4.3.2.6 Impacts from Alternative 3—New Transmission Elk Grove Substation to Tracy Substation

The ROW for Alternative 3 has not been surveyed for cultural resources. The EPMs summarized in Section 4.3.2.2, including the development of a PA and the implementation of associated commitments, are expected to avoid or minimize the magnitude of cultural resource impacts. Therefore, significant impacts are not expected.

4.3.2.7 Impacts from the No Action Alternative

There would be no new impacts under this alternative. Impacts would be restricted to transmission line and access road maintenance. This includes periodic air and ground patrols. Repair to the transmission lines or structures could involve localized ground disturbance from heavy equipment. Vegetation removal by hand or mechanical equipment may be necessary to improve access roads or access to individual transmission line structures. The EPMs summarized in Section 4.3.2.2 are expected to avoid or minimize the magnitude of cultural resource impacts. Therefore, significant impacts are not expected.

4.4 ELECTRIC AND MAGNETIC FIELDS

4.4.1 Affected Environment

Both voltage and current are required to transmit electrical energy over a transmission line. The current, a flow of electrical charge measured in amperes, is the source of a magnetic field. The voltage represents the potential for an electrical charge to do work and is measured in volts (V) or kilovolts (kV). The voltage is the source of an electric field.

The possibility of adverse health effects from electric and magnetic fields (EMFs) exposure has increased public concern in recent years about living near high-voltage transmission lines. Both fields occur together whenever electricity flows, hence the general practice of considering both as EMF exposure. The available evidence has not established that such fields pose a significant health hazard to exposed humans. However, the same evidence does not prove there is no hazard. Therefore, in light of present uncertainty, the issues are discussed below, and Western's policy is to reduce such fields to some degree, where feasible, until the issue is better understood.

4.4.1.1 Resource Study Area

Approximately 108 miles of linear features make up the Proposed Action and alternatives study area. The study area is the transmission line ROW and any structures (buildings, other transmission lines, etc.) within 200 feet of this ROW. All transmission lines for all alternatives would be operated at 230 kV.

4.4.1.2 Issues of Environmental Concern

All transmission lines generate electric and magnetic fields. The present lines, the Proposed Action, and the alternatives would generate similar electric and magnetic fields. The effects of concern relating to EMFs follow:

The electrical effects of a transmission line can be characterized as "corona effects" and "field effects." Corona is the electrical breakdown of air into charged particles. It is caused by the electrical field at the surface of conductors. Field effects are induced currents and voltages, as well as related effects that might occur as a result of EMFs at ground level.

Corona Effects

Corona can occur on the conductors, insulators, and hardware of an energized high-voltage transmission line. Corona on conductors occurs at locations where the field has been enhanced by protrusions, such as nicks, insects, dust, or drops of water. During fair weather, the number of these sources is small, and the corona effect is insignificant. However, during wet weather, the number of these sources increases, and corona effects are much greater. Effects of corona are audible noise, radio and television interference, visible light, and photochemical reactions.

- ***Audible Noise***—Corona-generated audible noise from transmission lines is generally characterized as a crackling/hissing noise. The noise is most noticeable during wet-weather conditions. Audible noise from transmission lines is often lost in the background noise at locations beyond the edge of the ROW.
- ***Radio and Television Interference***—Corona-generated radio interference is most likely to affect the amplitude modulation (AM) broadcast band (535 to 1,705 kilohertz); frequency modulation (FM) radio is rarely affected. Only AM receivers located very near to transmission lines have the potential to be affected by radio interference. Television interference from corona effects occurs during bad weather, and is generally of concern for transmission lines with a voltage of 345 kV or more and only for receivers within about 600 feet of the line.
- ***Visible Light***—Corona is visible as a bluish glow or as bluish plumes. On the transmission lines in the area, the corona levels are so low that the corona on the conductors would be observable only under the darkest conditions with the aid of binoculars.

- ***Photochemical Reactions***—When corona is present, the air surrounding the conductors is ionized and many chemical reactions take place producing small amounts of O_3 and other oxidants. Approximately 90 percent of the oxidant is O_3, while the remaining ten percent is composed principally of NO_x. The maximum incremental ozone levels at ground level produced by corona activity on the transmission lines during bad weather would be less than 1 ppb. This level is insignificant when compared to natural levels and their fluctuations.

Field Effects

The electric field created by a high-voltage transmission line extends from the energized conductors to other conducting objects such as the ground, transmission structures, vegetation, buildings, vehicles, and persons. The electric field is measured in units of kV/meter (m), at a height of 1 m above ground level. Field effects can include induced currents, steady-state current shocks, spark discharge shocks, and in some cases field perception.

- ***Induced Currents***—When a conducting object, such as an ungrounded fence, vehicle, or person, is placed in an electric field, current and voltages are induced. The magnitude of the induced current depends on the electric-field strength and size and shape of the object. The induced currents and voltages represent a potential source of nuisance shocks near a high-voltage transmission line. Under Western's transmission line requirements, high-voltage transmission lines are placed high above objects to reduce the potential for nuisance shocks. In addition, permanent structures in the ROW, such as fences, gates, and metal buildings are grounded.
- ***Spark-Discharge Shocks***—If the induced voltage is sufficiently high on an ungrounded object, a spark-discharge shock would occur as contact is made with the ground. Under Western's transmission line requirements, the magnitude of the electric field would be low enough that this type of shock would occur rarely, if at all. Carrying or handling conducting objects such as irrigation pipe, under transmission lines can result in spark discharges that are a nuisance. The primary hazard with irrigation pipes or any other long objects, however, is electrical flashover from the conductors if the section of pipe is inadvertently tipped up near the conductors.
- ***Steady-State Current Shocks***—Steady-state currents are those that flow continuously after a person contacts an object, such as an ungrounded fence, and provides a path to ground for the induced current. The effects of these shocks may include involuntary movement in a person.
- ***Field Perception and Neurobehavioral Responses***—When the electric field under a transmission line is sufficiently strong, it can be perceived by hair erection on an upraised hand. At locations directly under the conductors, it is possible for some individuals to perceive the field while standing on the ground. Perception of the field does not occur at or beyond the edge of ROW.

Magnetic Field

A 60-hertz magnetic field is created in the space around transmission line conductor s by the electric current flowing in the conductors. The magnetic field is expressed in units of microteslas (μT) and in gauss or milligauss (mG) where one mG is one thousandth of a gauss (1 μT = 10 mG). The maximum magnetic fields of transmission lines are similar to the maximum magnetic fields measured near some common household appliances. The actual level of magnetic field would vary as the current on the transmission line and the distance to the line varies. There are no established limits for peak magnetic fields. A possible short-term effect associated with magnetic fields from alternating current transmission lines is induced voltages and currents in long-conducting objects such as fences and aboveground pipelines.

Health Effects

While there is considerable uncertainty about the EMF/health effects issue, the following facts have been established from the available information and have been used to establish Western's existing policies:

- Any exposure-related health risk to the exposed individual would likely be small.
- The most biologically significant types of exposures have not been established.
- Most health concerns are about the magnetic field.
- The measures employed for such field reduction can affect line safety, reliability, efficiency, and maintainability, depending on the type and extent of such measures.

No Federal regulations have established environmental limits on the strengths of fields from power lines. However, the Federal government continues to conduct and encourage research on the EMF issue.

Due to the present uncertainty, several states have opted for design-driven regulations ensuring that fields from new transmission lines are similar to those from existing

lines. Some states (Florida, Minnesota, New Jersey, New York, and Montana) have set specific environmental limits on one or both fields. These limits, however, are not based on any specific health effects. Most regulatory agencies believe that health-based limits are inappropriate at this time. They also believe that the present knowledge of the issue does not justify any retrofit of existing lines.

The State of California Department of Education enacted regulations that require minimum distances between a new school and the edge of a transmission line ROW. The setback distances are 100 feet from the edge of the transmission line ROW for 50-kV to 133-kV lines, 150 feet from the edge of the transmission line ROW for 220-kV to 230-kV lines, and 350 feet from the edge of the transmission line ROW for 500-kV to 550-kV lines. These distances were not based on specific biological evidence, but on the known fact that fields from power lines drop to near background levels at those distances. In 1993, the California Public Utilities Commission (CPUC) authorized the state's investor-owned utilities to carry out no- and low-cost EMF avoidance measures in the construction of new and upgraded utility projects. Although not investor-owned, Western does have field-reducing guidelines for designing new and upgraded transmission lines. California has no other rules governing EMF.

Before the present health-based concern developed, measures to reduce field effects from power line operations were mostly aimed at the electric field component, which can cause radio noise, audible noise, and nuisance shocks. The present focus is on the magnetic field because only it can penetrate building materials to potentially produce the types of health impacts at the root of the present concern. It is important for perspective to note that an individual in a home could be exposed for short periods to much stronger fields while using some common household appliances (NIEHS 1995, DOE 1995). Scientists have not established which types of exposures would be more biologically meaningful. High-level magnetic field exposures regularly occur in areas other than the power line environment. Examples of magnetic fields at particular distances from household appliance surface are listed in Table 4.4-1.

4.4.1.3 Characterization

The Proposed Action and alternatives would all involve 230-kV transmission lines, in various configurations: single-circuit, double-circuit, and parallel single-circuit lines. Electric and magnetic fields measured under the lines and at the edge of the ROW would vary depending upon the configuration of the circuits. Circuits placed parallel to each other tend to cancel electric and magnetic fields, thus reducing the measured fields under the lines and at the edge of the ROW. Fields and currents can be induced on nearby fences, irrigation pipes, and other metallic objects.

4.4.2 Environmental Consequences

4.4.2.1 Standards of Significance

Electric and magnetic fields would be considered significant if:

- The distance between the edge of ROW and a newly constructed school is within 150 feet, or

Table 4.4-1. Magnetic Fields from Household Appliance Surfaces

Appliance	Milligauss at 1 foot	Milligauss at 3 feet
Can Opener	7.19 to 163.02	1.3 to 6.44
Clock	0.34 to 13.18	0.03 to 0.68
Clothes Iron	1.66 to 2.93	0.25 to 0.37
Coffee Machine	0.09 to 7.30	0 to 0.61
Computer Monitor	0.20 to 134.7	0.01 to 9.37
Dishwasher	4.98 to 8.91	0.84 to 1.63
Fax Machine	0.16	0.03
Portable Fan	0.04 to 85.64	0.03 to 3.12
Range	0.60 to 35.39	0.05 to 2.83
Television	1.80 to 12.99	0.07 to 1.11

Source: L. Zaffanella, School Exposure Assessment Survey, California EMF Program, interim results, (November 1997).

National Environmental Health Science Reports

In June 1999, the National Institute of Environmental Health Sciences (NIEHS) released its report, *Health Effects From Exposure to Power-line Frequency Electric and Magnetic Fields* (NIEHS 1999). The report's Executive Summary concludes that "extremely-low-frequency electric and magnetic field (ELF-EMF) exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion (NIEHS), this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the U.S. uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or noncancer health outcomes provide sufficient evidence of a risk to currently warrant concern." Nevertheless, the report goes on to recommend some actions: "In summary, the NIEHS believes that there is weak evidence for possible health effects from ELF-EMF exposures, and until stronger evidence changes this opinion, inexpensive and safe reductions in exposure should be encouraged (Electric Power Research Institute [EPRI] 1999)."

The NIEHS report, submitted to Congress, is the culmination of a long-term commitment under the Research and Public Information Dissemination (RAPID) Project, which began with the *Energy Policy Act* of 1992. RAPID's objective was to accelerate applied EMF research with a focused program supported by matching funds from the Federal government and the private sector. The electric utility industry provided most of the private sector funds.

The most significant source for the NIEHS report was the NIEHS Working Group (The Working Group) Report, which resulted from a nine-day meeting in June 1998. The Working Group considered all literature relevant to the potential effects of power-frequency electric and magnetic fields on health, including cancers of several types, adverse pregnancy outcomes, chronic illnesses (for example, Alzheimer's disease and amyotrophic lateral sclerosis), and neurobehavioral changes (for example, depression, learning, and performance). The Working Group found limited support for a causal relationship between childhood leukemia and residential exposure to EMF, and between adult chronic lymphocyte leukemia and employment on jobs with potentially high magnetic field exposure. Based on this assessment and charged with ranking EMF according to International Agency for Research on Cancer criteria, the Working Group assigned EMF a 2B ranking, which translates to "possible human carcinogen." For all other health outcomes, the Working Group concluded that the evidence was inadequate.

Although regulatory actions are not in the purview of the NIEHS, they suggest "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. We also encourage technologies that lower exposures from neighborhood distribution lines provided that they do not increase other risks, such as those from accidental electrocution or fire."

Paper by Dr. Sander Greenland, "A Pooled Analysis of Magnetic Files, Wire Codes, and Childhood Leukemia:"

A paper by Dr. Sander Greenland (University of California, Los Angeles) and colleagues entitled "A Pooled Analysis of Magnetic Fields, Wire Codes, and Childhood Leukemia" (Greenland 2000) has been accepted for publication in the journal *Epidemiology*. The work was funded by NIEHS (EPRI 2000).

The authors concluded:

- An effect of magnetic fields below 0.3 μT (3 mG) is unlikely or too small to detect in epidemiological studies.
- There is suggestive evidence that an association between magnetic fields greater than 0.3 μT (3 mG) and childhood leukemia exists.
- Magnetic fields show a more constant association with childhood leukemia than wire code do.
- Future studies of EMF and childhood leukemia should focus on highly exposed populations.

Paper by Dr. Anders Ahlbom, Karolinska Institute, Sweden

A paper describing the results of a pooled analysis of magnetic fields and childhood leukemia was published in the September 2000 issue of *British Journal of Cancer*. Dr Anders Ahlbom (Karolinska Institute, Sweden) and colleagues conducted the analysis funded by the European Union (Ahlbom 2000). This pooled analysis is based on original, individual-level data unlike meta-analysis, which is based on published results-combined from previous epidemiological studies to examine whether there is an association between magnetic fields and leukemia (EPRI 2000).

The authors concluded:

- "We did not find any evidence of an increased risk of childhood leukemia at residential magnetic field levels less than 0.4 μT (4 mG). However, we did find a statistically significant relative risk estimate of two for childhood leukemia in children with residential exposure to EMF greater than 0.4 μT (4 mG) during the year before diagnosis. Less than one percent of subjects were in this highest exposure category. The results did not change following adjustment for the potential confounders. In addition, the existence of the so-called wire code paradox could not be confirmed."
- "The explanation for the elevated risk is unknown but selection bias may have accounted for some of the increase."

Report by the Department of Health Services, State of California, "A*n Evaluation of the Possible Risks from Electric and Magnetic Fields from Power Lines, Internal Wiring, Electrical Occupations, and Appliances*"

In response to a requirement of the California Public Utilities Commission (CPUC), the California Department of Health Services (DHS) initiated research on the possible health effects of electric and magnetic fields created by the use of electricity. While the report does not include recommendations on how to protect against the identified health risks, it does recommend further research.

The final report, dated June, 2002 asked three DHS scientists to review studies to examine the potential biological and health effects resulting from EMF exposure. The following conclusions were made:

- To one degree or another, all three of the 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 strongly believe that EMFs do not increase the risk of birth defects, or low birth weight.
- They 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 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.
- 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.
- 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.

magnetic fields are in excess of 22 MG (the average value of the magnetic field of a 230-kV single-circuit line at 150 feet is 15 mG.)

- EMF avoidance practices are not conducted in the design and operation of the transmission line.

4.4.2.2 Environmental Protection Measures

One EPM for electric and magnetic fields was listed in Table 3-4. It states that Western will respond to complaints of radio or television interference generated by the transmission line and take appropriate actions.

4.4.2.3 Impacts from Proposed Action—New Transmission O'Banion Substation to Elverta Substation; Realignments; Reconductoring Elverta Substation to Tracy Substation

Western follows Federal and state regulations for designing, constructing, maintaining, and operating its transmission lines. Impacts associated with the Proposed Action and alternatives would be relatively the same. Table 4.4-2 presents the maximum design values for electrical and magnetic fields for the Proposed Action and alternatives. A discussion of the impacts from electric and magnetic field effects is presented below:

- ***Audible Noise***—There are no design-specific Federal regulations to limit the audible noise from transmission lines. There are no noise codes applicable to transmission lines in California. Audible

Table 4.4-2. Electric and Magnetic Fields from the Proposed Action and Alternatives

Configuration	Electric, Magnetic Field at Centerline	Electric, Magnetic Field, Edge of ROW	Electric, Magnetic Field, 200 Feet from Centerline
Proposed Action. Double circuit, Elverta Substation to Tracy Substation	1.0 kV/m, 160 mG	0.53 kV/m 50 mG	0.03 kV/m, 2 mG
Proposed Action. Double circuit parallel to the existing double circuit line, O'Banion Substation to Elverta Substation	1.7 kV/m, 202 mG	0.56 kV/m 50 mG	0.03 kV/m, 2.5 mG
Proposed Action. Single circuit between Cottonwood Roseville	1.9 kV/m, 180 mG	0.96 kV/m 80 mG	0.07 kV/m, 9 mG
Alternative 1. Double circuit parallel to the existing double circuit line, O'Banion Substation to Elverta Substation	1.7 kV/m, 202 mG	0.56 kV/m 50 mG	0.03 kV/m, 2.5 mG
Alternative 1. Double circuit line Elverta Substation to Hurley Substation	1.0 kV/m, 160 mG	0.53 kV/m 50 mG	0.03 kV/m, 2 mG
Alternative 2. Double circuit parallel to the existing double circuit line, O'Banion Substation to Elverta Substation	1.7 kV/m, 202 mG	0.56 kV/m 50 mG	0.03 kV/m, 2.5 mG
Alternative 2. Single circuit between Cottonwood and Roseville	1.9 kV/m, 180 mG	0.96 kV/m 80 mG	0.07 kV/m, 9 mG
Alternative 3. Double circuit Elk Grove Substation to Tracy Substation parallel to existing *double and single* circuit	1.7 kV/m, 202 mG	0.56 kV/m 50 mG	0.03 kV/m, 2.5 mG
No Action	1.9 kV/m, 180 mG	0.96 kV/m 80 mG	0.07 kV/m, 9 mG

Source: Original 2002
kV/m: kilovolt per meter
mG: milligauss

noise from transmission lines associated with the Proposed Action is limited instead through design and maintenance standards established from industry research and experience as effective without significant impacts on line safety, efficiency, maintainability, and reliability.

The noise level depends on the strength of the line electric field. The potential for occurrence can be assessed from estimates of the field strengths expected during operation. Such noise is usually generated during wet weather and from lines 345 kV or higher. Research by EPRI (1982) has validated this by showing the fair weather audible noise from modern transmission lines of less than 500 kV to be indistinguishable from background noise at the edge of a 100-foot ROW.

For the Proposed Action, low-corona design would minimize the potential for corona-related audible noise. This means upgraded, modified, and new transmission lines would add a small incremental noise level to existing background noise levels.

- ***Radio and Television Interference***—Transmission line-related radio frequency interference is an indirect effect of line operation produced by the physical interactions of line electric fields. The level of interference usually depends on the magnitude of the electric fields involved. The potential for such interference is usually only of concern for lines of 345 kV and above and not the 230-kV lines associated with this Proposed Action and alternatives. The lines would be constructed according to Western's standards, which minimize the potential for surface irregularities (nicks and scratches on the conduc-

tor), sharp edges on suspension hardware, and other irregularities.

However, if such interference occurred, Western would implement practices to eliminate it such as by appropriate line maintenance and antenna modification.

- ***Visible Light***—On the transmission lines for the Proposed Action, the corona would be similar to those on existing lines. The visible corona on the conductors would be seen only under the darkest conditions with the aid of binoculars, and would not be significant.
- ***Photochemical Reactions***—The maximum incremental O_3 levels at ground level produced by corona activity on the new and upgraded transmission lines for the Proposed Action and alternatives would be similar to that produced by existing lines in the area. During rain or fog, O_3 produced would be less than 1 ppb. This level is insignificant when compared to natural levels and their fluctuations.
- ***Induced Currents***—The magnitude of the induced currents depends on the electric field strength and size, and shape of the object. Under Western's transmission line requirements, high-voltage transmission lines are placed high above objects to reduce the potential for these shocks. In addition, permanent structures in the ROW, such as fences, gates, and metal buildings, would be grounded. Induced currents are insignificant for the Proposed Action.
- ***Steady-State Current Shocks***—Features reducing the level of potential for induced current in objects near the transmission line also reduce the level of possible induced current shock. The Proposed Action would be constructed according to Western's requirements to prevent hazardous shocks from direct or indirect human contact with overhead, energized line. Therefore, these lines are not expected to pose any such hazards to humans.
- ***Spark-Discharge Shocks***—Under Western's transmission line requirements, the magnitude of the electric field would be low enough that this type of shock would occur rarely, if at all. Under current Western practice, the potential for nuisance shocks would be minimized through standard grounding procedures. Ensuring adequate ground clearance would minimize the potential for the electrical charging.
- ***Field Perception and Neurobehavioral Responses***—Perception of the field associated with the new and upgraded lines for the Proposed Action would not be detected beyond the edge of the ROW. Persons working under the ROW (for example, farmers) might feel the field. Studies of short-term exposure to electric fields have shown that some people may perceive fields (such as felt movement of arm hair) at levels of about 2-to10-kV/m, but studies of controlled, short-term exposures to even higher levels in laboratory studies have shown no adverse effects on normal physiology, mood, or ability to perform tasks. The International Commission on Non Ionizing Radiation Protection (ICNIRP 1990) guidelines propose that short-term exposures be limited to 10-kV/m for the general public. This level could occur directly below the proposed transmission line but would decrease with distance from the centerline.
- ***Magnetic Fields***—The maximum magnetic fields of the transmission lines for the Proposed Action would be comparable with the maximum magnetic fields measured near some common household appliances (NIEHS 1995, DOE 1995). The actual level of magnetic field would vary as the current on the transmission line varies and as the height of the line above ground varies. There are no established limits for peak magnetic fields.

Transmission lines in Segment D pass within 150 feet of an existing school. Land use criteria require new schools to be located at least 150 feet from transmission lines. Magnetic fields at the school would be less than those upon which the State of California bases the 150 feet distance requirement for 230-kV lines, which is approximately 22 mG. At this location, the magnetic field would be 15 mG.

4.4.2.4 Impacts from Alternative 1—Reconductoring O'Banion Substation to Tracy Substation

The impacts of Alternative 1 on emissions of EMF effects would be similar to those described for the Proposed Action. Impacts from Alternative 1 are not expected to be adverse and significant.

4.4.2.5 Impacts from Alternative 2—New Transmission O'Banion Substation to Elverta Substation and Realignments

The impacts of Alternative 2 on emissions of EMF effects would be similar to those described for the Proposed Action. Impacts from Alternative 2 are not expected to be adverse and significant.

4.4.2.6 Impacts from Alternative 3—New Transmission Elk Grove Substation to Tracy Substation

The impacts of Alternative 3 on emissions of EMF effects would be similar to those described for the Proposed Action. Impacts from Alternative 3 are not expected to be adverse and significant.

4.4.2.7 Impacts from the No Action Alternative

Under the No Action Alternative, power shortages would be more frequent than shortages under the Proposed Action and action alternatives. No change to existing conditions would be expected.

4.5 ENVIRONMENTAL JUSTICE

4.5.1 Affected Environment

This section assesses the potential for environmental justice impacts that would result from the implementation of the Proposed Action and alternatives.

Executive Order 12898, "Federal Actions to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations," provides that "each Federal agency shall make achieving EJ part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health and environmental effects of its programs, policies, and activities on minority and low-income populations and Indian tribes." The EO requires the EPA and all other Federal agencies, as well as state agencies receiving Federal funds, to develop standards to address this issue. The CEQ has oversight of the Federal government's compliance with EO 12898 and NEPA. The CEQ has developed implementation guidance for EJ under NEPA, dated December 10, 1997.

4.5.1.1 Resource Study Area

The EJ study area consists of Sutter, Placer, Sacramento, San Joaquin, Contra Costa, and Alameda counties (Segments A through H). The area of consideration includes both urban and rural areas, including the Sacramento metropolitan area. The Proposed Action, Alternative 1, and No Action ROWs would pass through the City of Sacramento.

4.5.1.2 Issues of Environmental Concern

Environmental justice considerations focus on the potential for disproportionate impacts resulting from Federal activities on minority populations, low-income communities, and tribes. Specifically, EJ issues include such things as the potential physical displacement of populations and employment and income impacts. Other issues may include the potential for adverse impacts on community institutions and organizations, reductions in access to public services, traditional and religious practices, and forms of land use, and community cultural character. Impacts related to these issues could occur temporarily during construction and for the long term after construction.

Participation in the project by Indian tribes and other potentially affected minorities and the effects of potential rate increases were issues identified during the public scoping process. Rate increases might affect low-income populations more than others. While rate increases are not included in the Proposed Action and alternatives, they could occur as a result of the added cost of improving Western's transmission system.

4.5.1.3 Characterization

The majority of the transmission line ROWs included in the Proposed Action and alternatives is in rural areas, except for portions of the Proposed Action and Alternative 1 and the No Action Alternative that would pass through Sacramento in an existing transmission ROW. Segment B from MP 4.0 to the Elverta Substation and Segment C from the Elverta Substation to MP 3.5 are adjacent to Rio Linda. Segment C from MP 3.5 to the Hurley Substation passes through the City of Sacramento. Segment D from the Hurley Substation to the Hedge Substation is within Sacramento. Segment D between MP 13.0 to 15.0 is adjacent to Elk Grove. Otherwise, residences and farms are scattered along the length of the line.

Minority and low-income populations are found in each county in the study area. Among these counties, San Joaquin and Sacramento counties have the highest percentages of residents below the poverty line (18.8 and 17.2 percent, respectively) and have Hispanic populations that are 30.5 and 16.0 percent of their respective total populations.

4.5.2 Environmental Consequences

4.5.2.1 Standards of Significance

As noted in Section 4.5.1.1 above, EO 12898 guides EJ analyses. The CEQ has also issued guidance on compliance with EO 12898 (*Environmental Justice: Guidance Under the National Environmental Policy Act,* 1997). Based on this guidance, Western has coordinated the assessment of potential EJ impacts with air quality, cultural resources, electromagnetic fields, health and safety, noise impact assessments, and socioeconomics (see Sections, 4.1, 4.3, 4.4, 4.8, 4.10, and 4.12 respectively). The EJ analysis has determined how the types of impacts addressed in these other sections could disproportionately affect low-income and minority populations. Minority and low-income populations would incur significant and adverse impacts if they experience a disproportionate share of the adverse effects caused by the Proposed Action or alternatives.

4.5.2.2 Environmental Protection Measures

EPMs described in the air quality, cultural resources, electromagnetic fields, health and safety, noise impact assessments, and socioeconomic sections would also help minimize and avoid adverse impacts to minority and low-income populations (see Sections, 4.1, 4.3, 4.4, 4.8, 4.10, and 4.12