); and
- Use a "triangular" type pole-head configuration as shown on Figure 4.

For the Proposed Substation:

- Place major substation electric equipment (such as transformers, capacitor banks, switchracks, etc.) away from the substation property lines, as shown on Table 3 on page 28.
- Phase Devers–El Casco and El Casco–San Bernardino 220 kV Transmission Lines optimally: C-A-B and C-A-B (or equivalent): top-to bottom at the getaway structure(s).

SCE's plan for applying the above "no-cost" and "low-cost" magnetic field reduction measures uniformly and equitably for the entire Project Area is consistent with CPUC policy and with the direction of leading national and international health agencies. Furthermore, the plan complies with SCE's EMF Design Guidelines as well as all applicable national and state safety standards for new electric facilities.

APPENDIX A: TWO-DIMENTIONAL MODEL ASSUMPTIONS AND YEAR 2009 FORECASTED LOADING CONDITIONS

Magnetic Field Assumptions:

SCE's "Fields"[31] software program is used to model the magnetic field characteristics of the various subtransmission line designs and magnetic field reduction measures considered. Two-dimensional magnetic field modeling assumptions typically include:

- All subtransmission lines would be considered operating at forecasted loads (see Table 4 below) and all conductors are straight and infinitely long;
- Six feet of sagging for all 115 kV overhead subtransmission line designs;
- All structures or poles are located next to each other;
- Magnetic field strength is calculated at a height of three feet above ground (assuming flat terrain);
- Resultant magnetic fields are being used;
- All line loadings are balanced (i.e. neutral or ground currents are not considered);
- Terrain is flat; and
- Dominant power flow directions are being used.

31 Kim, C., Fields for Excel Version 1.0, 2005.

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Table 4. Forecasted Peak Loading Conditions For the Proposed Subtransmission Lines Along Segment 1 and 2:			
Circuit Name	**Year 2008**	**Year 2009**	**Year 2010**
San Bernardino – Maraschino 115 kV	349 Amp	N/A	N/A
Maraschino – El Casco 115 kV	N/A	331 Amp	405 Amp
Banning – El Casco 115 kV	N/A	N/A	244 Amp
Banning – Maraschino 115 kV	0 Amp	0 Amp	67 Amp

Note:

1. For 115 kV subtransmission lines, the power is flowing from El Casco Substation to Maraschino Substation and to Banning Substation.
2. Forecasted peak loading data is based upon scenarios representing load forecasts for the year 2008, 2009, and 2010. The forecasting data is subject to change depending upon availability of generation, load increases, changes in load demand, and by many other factors.

APPENDIX B: MAGNETIC FIELD MODELS

A. Magnetic field model for the proposed double–circuit for Line Segment 1[32]

Input Data

Seg. 1: Existing Design	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
San Bernardino – Maraschino 115 kV	-12	50	349	30
San Bernardino – Maraschino 115 kV	0	50	349	150
San Bernardino – Maraschino 115 kV	12	50	349	270

Seg. 1: 2009 - Existing Design	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
El Casco – Maraschino 115 kV	-12	50	331	30
El Casco – Maraschino 115 kV	0	50	331	150
El Casco – Maraschino 115 kV	12	50	331	270

Seg. 1: 2010 Design ("Proposed Design")	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
El Casco – Banning 115 kV	-6.9	75	244	270
El Casco – Banning 115 kV	-6.9	66	244	150
El Casco – Banning 115 kV	-6.9	57	244	30
El Casco – Maraschino 115 kV	6.9	75	405	30
El Casco – Maraschino 115 kV	6.9	66	405	150
El Casco – Maraschino 115 kV	6.9	57	405	270

Output Table

Distance (ft)	Seg. 1: Existing Design (mG)	Seg. 1: 2009 - Existing Design (mG)	Seg. 1: 2010 Design ("Proposed Design") (mG)
-100	3.9	3.7	0.8
-90	4.7	4.4	0.9

32 See Figure 1 for Line Segment Identifications.

Distance (ft)	Seg. 1: Existing Design (mG)	Seg. 1: 2009 - Existing Design (mG)	Seg. 1: 2010 Design ("Proposed Design") (mG)
-80	5.6	5.3	1.1
-70	6.8	6.4	1.3
-60	8.3	7.9	1.6
-50	10.2	9.7	2.1
-40	12.5	11.9	2.6
-30	15.1	14.4	3.4
-20	17.7	16.8	4.2
-10	19.7	18.7	5.0
0	20.4	19.4	5.7
10	19.7	18.7	5.9
20	17.7	16.8	5.7
30	15.1	14.4	5.3
40	12.5	11.9	4.6
50	10.2	9.7	4.0
60	8.3	7.9	3.3
70	6.8	6.4	2.8
80	5.6	5.3	2.4
90	4.7	4.4	2.0
100	3.9	3.7	1.7

Note: See Figure 8 on page 23 for the magnetic field graph for Segment 1.

B. Appendix B: Magnetic field model for the proposed single-circuit overhead 115 kV subtransmission line design for Line Segment 2

Input Data

Seg. 2: Existing Design	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
San Bernardino – Maraschino 115 kV	-5.0	51.5	349	30
San Bernardino – Maraschino 115 kV	5.0	47.5	349	150
San Bernardino – Maraschino 115 kV	-5.0	43.5	349	270

Seg. 2: 2009 - Existing Design	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
El Casco - Maraschino 115 kV	-5.0	51.5	331	30
El Casco - Maraschino 115 kV	5.0	47.5	331	150
El Casco - Maraschino 115 kV	-5.0	43.5	331	270

Seg. 2: 2010 Design ("Proposed Design")	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
El Casco - Maraschino 115 kV	-4.5	59	405	30
El Casco - Maraschino 115 kV	4.5	55	405	150
El Casco - Maraschino 115 kV	-4.5	51	405	270

Output Table

Distance (ft)	Seg. 2: Existing Design (mG)	Seg. 2: 2009 - Existing Design (mG)	Seg. 2: 2010 Design ("Proposed Design") (mG)
-100	2.4	2.3	2.4
-90	2.8	2.7	2.8
-80	3.4	3.2	3.4
-70	4.2	3.9	4.1
-60	5.1	4.9	4.9
-50	6.4	6.1	5.9

Distance (ft)	Seg. 2: Existing Design (mG)	Seg. 2: 2009 - Existing Design (mG)	Seg. 2: 2010 Design ("Proposed Design") (mG)
-40	8.0	7.6	7.2
-30	9.9	9.4	8.6
-20	11.9	11.3	9.9
-10	13.5	12.9	10.9
0	14.0	13.3	11.2
10	13.2	12.6	10.7
20	11.5	10.9	9.6
30	9.5	9.0	8.2
40	7.6	7.2	6.9
50	6.1	5.8	5.7
60	4.9	4.6	4.7
70	4.0	3.8	3.9
80	3.3	3.1	3.3
90	2.7	2.6	2.7
100	2.3	2.2	2.3

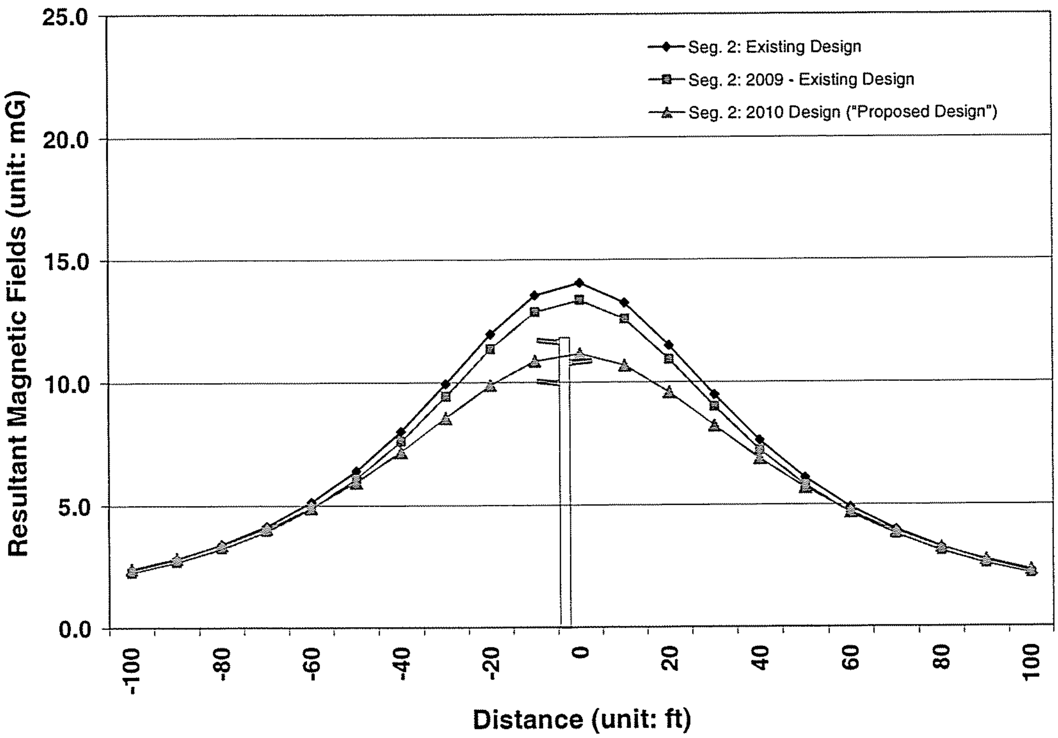


Figure 10. Magnetic Fields for Line Segment 2

C. Appendix B: Magnetic field model for the proposed single-circuit overhead 115 kV subtransmission line design for Line Segment 3

Input Table

Seg. 3: Existing Design	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
Maraschino - Banning 115 kV	-5.0	51.5	0	150
Maraschino - Banning 115 kV	5.0	47.5	0	30
Maraschino - Banning 115 kV	-5.0	43.5	0	270

Seg. 3: 2009 Existing Design	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
Maraschino - Banning 115 kV	-5.0	51.5	0	150
Maraschino - Banning 115 kV	5.0	47.5	0	30
Maraschino - Banning 115 kV	-5.0	43.5	0	270

Seg. 3: 2010 Design ("Proposed Design")	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
Maraschino - Banning 115 kV	-4.5	59	67	30
Maraschino - Banning 115 kV	4.5	55	67	150
Maraschino - Banning 115 kV	-4.5	51	67	270

Output Table

Distance (ft)	Seg. 3: Existing Design (mG)	Seg. 3: 2009 Existing Design (mG)	Seg. 3: 2010 Design ("Proposed Design") (mG)
-100	0.0	0.0	0.4
-90	0.0	0.0	0.5
-80	0.0	0.0	0.6
-70	0.0	0.0	0.7
-60	0.0	0.0	0.8
-50	0.0	0.0	1.0
-40	0.0	0.0	1.2
-30	0.0	0.0	1.4
-20	0.0	0.0	1.6
-10	0.0	0.0	1.8
0	0.0	0.0	1.9

Distance (ft)	Seg. 3: Existing Design (mG)	Seg. 3: 2009 Existing Design (mG)	Seg. 3: 2010 Design ("Proposed Design") (mG)
10	0.0	0.0	1.8
20	0.0	0.0	1.6
30	0.0	0.0	1.4
40	0.0	0.0	1.1
50	0.0	0.0	0.9
60	0.0	0.0	0.8
70	0.0	0.0	0.6
80	0.0	0.0	0.5
90	0.0	0.0	0.5
100	0.0	0.0	0.4

Magnetic Fields Graph

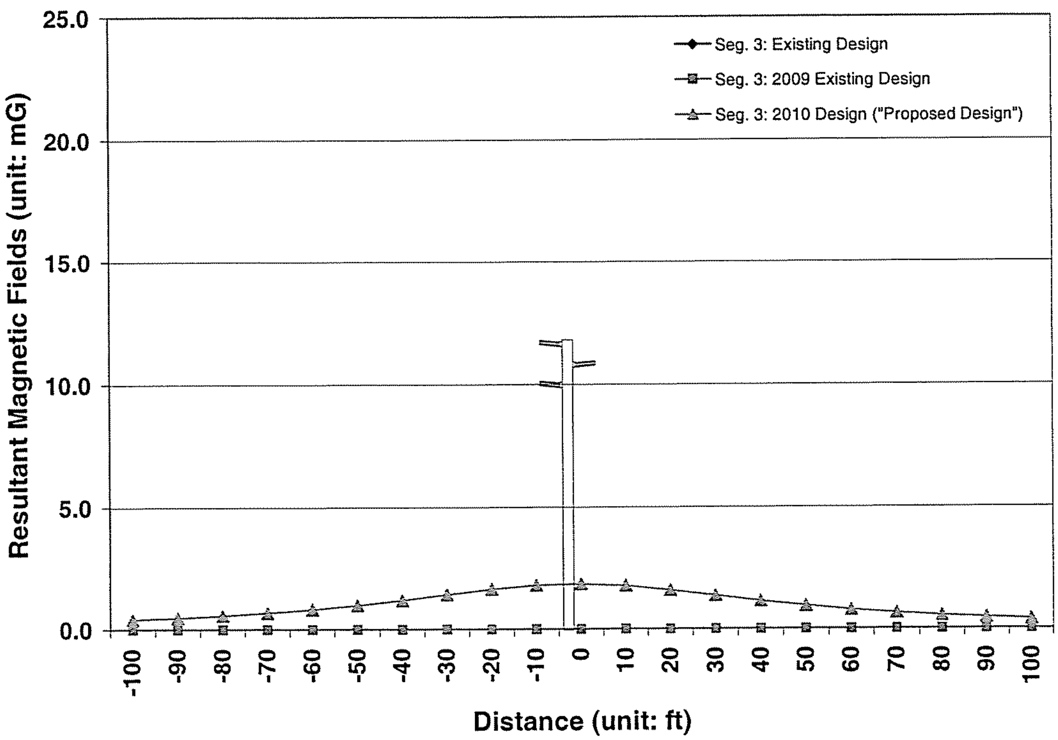


Figure 11. Magnetic Fields for Line Segment 3

D. Appendix B: Magnetic field model for the proposed single-circuit overhead 115 kV subtransmission line design for Line Segment 4

Input Table

Seg. 4: Existing Design	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
Idle	-12.0	50	0	30
Idle	0.0	50	0	150
Idle	12.0	50	0	270

Seg. 4: 2009 - Existing Design	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
Idle	-12.0	50	0	30
Idle	0.0	50	0	150
Idle	12.0	50	0	270

Seg. 4: 2010 Design ("Proposed Design")	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
El Casco - Banning 115 kV	-4.5	59.0	244	270
El Casco - Banning 115 kV	4.5	55.0	244	150
El Casco - Banning 115 kV	-4.5	51.0	244	30

Output Table

Distance (ft)	Seg. 4: Existing Design (mG)	Seg. 4: 2009 - Existing Design (mG)	Seg. 4: 2010 Design ("Proposed Design") (mG)
-100	0.0	0.0	1.5
-90	0.0	0.0	1.7
-80	0.0	0.0	2.0
-70	0.0	0.0	2.4
-60	0.0	0.0	2.9
-50	0.0	0.0	3.6
-40	0.0	0.0	4.3
-30	0.0	0.0	5.1
-20	0.0	0.0	5.9
-10	0.0	0.0	6.5
0	0.0	0.0	6.7

Distance (ft)	Seg. 4: Existing Design (mG)	Seg. 4: 2009 - Existing Design (mG)	Seg. 4: 2010 Design ("Proposed Design") (mG)
10	0.0	0.0	6.4
20	0.0	0.0	5.8
30	0.0	0.0	5.0
40	0.0	0.0	4.1
50	0.0	0.0	3.4
60	0.0	0.0	2.8
70	0.0	0.0	2.3
80	0.0	0.0	2.0
90	0.0	0.0	1.7
100	0.0	0.0	1.4

Magnetic Fields Graph

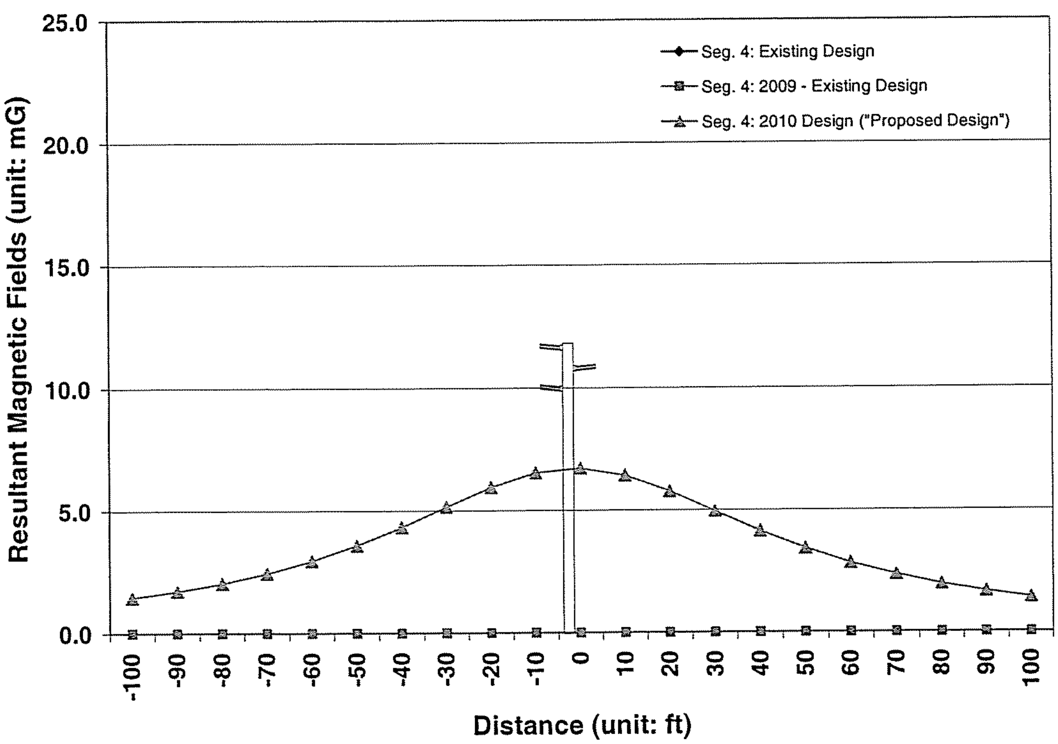


Figure 12. Magnetic Fields for Line Segment 4

E. Appendix B: Magnetic field model for the proposed double-circuit overhead 115 kV subtransmission line design for Line Segment 5

Input Table

Seg. 5: Existing Design	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
Maraschino - Banning 115 kV	-12.0	50	0	30
Maraschino - Banning 115 kV	0.0	50	0	150
Maraschino - Banning 115 kV	12.0	50	0	270

Seg. 5: 2009 - Existing Design	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
Maraschino - Banning 115 kV	-12.0	50	0	30
Maraschino - Banning 115 kV	0.0	50	0	150
Maraschino - Banning 115 kV	12.0	50	0	270

Seg. 5: 2010 Design ("Proposed Design")	Phase Coordinates		Phase	Phase
Phase Name	X (ft)	Y (ft)	Current (Amp)	Angle (Degree)
El Casco - Banning 115 kV	-4.5	64	244	270
El Casco - Banning 115 kV	-4.5	56	244	150
El Casco - Banning 115 kV	-4.5	48	244	30
Maraschino - Banning 115 kV	4.5	64	67	30
Maraschino - Banning 115 kV	4.5	56	67	150
Maraschino - Banning 115 kV	4.5	48	67	270

Output Table

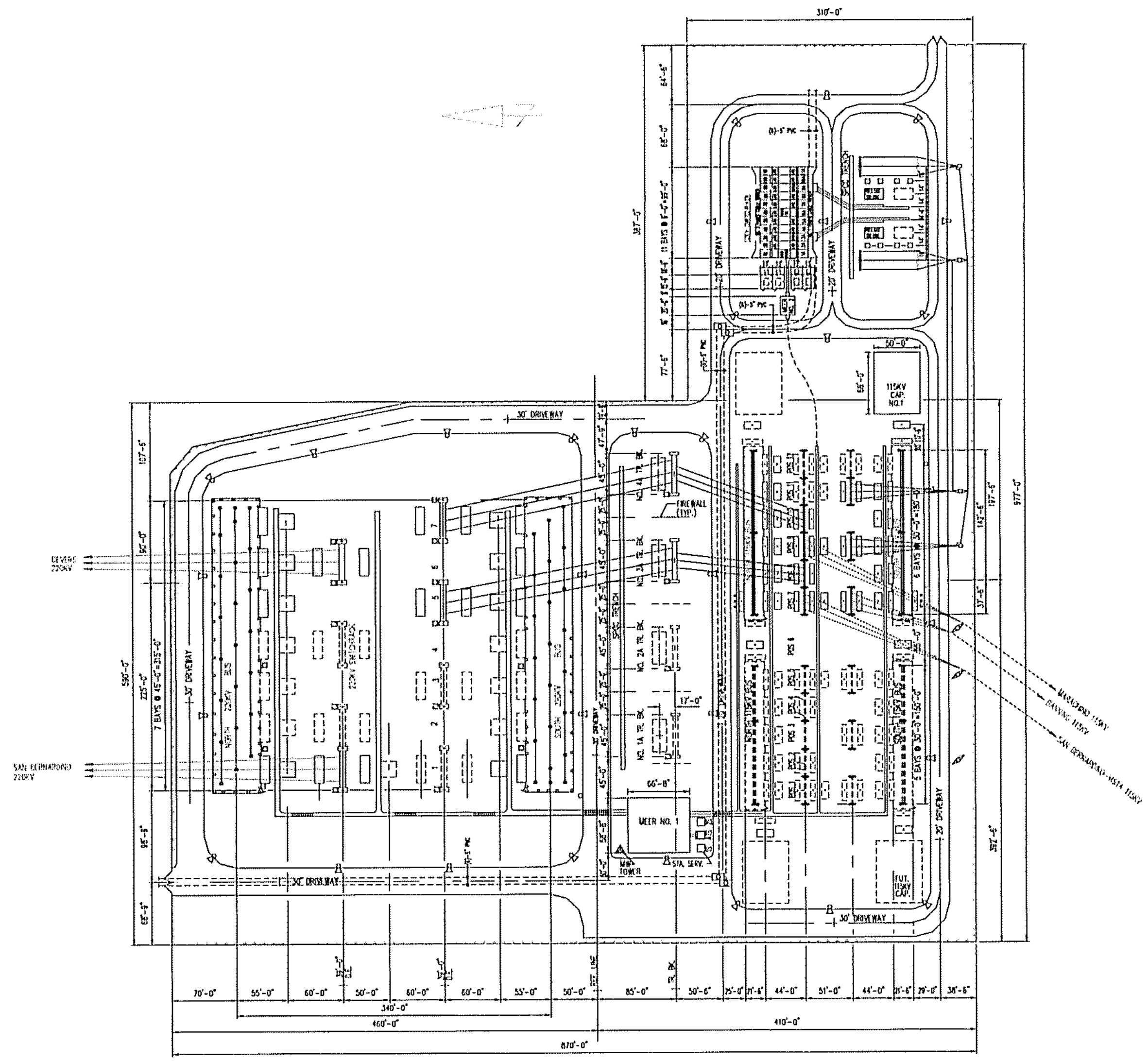
Distance (ft)	Seg. 5: Existing Design (mG)	Seg. 5: 2009 - Existing Design (mG)	Seg. 5: 2010 Design ("Proposed Design") (mG)
-100	0.0	0.0	1.4
-90	0.0	0.0	1.7
-80	0.0	0.0	2.0
-70	0.0	0.0	2.4
-60	0.0	0.0	2.9
-50	0.0	0.0	3.5
-40	0.0	0.0	4.3
-30	0.0	0.0	5.0

Distance (ft)	Seg. 5: Existing Design (mG)	Seg. 5: 2009 - Existing Design (mG)	Seg. 5: 2010 Design ("Proposed Design") (mG)
-20	0.0	0.0	5.7
-10	0.0	0.0	6.1
0	0.0	0.0	6.0
10	0.0	0.0	5.5
20	0.0	0.0	4.7
30	0.0	0.0	3.9
40	0.0	0.0	3.2
50	0.0	0.0	2.6
60	0.0	0.0	2.2
70	0.0	0.0	1.8
80	0.0	0.0	1.5
90	0.0	0.0	1.3
100	0.0	0.0	1.1

Magnetic Fields Graph

Note: See Figure 9 on page 24 for the magnetic field graph for Line Segment 5.

APPENDIX C: PROPOSED SUBSTATION LAYOUT



CERTIFICATE OF SERVICE

I hereby certify that, pursuant to the Commission's Rules of Practice and Procedure, I have this day served a true copy of the **APPLICATION OF SOUTHERN CALIFORNIA EDISON COMPANY (U 338-E) FOR A PERMIT TO CONSTRUCT ELECTRICAL FACILITIES WITH VOLTAGES BETWEEN 50 KV AND 200 KV: EL CASCO SYSTEM PROJECT** on the parties identified below. Service was effected by placing the copies in properly addressed sealed envelopes and depositing such envelopes in the United States mail with first-class postage prepaid (Via First Class Mail).

Mr. B.B. Blevins
Executive Director
California Energy Commission
1516 9th Street, MS3-39
Sacramento, CA 95814-5512
(3 copies)

Mr. Kenneth Lewis
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102
(2 copies)

Mr. Joseph A. Abhulimen
Office of Ratepayer Advocates
505 Van Ness Ave.
San Francisco, CA 94102

Executed February 16, 2007, at Rosemead, California.

Nicole M Broadwater

Nicole Broadwater
Project Analyst
SOUTHERN CALIFORNIA EDISON COMPANY

2244 Walnut Grove Avenue
Post Office Box 800
Rosemead, California 91770
Telephone: (626) 302-3124