Hingtgen, Robert J

From: Donna Tisdale [tisdale.donna@gmail.com]
Sent: Monday, January 07, 2013 12:41 PM
To: Hingtgen, Robert J
Cc: Slovick, Mark; Gungle, Ashley
Subject: Soitec Solar PEIR comments Tisdale-POC-BAD
Attachments: Groundwater monitoring1993 Campo Landfill.pdf; Inverter harmonics & noise white paper.pdf; Ground Currents_Duane A Dahlberg, Ph.D.pdf; Campo-Cottonwood-SSA-map.pdf

Soitec Solar PEIR: 3800 12-010; Tierra Del Sol Solar; 3300 12-010 (MUP); 3600 12-005 (REZ); 3921 77-046-01 (AP) ; Rugges Solar , 3300 12-007 (MUP); LanWest 3300 12-002 (MUP); Environmental LOG N.: 3910 120005 (ER)

Hello Robert,

Our groups and members are strongly opposed to these and other industrial scale rural solar, wind, and transmission projects, especially as proposed too close to homes and other sensitive receptors in fire-prone groundwater dependent areas with sensitive biological, historic, cultural and other resources.

They represent a host of significant and cumulatively significant adverse direct and indirect impacts to people, groundwater, wildlife, habitat, historic and cultural, and recreation resources. They also represent adverse impacts to our, power quality, public health and safety, long-term investments increased fire risk and related insurance rates, and more. Major issues include noise, low-frequency noise, electrical, visual, and light pollution.

We also strongly oppose any changes to the Boulevard Community Plan and General Plan to benefit unnecessary for-profit commercial industrial uses, where no commercial or industrial zoning exists, at the expense of the adversely impacted low -income community, non-particpating property owners and at-risk resources. Boulevard qualifies as an Environmental Justice community and the Attorney General has gone on record interpreting CEQA to include Environmental Justice issues.

Point of use alternative renewable energy projects in the urban use basin with existing infrastructure, imported water, emergency services, are less expensive, less destructive, and easier to permit.

If time allows, I will provide more detailed comments later.

Please include the attached and linked documents in the Soitec Solar PEIR public record for myself as an individual, for the non-proift groups The Protect Our Communities Foundation and Backcountry Against Dumps:

1. 1993 County Ground monitoring report for the Tierra Del Sol area of Boulevard
2. White Paper: Harmonics and Noise in Photovoltaic (PV) Inverter and the Mitigation Strategies
3. Ground Currents An Important Factor in Electromagnetic Exposure by Duane A. Dahlberg, Ph.D
4. Campo Cottonwood Creek Sole Source Aquifer boundary map that includes the Tierra Del Sol area
5. Dr VM Ponce's comments on the Supplemental DEIS Campo Landfill (5-5-10) with Tierra Del Sol groundwater and other information including cross-border impacts:http://ponce.tv/comments_to_dseis_100505.html

6. By reference: Dr VM Ponce's comments on the DEIS Campo Landfill (5-6-06): IMPACT OF THE PROPOSED CAMPO LANDFILL ON THE HYDROLOGY OF THE TIERRA DEL SOL WATERSHED A REFERENCE STUDY
7. Mature semiarid chaparral ecosystemscan be significant sink for atmospheric carbon dioxide: (Global Change Biology (2007) 13, 386-396, doi:10.1111/j.1365-2486.2006.01299.x) http://mercury.ornl.gov/metadata/ornldaac/daac_citations/2007/luo_etal.pdf ;

Excerpt from the 1993 report, authored by Eric Gibson, geologist and former Director of DPLU:

"The shallow groundwater levels recorded are indicative of the aquifer being at

storage capacity. These conditions are consistent with other monitoring

results within the portions of the County underlain by the fractured,

crystalline bedrock aquifer. However~I was impressed with the high numbert

areal extent (in both topographically high and low areas), and flow rates of

the springs n the area."

Thank you,

Donna Tisdale,

President for Backcountry Against Dumps

Secretary for The Protect Our Communities Foundation

co-owner Morning Star Ranch, Tierra Real Rd

PO Box 1275

Boulevard, CA91905

LAUREN M. WASSERMAN
DIRECTOR
(619) 694-2962

County of San Diego

DEPARTMENT OF PLANNING AND LAND USE

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March 8, 1993

Donna Tisdale, Chair
Boulevard Sponsor Group
P.O. Box 1272
Boulevard, CA 91905

GROUNDWATER MONITORING RESULTS - BOULEVARD/PROPOSED CAMPO LANDFILL AREA

Attached are the results of the recent (March 4, 1993) groundwater level monitoring that I completed in the area. Thank you for taking the time to obtain permission from the local well owners for this monitoring, this saved many hours of my time. I would appreciate your further assistance in completing the establishment of a regional groundwater level monitoring program in the Boulevard area.

The shallow groundwater levels recorded are indicative of the aquifer being at storage capacity. These conditions are consistent with other monitoring results within the portions of the County underlain by the fractured, crystalline bedrock aquifer. However, I was impressed with the high number, areal extent (in both topographically high and low areas), and flow rates of the springs in the area.

If you have any questions regarding this report, please contact me at 694-2952.

Sincerely,

J. Eric Gibson, County Groundwater Geologist
CA Registered Geologist #5431

LAUREN M. WASSERMAN
DIRECTOR
(619) 694-2962

County of San Diego

DEPARTMENT OF PLANNING AND LAND USE

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March 8, 1993

TO: File

FROM: Eric Gibson, County Groundwater Geologist

GROUNDWATER LEVEL MONITORING - BOULEVARD/PROPOSED CAMPO LANDFILL AREA

A round of groundwater levels were collected in the subject area on March 4, 1993. These levels were collected in conjunction with the groundwater level monitoring program which is mandated within the County of San Diego Groundwater Ordinance #7994. Monitoring was initiated because of a request of the Boulevard Sponsor Group Chairperson's request to document groundwater levels. Staff has also focused on expanding the monitoring program this winter as a result of the heavy rainfall season of 92/93.

Groundwater levels were collected by myself using either the ACTAT™ Corporation, Model 300 Olympic Well Probe or by direct measurement with a retractable tape measure where permitted by well access and shallow water table. The top of the well casing was utilized as a datum for water level measurements. The accuracy of these measurements are estimated to be +/- 0.1 feet. Additionally, in order to determine groundwater levels in relation to land surface, the casing height in relation to the ground surface was also measured by direct measurement. At well locations where the land surface was uneven measurements were tied to the estimated average land surface level, with an accuracy estimated at +/- 0.2 feet. Several flowing artesian wells were encountered during monitoring. Because the seals in these wells were not water-tight (under artesian pressure) and were not fitted with a pressure gauge, no accurate head value could be taken. Therefore, all flowing artesian water levels noted should be regarded as the minimum possible groundwater level and actual levels may be substantially higher.

Results of the monitoring are presented in Table 1. A location map of the monitored wells is presented in Figure 1. A total of 25 wells were measured and water levels varied from 1.2 feet above land surface (flowing artesian) to 31.5 feet below land surface (BLS). Groundwater levels in all but 5 of the 25 monitored wells were less than 4 feet BLS. Surfacing groundwater (springs) was noted virtually everywhere throughout the monitoring area including both topographically high and low areas. Rainfall had not occurred for over a week prior to monitoring so that the surface water noted is virtually all surfacing groundwater.

BOULEVARD MONITORING RESULTS
March 4, 1993

#	WELL NAME	WELL PUMPED?	EIS I.D. # *	CASING HEIGHT	WATER LEVEL BTC**	WATER LEVEL BLS***
1	Morningstar Ranch - Corral Well	YES	4	1.0	1.2	0.2
2	Morningstar Ranch - Playhouse Well	YES	3	3.2	5.0	1.8
3	Morningstar Ranch - Southeast Pasture	NO	N/A	1.0	0.0	-1.0
4	Summer's Domestic	YES	19	0.5	1.1	0.6
5	Morningstar Ranch - Handdug	NO	1	1.6	5.5	3.9
6	Morningstar Ranch - Cased Well Within Handdug	NO	1	1.8	5.9	4.1
7	Morningstar Ranch - Windmill (North Pasture)	YES	5	0.8	3.8	3.0
8	House Well	YES	14	0.3	3.2	2.9
9	Morningstar Ranch - North of Tierra Real Ln.	NO	N/A	0.3	1.0	0.7
10	Utz Well	NO	N/A	1.2	2.4	1.2
11	Malley Well	YES	N/A	1.7	2.4	0.7
12		YES	N/A	1.6	2.4	0.8
13	Johnson Swine Farm	YES	25	1.2	3.2	2.0
14	Polon Well	YES	26	1.2	1.2	0.0
15	Windmill	NO	13	1.6	26.6	25.0
16	Espinoza	YES	22	1.6	33.1	31.5
17	Tucker	YES	11	2.3	4.8	2.5
18	Harris	YES	N/A	0.4	17.2	16.8
19	Albam Handdug	YES	N/A	2.3	2.2	-0.1
20	Albam Well	NO	N/A	1.2	0.0	-1.2
21	Gonzales	YES	N/A	3.7	4.7	1.0
22	McGrew - Melowest Ranch	YES	N/A	1.8	3.2	1.4
23		NO	31	5.5	12.0	6.5
24	Haselton Ranch	NO	N/A	2.3	8.0	5.7
25	Haselton Ranch	YES	N/A	0.6	0.6	0.0

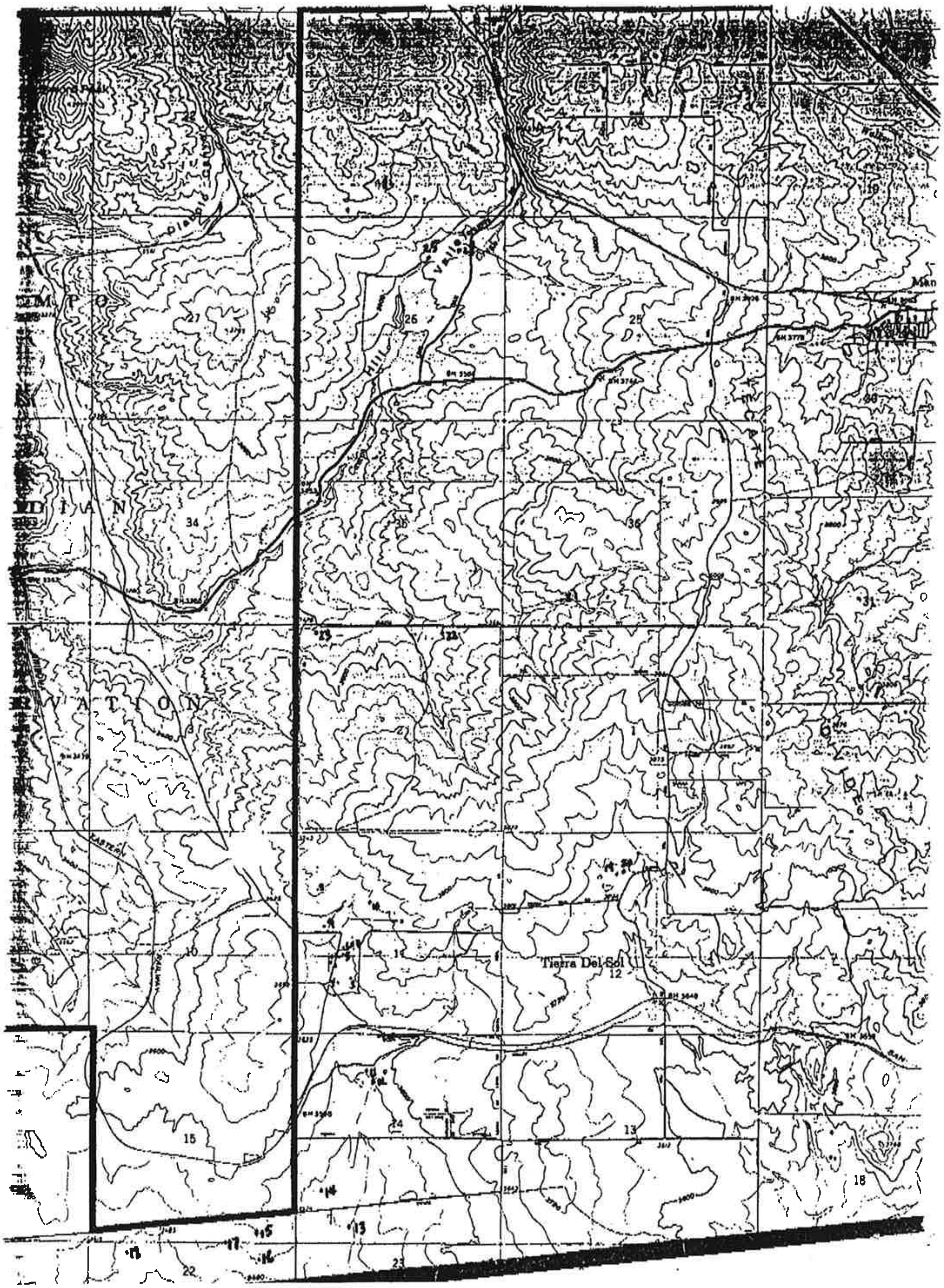
All Measurements in feet

* - Well I.D. as noted in Figure 3.3.2 (pg. 3-31) of the Final Environmental Impact Statement for the Campo Solid Waste Management Project (11/92).

** - BTC - Below Top of Well Casing

*** - BLS - Below Land Surface, a negative number indicates that the well was flowing artesian,. Accurate water level measurements within flowing artisian wells were not possible, therefore the figure represents the minimum water level.

N/A - Well Not monitored during EIS.



Tierra Del Sol
D I A N
A T I O N
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White Paper

Soonwook Hong, Ph. D.
Michael Zuercher-Martinson

Harmonics and Noise in Photovoltaic (PV) Inverter and the Mitigation Strategies

1. Introduction

PV inverters use semiconductor devices to transform the DC power into controlled AC power by using Pulse Width Modulation (PWM) switching. PWM switching is the most efficient way to generate AC power, allowing for flexible control of the output magnitude and frequency. However, all PWM methods inherently generate harmonics and noise originating in the high dv/dt and di/dt semiconductor switching transients. In order to reduce harmonics and switching noise, external filtering needs to be added. The following conceptual figure shows how the AC output voltage is generated at the inverter power stage output using PWM switching.

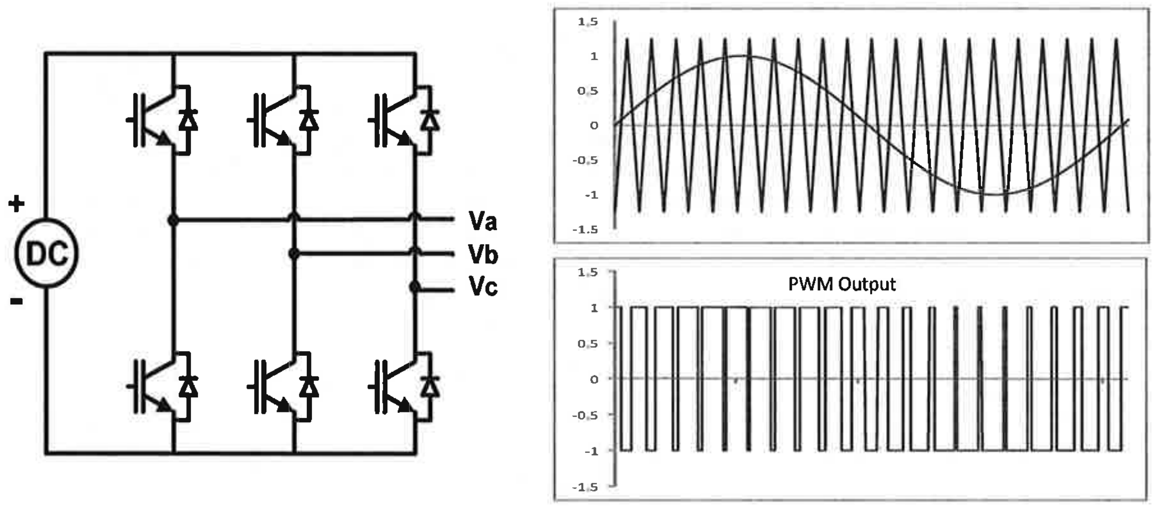


Figure 1. Three Phase Inverter PWM Generation

As shown in Figure 1, the PWM waveform is generated by comparing a reference signal (sinusoidal red trace) and a carrier waveform (triangular blue trace). The PWM waveform controls the Insulated Gate Bipolar Transistor (IGBT) switches to generate the AC output. When the reference signal is bigger than the carrier waveform, the upper IGBT is triggered on (lower IGBT being off) and positive DC voltage is applied to the inverter output phase (A). In the other case, when the reference signal is smaller than the triangular carrier waveform, the lower IGBT is turned on (upper IGBT being off) and negative DC voltage is applied to the inverter output. The reference signal magnitude and frequency determine the amplitude and the frequency of the output voltage. The frequency of the carrier waveform is called the modulation frequency. In order to generate more precise sinusoidal AC voltage waveforms and keeping the size of the LC filter small, high modulation frequencies are generally used.

There are many industrial standards that control the noise and harmonic contents in an inverter system, such as AC motor drives, Uninterrupted Power Supplies (UPS) or other AC power applications. In the case of grid-tied PV inverters, the Institute of Electrical and Electronics Engineers (IEEE) 1547, Underwriters Laboratories (UL) 1741 and FCC Part 15B standards specify the guidelines to control the harmonic contents of the output current and the Electro Magnetic Interference (EMI) generation in the inverter. The guidelines guarantee that:

- The inverters do not generate excessive noise and harmonics, which can contaminate the AC grid voltage.
- The inverters are immune to electrical and magnetic noise from other sources and provide reliable operation in an environment of high electromagnetic noise.
- The inverters do not generate unwanted radiated or conducted noise, which can disturb the stable operation of other equipment coupled either electrically or magnetically.

Most of the PV inverters manufactured in the United States are designed to meet UL 1741 and IEEE 1547 standards. As the capacity of PV generation in power distribution systems grows, utility companies become increasingly concerned that the noise and harmonics from the PV inverter systems will adversely impact the power quality or affect the operation of other equipment and cause it to malfunction or otherwise disrupt the stable operation of the power distribution system.

This article lists the possible sources of the harmonics and switching noise generated by the PV inverter and describes how they can be controlled to meet customer requirements and relevant industrial standards. To present the theoretical and experimental analysis of this phenomenon, a Solectria Renewables PVI 82kW - 480VAC PV inverter system is being used. However, since most PV inverters have similar types of component configurations, the information in this article can be used to understand the harmonics and EMI issues in a variety of inverter systems.

2. PV Inverter System Configuration

Figure 2 shows the block diagram of a Solectria PVI 82kW inverter, including the filters used for attenuating the high frequency noise on the inverter output voltages and currents. There are two main sources of high frequency noise generated by the PWM inverters. The first one is the PWM modulation frequency (2 ~ 20kHz). This component is mainly attenuated by the LC filter and the transformer. The second source originates in the switching transients of the power electronics switching devices (IGBTs). The frequency of the switching transients is dependent on the device switching characteristics, gate drive circuit and the snubber circuit in the inverter, and ranges from several hundred kHz to 100MHz. The series filter and the shunt filter are designed to attenuate the frequency components caused by these switching transients and also the harmonics from other subsystem components such as the switched mode power supply (SMPS) and other inverter control circuitry.

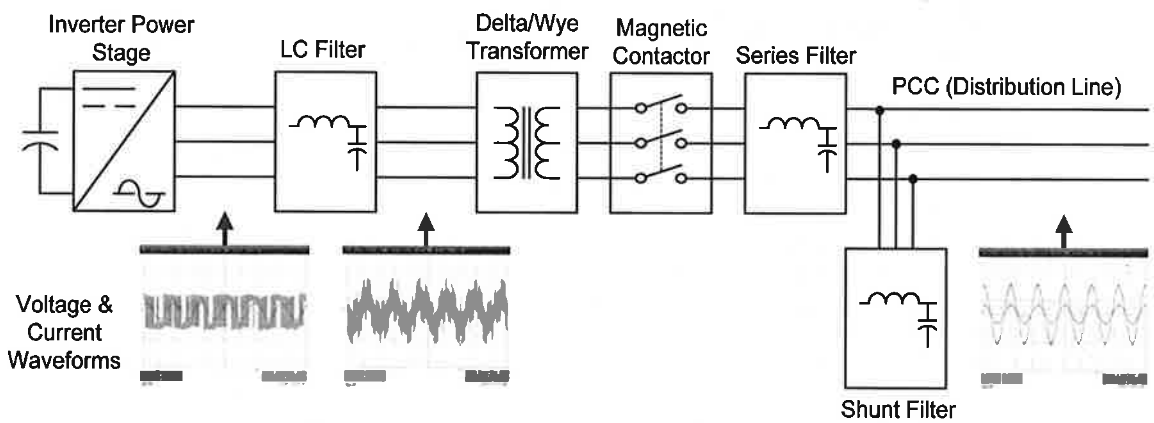


Figure 2. PVI 82kW Inverter Filtering Configuration and V/I Waveforms

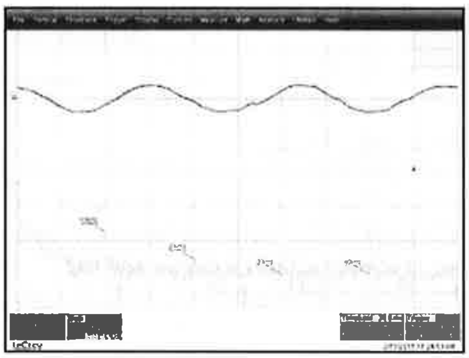
Figure 2 also shows the voltage and current waveforms in each stage of the inverter. Most of the harmonic components in the voltage and current waveforms are filtered out by the LC, series and shunt filters. The inverter output current is in phase with the voltage (unity power factor) and the total harmonic distortion (THD) is less than 5% at rated operation, which is far better than the current THD of most industrial loads, and is comparable to the output current waveforms of an Uninterruptable Power Supply (UPS).

2.1. PWM frequency and LC filter

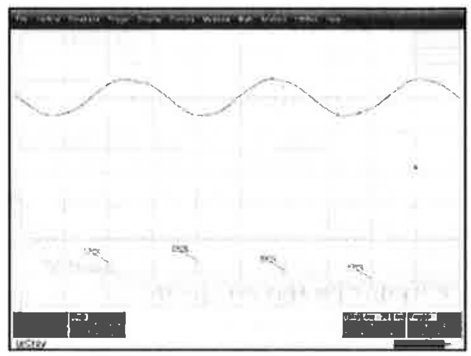
An LC filter is used to attenuate the PWM modulation frequency and its harmonics in the inverter system. The leakage inductance of the integrated isolation transformer further attenuates the high frequency component so that the output current will be sinusoidal and meet the desired THD limit. A symmetrical PWM scheme is generally preferred to reduce the ripple in the inverter output current. A symmetrical PWM scheme compared to an asymmetrical PWM reduces the effective peak-to-peak ripple current by half when using the same switching frequency.

As shown in Figure 2, the inverter's power stage output voltage waveform is composed of a series of square waveforms and includes high frequency components. The current waveform is relatively smooth and sinusoidal as the inverter output current flows into the inductor in which it cannot change instantaneously.

Figure 3 compares the power stage output to the inverter output current. In the time domain, the waveforms do not look very different. However, the Fast Fourier Transformation (FFT) results show that the inverter current after the LC filter has much less high frequency components than the unfiltered power stage output current.



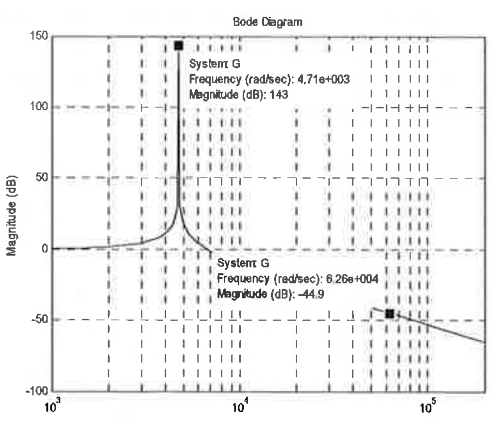
a) Power stage output current waveform and FFT



b) Inverter output current waveform and FFT

Figure 3. PVI 82kW Current Harmonic Analysis

This filtering effect can be illustrated in a Bode Plot. Figure 4 (a) shows the LC filter frequency characteristics using the theoretical frequency analysis and the measured harmonic components with a frequency analyzer when the inverter operates at full power. In the example the LC filter resonant frequency is tuned to 750Hz. Assuming a PWM modulation frequency of 10 kHz it would be attenuated to 45dB below the fundamental current component. The actual inverter output current FFT result shows that the 10 kHz ripple component is further attenuated to 60dB below the fundamental component by the shunt filter, which is about 0.1% of the fundamental 60Hz current. Figure 4 (b) shows that all the harmonic component frequencies are well controlled and the overall THD is 2.31%.



a) LC Filter Bode Plot (Theoretical Result)

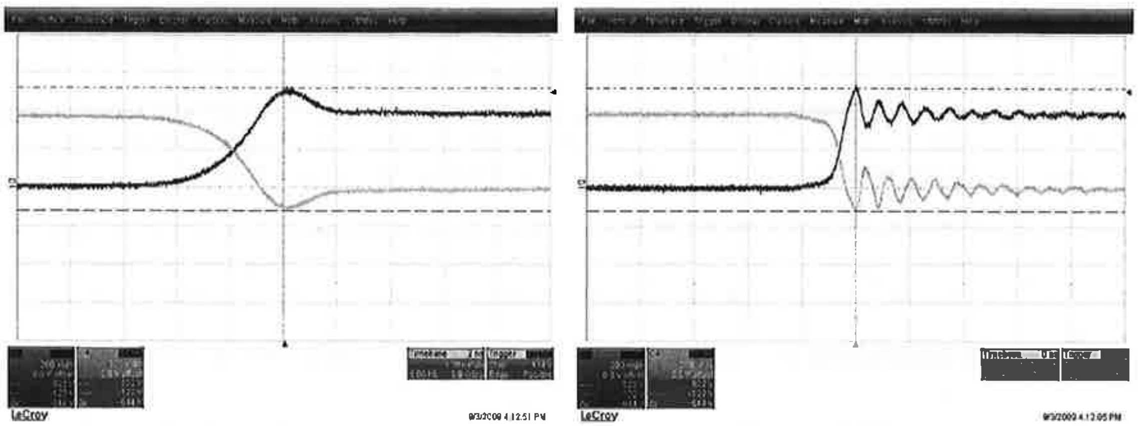
THD	2.31%	12th	0.08%
		13th	0.16%
2nd	0.71%	14th	0.25%
3rd	1.85%	15th	0.05%
4th	0.57%	16th	0.05%
5th	0.52%	17th	0.06%
6th	0.10%	18th	0.04%
7th	0.61%	19th	0.05%
8th	0.07%	20th	0.04%
9th	0.08%	21st	0.05%
10th	0.12%	22nd	0.03%
11th	0.24%	23rd	0.07%

b) Inverter output current FFT (Test Result)

Figure 4. PVI 82kW System Output Current Harmonics Analysis

2.2. High frequency noise generated by switching transients

When the switching devices are turned on and off, high dv/dt and di/dt cause oscillations during the transients, which contain high frequency noise in the range of 100kHz or higher. Figure 5 shows the switching transients of the IGBT voltage and current with two different gate drive circuit designs.



a) Slow switching transient   b) Fast switching transient

Figure 5. High Frequency Noise Generated by IGBT Switching Transients

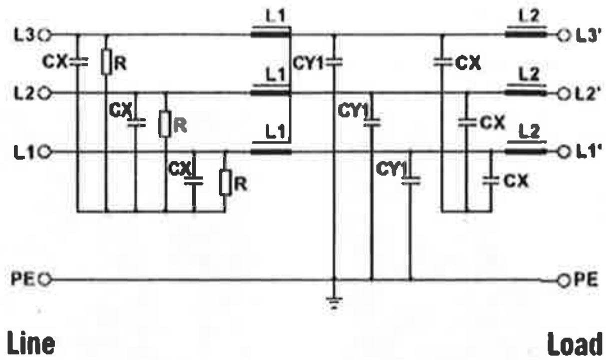
By using a slow switching transient (a), the oscillation can be minimized but switching losses are increasing due to longer operation of IGBTs in the active region. With a faster switching speed, the switching losses can be kept lower but oscillations in voltage and current are being generated due to the parasitic inductance and capacitance in the inverter stack. This high frequency oscillation falls into the frequency band regulated by FCC. In order to increase the overall efficiency of the inverter and at the same time to minimize EMI, the IGBT switching speed and noise filter design must be carefully coordinated.

There are other sources of switching noise in the inverter system caused by the Switch Mode Power Supplies SMPS and the digital control logic circuits. The noise from these components can reduce the system performance by contaminating internal analog feedback signals, resulting in logic level or communication errors and could also cause EMI interference with the outside world.

The high frequency noise can be further classified into radiated noise and conducted noise. The radiated noise can be controlled in many ways at the board level and at the system level such as shielding, component layout, wiring routing, and signal grouping. The conducted noise can be controlled by grounding or the use of proper filters, carefully designed to eliminate specific frequency components. In Solectria's PVI 82kW inverter, excellent noise levels were achieved by implementing a robust printed circuit board (PCB) layout in combination with hardware and software filters. Noise in signal circuits is solely controlled by ferrite beads and proper grounding. The PVI 82kW inverter also features series and shunt filters in the final output stage of the system. These filters are frequency band limiting and designed to filter out switching frequency transients.

Series Filter

The IGBT switching transients normally last 0.1 ~ 10usec, therefore, the filter should be tuned to between 100kHz and several MHz. Also, the controller uses a SMPS switched at 150kHz. The series filter in the PVI 82kW attenuates both common mode and differential mode noise. It provides 80dB common mode attenuation for the frequencies between 100kHz and 1MHz, and 70dB differential mode attenuation for the frequencies between 200kHz and 3MHz. The filter is selected to eliminate the system specific dominant frequency components, and is not active in the lower PWM modulation frequency range.



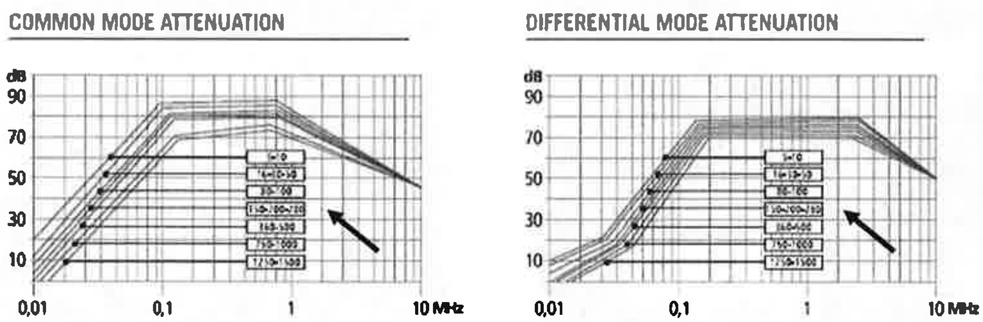


Figure 6. Series Filter Characteristics

Shunt Filter

The selected shunt filter for the PVI 82kW inverter has a resonance point around 150kHz and provides a reduction of noise interference particularly in the frequency range between 50kHz and 5MHz. This filter is added to further reduce the switching noise from the power stage as well as from the switch mode power supply in the inverter control system. The shunt filter also provides a protection circuit against surges of atmospheric origin to the grid, typically caused by lightning and characterized by high current levels of short duration. The filter reacts in a few microseconds to current spikes of a few kA, and protects the system against impulse surges of up to 1000 volts.

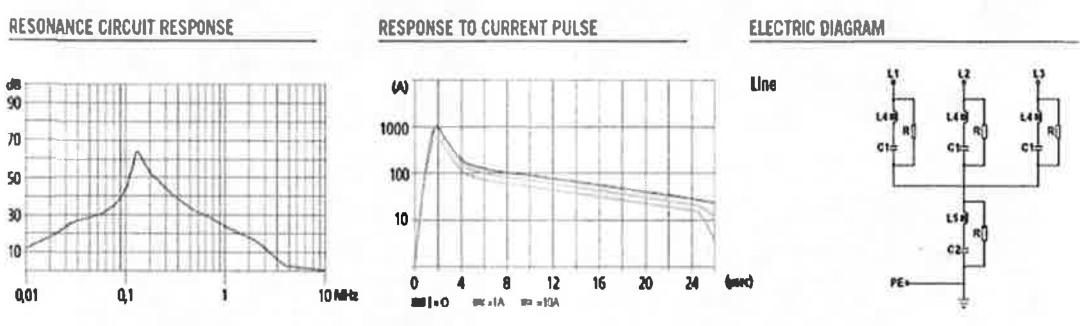
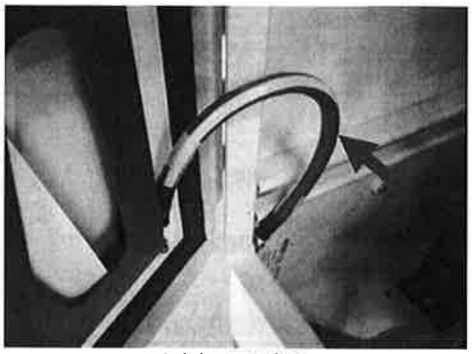


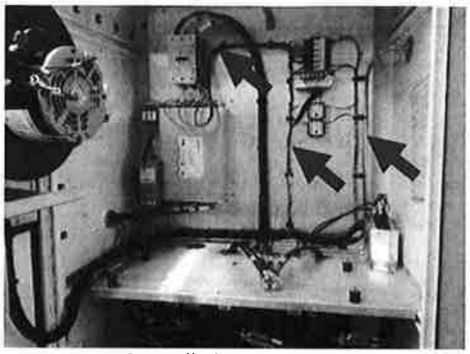
Figure 7. Shunt Filter Characteristics

3. System wide EMI Control

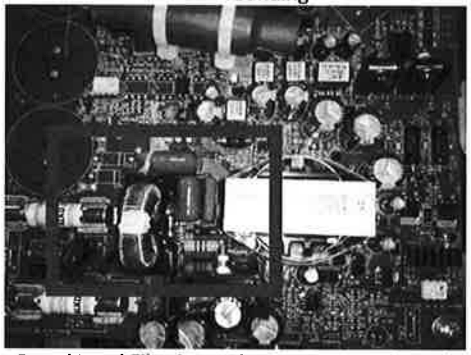
The following pictures show some of the EMI reduction strategies that are used in a PVI 82KW inverter.



Solid Grounding

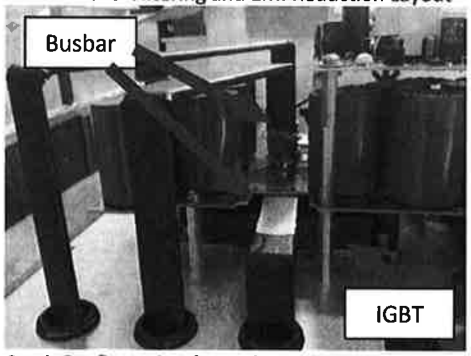


Controlled Wire Routing

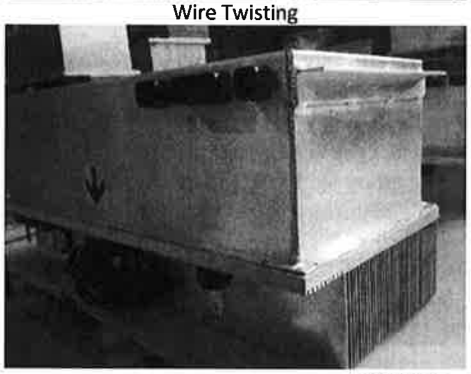


Board Level Filtering and EMI Reduction Layout

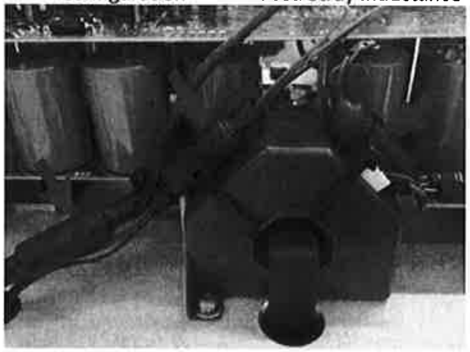
Wire Twisting



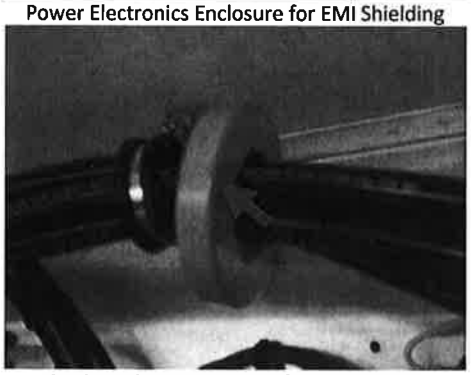
Stack Configuration for Reduced Stray Inductance



Power Electronics Enclosure for EMI Shielding



Analog Signal Conditioning using Ferrite Beads



DC side High Power Wiring for EMI shielding

4. Harmonics Generated by Firmware Control

Conventional PV inverters firmware runs at least two nested control loops. One is the AC current control loop to control the inverter output current, purely sinusoidal and in phase with the grid voltage, generating active power. The other is the DC voltage control loop in conjunction with a Maximum Power Point Tracking (MPPT) algorithm to most efficiently harvest the DC power generated by the solar panels.

When grid conditions change due to power grid transients, power line faults or load based voltage fluctuations in the distribution line, the inverter output current is controlled to balance the power transfer from the PV array to the grid. If the current control loop gains are tuned properly, the dynamic response due to the transients can be controlled at the bandwidth usually less than 1kHz. The DC voltage control loop is around the current control loop and is usually controlled at a lower sampling rate. If the DC voltage fluctuates due to sudden changes in weather conditions, the DC voltage control loop has a certain bandwidth to react and stabilize the system output. During sunlight transients, the system might generate even slower oscillations in the DC bus voltage and output AC currents control. Since the DC voltage control loop bandwidth is low, it does not cause any harmonics or EMI issues. However, if the voltage control loop were not tuned properly, the generation efficiency would decrease due to failure to track the maximum power point of the PV panels.

Solectria Renewables' inverters have been fully tested at different load conditions to have excellent dynamic characteristics for both the AC current and DC voltage control loops. The AC current control bandwidth is about 2kHz and the DC voltage control bandwidth is more than 100Hz.

5. Conclusion

This article described how the current harmonics and EMI are controlled in PV inverters. IEEE 1547, UL 1741 and FCC Part 15B standards impose strong guidelines for grid-tied PV inverters to reduce current harmonics and eliminate electromagnetic noise. Extra attention is given by the PV inverter manufacturer to design inverters that are immune to EMI problems and guarantee reliable operation of the inverter in all worst case operating conditions.

Different types of practical harmonics and noise reduction strategies for a commercial three-phase PV inverter were introduced in this article. The filtering of harmonics and EMI needs to be carefully designed to maintain the control bandwidth of the inverter and to provide clean and reliable control signals in both analog and digital electronic circuits. The PVI 82kW inverter system is equipped with several levels of harmonics and EMI filtering and its effectiveness and reliability have been proven in the harshest commercial and utility scale applications.


Controlled Workmanship


8 Hour HASS Burn-in Test and Final Verification

Ground Currents

An Important Factor in Electromagnetic Exposure
by Duane A. Dahlberg, Ph.D.

Introduction

Life on this earth has developed and is maintained through the utilization of both chemical and electromagnetic(EM) energies. In general, both chemicals and EM energies are required for the continued well being of living organisms. In the modem industrial era we have also learned that the consequences of the intake of certain undesirable chemicals and exposure to unwanted EM energies can have a negative impact on this well being. The acceptance and understanding of adverse effects from undesirable chemicals is quite universal, whereas in the Western world, especially in the United States, there has been a reluctance to accept or try to understand the possibility of adverse effects from disturbing EM energies. The stray voltage problem in the dairy industry has opened the door to a realization of effects on behavior, health, and production of dairy cows and on the health of people when they are exposed to EM energies arising from the power system and, more recently, from cellular transmitters. Stray voltage problems can be caused by electric currents in the earth and EM energy fields. The currents in the earth are advertently present, because of the electrical distribution system's use of the earth as a current-carrying conductor, and also inadvertently present, because of electrical problems on the farm.

Health effects from exposure to electromagnetic (EM) energies become quagmired in debates over inconsistencies in research data and the inability of present models to explain the empirically observed cancer connection. From these inconsistencies it is tempting to draw the conclusion that even if a connection may exist between EM energies and certain types of cancer, that connection is weak and probably requires little attention considering the large number of other environmental health risks. Another more persuasive conclusion would be that the approach to understanding EM effects has thus far been too narrowly focused. The effects examined must extend beyond cancer. EM energy exposure is very complex and difficult to measure; clearly defined mechanisms are elusive; the electric and magnetic systems of the human body are not well understood; and a control space is in general unavailable. Together these factors make research very difficult

In the dairy industry an impasse exists between observation and laboratory research. In laboratory research the cause of animal effects is assumed to be intermittent electric shock, with no consideration given to causes from chronic exposure to a number of types of EM energies, especially from electric currents in the earth. In addition laboratory research has based its search for effects on the behavior of the dairy cows and has assumed that without behavioral effects, there can be no health and production effects. Within this model human health effects are considered impossible. Through observation and qualitative research Dahlberg and Falk have shown that the causes are not only from low energy electrical shock, but also from a continuous exposure to low level electric currents and fields. They also discovered that these currents and fields are able to produce a number of behavior, health and production effects in dairy animals as well as human health effects (Falk and Dahlberg 1993, Dahlberg and Falk 1995). This difference in the conclusions from laboratory research and those from observation and qualitative research calls for a new research effort - a quantitative research effort that addresses the findings frown observation and qualitative research-

Stray Voltage

For a period of over 50 years the dairy industry has been aware of the need to maintain a trouble free electrical system in the environment of the dairy farms. Dairy cows are known to experience a set of behavioral, health and production effects when an electrical problem exists proximate to dairy farms in which electricity is short circuited into the earth. Farm experience identifies the effects as a general attack on the well being of the cows. Veterinarians experienced with electrical effects describe them as an apparent destruction of the cows' immune system. Farmers, dairy equipment suppliers, power suppliers, agricultural extension specialists, veterinarians, feed suppliers, and electricians all attest to the effects associated with electrical exposure from ground faults. In addition, more recent research associates the effects in dairy herds with the grounding of the electric utility neutral on the farm (Hartsell, Dahlberg, Lusty, Scott 1994, Dahlberg and Falk 1995). The general name given to this problem is stray voltage. The results of stray voltage research may offer some guidance in the overall understanding of ground currents and their potential for affecting animals and people. Frequently the dairy cow has been described as the "canary in the coal mine". Since many other spaces, including schools, factories, shopping centers, etc. have similar physical characteristics to the dairy barn, the application of the findings from stray voltage research may extend far beyond the dairy barn.

The traditional theory emanating from the stray voltage research rests on the assumption that a cow will be affected when experiencing an electric current as it makes contact with a conducting part of the barn. This theory assumes that the animal receives a low voltage shock, and only when contacting a conducting material in the barn. The results of research based on this theory have shown no statistically significant health and production effects from shocking the cows intermittently with electric currents below 6 milliamperes. These research results precipitated the deduction that the health and production problems are the ramification of the methods used by the dairy operators to manage the behavioral problems (Lefcourt 1991). Unfortunately this deduction was accepted without any research to determine the management procedures used by dairy operators under stray voltage conditions. The traditional theory is not consistent with the dairy operators' observations, nor does it take into account possible effects from continuous exposure of cattle to lower levels of currents and other electric, magnetic and EM fields in the barn. In addition, it is important to keep in mind that during approximately 95 percent of the time the cows are in the barns, they are in contact only with the floor (Dahlberg and Falk 1995).

Whether associated with dairy cows or humans, a gulf exists between the observations of dairy farmers, the field experience of those investigating the problems, and the traditional concept of stray voltage. Even though field experiences abound relating electrical exposure to human health effects and behavioral, health, and production effects in livestock, the results of research associated only with effects from electrical shock have dominated the interpretation of how electricity may or may not affect cows and people in the dairy barn setting. There has been an effort to restrict the use of the term stray voltage to this traditional concept of electrical shock. Contradictory reports continue to appear, however, resulting in a serious conflict between observation and theory (Dahlberg 1986,1991, Marks, Ratke, English 1995).

Since the term stray voltage has become so closely associated with electrical shock and effects from shock, it might be preferable to consider a new term, electromagnetic ecology, that would take into account all EM energy parameters and all potential effects on both animals and people. Shock would be one aspect of electromagnetic ecology. The term stray voltage, however, has been used for so many years that the term persists, although it is often redefined to include all aspects of the problem. For example Michigan's Attorney General has defined stray voltage as "any electrical energy (whether alternating current, direct current, transients, harmonics or other spikes, etc.), regardless of strength, that is flowing outside the circuit's designed path, be it from the electric utility's transmission or distribution lines and facilities, or the telephone, cable or gas utilities' designed systems" *(Kelley* 1998). For this reason, the term is used in this paper as defined by the Michigan's Attorney General with the additional implication of effects on livestock and humans. Whatever the choice may be for a term, it is most important to recognize that the cause of the problem has not changed; it is our understanding of the problem that is evolving.

Experience in problem solving encourages that a "systems" methodology be used as a first approach for a problem as complex as the effects of EM energy on living organisms. A good example of the systems methodology is that used in the NASA organization as they worked on the challenge of landing people on the moon. The information provided subsequently is based on this research methodology.

Observations of the actions and responses of cows in the dairy barns suggest that cows sense some adverse stimulus that seems to be continually present in the barn. Frequently the cows also respond to random events that appear to be present only for relatively short periods of time and then disappear. These effects can be observed even in stalls where the only cow contacts are the hooves of the cows as they stand on the floor of the barn. Many of the effects are associated with chronic health issues. Usually the effects include a sudden onset of a number of bacterial diseases as well as a gradual deterioration of the muscle and skeletal structure of the body. In severe cases cows suddenly fall to the floor of the barn and in some cases die immediately. The overall well being of the animals tends to degenerate in direct relationship to time spent in the barn. Housing the cows in elevated facilities that are electrically isolated from the earth significantly improves both the production and health of the dairy animals (Dahlberg and Falk 1995).

Dahlberg and Falk conducted surveys assessing the perceptions of dairy farmers who experience stray voltage problems. The results of these surveys reveal a strong correlation among effects in cattle behavior, health, and production; human health effects; the malfunctioning of electrical equipment; and a rapid deterioration of metals in contact with the earth. If there is a stray voltage problem on the dairy farm causing problems for cattle, there are likely to be commensurate health problems for the dairy operators and unusual effects in electrical equipment used on the farm (Dahlberg and Falk 1993). Using PROBIT as the analytical tool, Dahlberg and Falk also found a suggestion of a double track connecting human health directly to the electrical exposure and indirectly through stress brought about by the livestock problems. Significant correlation was found between human and animal symptoms and proximity to transmission lines. However there was also a weaker correlation between human and animal symptoms and proximity to a natural gas or oil pipeline. Stray voltage problems can also exist at long distances from either electrical transmission or pipelines. It seems appropriate to assume that transmission lines and pipe lines are sources of EM energy, but certainly are not the only sources associated with the assessed symptoms. These surveys also show that the mitigation methods developed as solutions to the problem have typically only served as Band-Aids with short term benefits. Mitigation procedures help some dairy operations while for others the problems are made worse. These studies suggest that the traditional assumptions about the sources of EM energy and their effects require alteration (Dahlberg and Falk, 1993).

Ground Currents

All living organisms are exposed to numerous sources of EM energy. Some of these sources are obvious, such as 60 Hz magnetic fields and shock currents between contact points in the barn, and their interactions with living organisms can more easily be determined. In stray voltage investigations a major source of EM energy interacting with the dairy cow is electric current in the floor of the barn and in the ground beneath the floor. Whether by shock or through continuous electrical exposure, earth pathways are the means by which a most intrusive EM energy reaches cows in the dairy barn and, as a matter of fact, also reaches all other living organisms. In this paper, this source of EM energy is called **ground currents.** Ground currents can be either DC or AC and either continuous or intermittent. Their sources can be either natural or man-made, a product of the way electricity is generated and distributed for use in our society. The present discussion is limited to ground currents that arise from the farm electrical system and from the electrical utility distribution system.

The farm has a self-contained, closed electrical system except for the connection of the electrical utility (primary) neutral to the farm (secondary) neutral. Several electrical problems on the farm could lead to significant ground currents, such as electrical faults, imbalances in the farm electrical system, motor problems, or wiring errors. Each of these conditions can cause electricity to be in the farm grounding system and, therefore, cause electric current to be in the ground. Because the neutral of the secondary system is normally grounded, there is always the possibility of ground currents resulting from the normal use of electricity. Since the farm electrical system is structured to use wires to carry the current, the ground currents from this source are minimized.

The electrical distribution system serving the rural areas is usually at 7200 V ac and basically connects the consumer to a substation. The single phase distribution lines consist of a high voltage wire and a neutral wire. The two wires provide the complete path required in any electrical circuit. These wires may be overhead on poles or buried in the earth. When the distribution system was first conceived, it was totally closed with no connection to the earth. Early in the expansion of the electrical distribution system in rural America, the utility industry made a decision to change the originally ungrounded distribution system to a grounded system. This change allowed a portion of the neutral current to return to the substation through the earth. The neutral wire of the distribution system is connected to ground rods throughout the system in order to provide a path for the current to be able to get into the earth. Grounding became a common practice in both the utilities' distribution and transmission systems. The grounding of the neutral wire caused the earth to become a path for electric current on the neutral side of the distribution system and also connected everything in and on the earth to the distribution system neutral. Since the original grounding of the distribution system, demands and loads have grown rapidly, and voltage levels have increased beyond their designed energy carrying capacity resulting in an ever-increasing need for the earth connection. Electric currents flow through wires, objects, and the earth according to their respective conductivities. Today the earth has a higher conductivity than the utility's neutral circuit return wires, and therefore, carries the majority of neutral current going back to the substation (Gonen 1986; Morrison 1963, Hendrickson, Michaud, Bierbaurn 1995).

In providing electrical energy to the consumer, the utility connects its system to the primary windings of a transformer, and the farm electrical system is connected to the secondary windings of the same transformer. A transformer has the function of isolating electrical systems and increasing or decreasing voltages. In this case, the transformer reduces the 7200 V on the primary system to 120 and 240 V on the secondary system. Both the primary and secondary electrical systems are designed to function without any physical electrical connection between them.

At some point in the expansion of electrical distribution systems, the neutral wires of the primary were connected to the neutral wires of the secondary electrical system. Thus the secondary system was no longer isolated from the primary system. Today this is a common practice throughout the electrical distribution network. The stated reason for this connection is to provide a safer electrical system for both the consumer and the electrical utility personnel. Certainly the potential for electrocution is a significant safety concern to electric utilities. An even more important reason for the interconnection may be to provide additional grounding points for the utility neutral current to enter the earth for its return to the substation. To solidify the earth connection for insuring adequate grounding the neutral has been grounded to water pipes and water systems. This present code requirement forces water pipes to become a current carrying conductor, especially for the primary system. The consequence of these practices and code requirements is an increase in current entering the earth where animals live and people live and work. It also increases the connection of all living organisms to the electrical distribution system, and accounts for the electrical utilities' distribution system being a primary source of ground currents.

Through the evolution of the electrical distribution system, the earth has become a major current carrying conductor in that system. Because of the potential impact of that large quantity of current in the earth, it is important to investigate the factors that have influenced the changes in the original system.

One factor in the proliferation of power plants is a concern for dependability. If only one power source were providing the electrical energy for the distribution system, failures in the power source could, of course, disrupt the availability of electricity. Economy of scale has also been applied in the electrical generating industry, resulting in larger power plants capable of providing electricity to a larger numbers of users. There are numerous changes required in the national distribution of electricity in order to utilize the larger power plants. In some cases the larger power plants do not easily change power levels to accommodate changing loads. Additional smaller plants are required in the system to provide for changing demands. In the case of 60 Hz electrical power, storage is not feasible. Interconnecting power sources and individual distribution systems require careful matching of the phases of the various sources and the users. As individual electrical utilities joined together, transferring electricity according to demand and the availability of electrical power, the earth became the common reference for the entire system and the neutrals were interconnected. Interconnection of the electric utilities certainly increased the reliability and dependability for the user and also possibly decreased the cost.

A second reason for the utilization of the earth to carry current is economic. According to utility engineers, the resistance of the neutral wire causes significant voltage drops along the lines, requiring frequent voltage adjustments.

As the demand for electricity has increased and as the number of users has grown, the distribution lines have been extended to supply the increased number of users. The greater the electrical current on these lines, obviously the greater the loss of electrical energy and the greater the voltage decreases. Experience indicates that using the earth reduces the losses and consequently reduces the need for as many voltage adjustments. Thus the previously ungrounded electrical distribution system became a multi grounded system which uses the earth to carry the neutral current (Mairs 1994). Ground rods were added for the users and the power system. The neutral wire in the entire system was wired to the earth through the ground rods and other connections in the earth. This connection has produced an electrical distribution system which uses the earth in parallel with the neutral wire as the return path for the electric current.

A third reason that has been expressed for this change is safety from electrocution or other bodily harm caused by contact with electric lines. For the previously ungrounded system lightning arrestors were used to alleviate the destruction of electrical equipment, which could occur if lightning were to strike the lines. The lightning arrestor connected the electrical distribution lines to ground and shunted the current to the earth, avoiding damage from the lightning strikes. In contrast to the present multi grounded system, a totally ungrounded system has the advantage that a person could stand on the ground and touch either the neutral or the high voltage wire, but not both, and not be electrocuted.

The present multi grounded system has the disturbing effect of placing every living organism in contact with one terminal (the neutral wire) of the entire electrical distribution system of the North American continent. As human beings, we literally stand on one terminal of the electrical system with no way of escaping that state. The consequences of this continual contact are numerous. An assumption has been made that the multi grounded system places living organisms on an equipotential plane, the earth connected to the neutral of the system. An additional assumption follows, that an equipotential plane is an electrically safe place to be. The stray voltage problems in the dairy industry have shown that neither of these assumptions holds. The currents in the earth produce voltage differences, and alternating currents have many interactions. Electric utilities' warnings for people to keep all materials away from the electric distribution lines are a continual reminder of the dangers in contacting the high voltage wires. Of course the reason is that we are in constant contact with the neutral wire. Consequently if we make contact with a high voltage wire the entire voltage is across our bodies. This condition makes the present multi grounded electrical system far more dangerous than the former ungrounded one.

The fact that living organisms are in continuous contact with the electrical distribution system forces a continuous electrical exposure. Contact with the neutral of the distribution system also forces electrical currents to be present to a greater or lesser degree in all materials making up the environment of all living organisms. Of course the living organisms, since they are themselves conductors of electricity and in contact with materials carrying electric currents, are plugged into the electrical circuitry of the distribution system.

Alternating currents move in non-conducting paths by means of capacitive and inductive coupling. Associated with the 60 Hz alternating current are 60 Hz alternating electric, magnetic and electromagnetic fields. Electric currents can be induced in living organisms inductively by the 60 Hz magnetic fields associated with the electric currents in transmission lines, distribution lines and in any other carrier of electric current. Electric currents can also be induced into living organisms capacitively by electric fields associated with all sources of electric charge. Electric currents produced in living organisms by each of these mechanisms are indistinguishable from one another. The currents simply access the body differently. In addition to possibly inducing an electric current in the body of living organisms, the magnetic, electric and electromagnetic fields may independently or synergistically interact with them.

Ground Currents and Stray Voltage

Surveys and farm evaluations and investigations have provided a significant body of information concerning the effects of ground currents. As mentioned previously, the historic documentation of electrical effects in dairy barns involved ground faults. When electric current inadvertently enters the earth from a high voltage wire, the event is called a ground fault. The high voltage wire can either be from the primary or secondary system. Usually discussions of ground faults center on problems in the secondary system. Well-known effects from ground faults include the behavioral, health, and production problems for confined livestock, such as dairy animals, and human electrocution. In the investigation of stray voltage problems, a number of verifiable observations have been made.

1. Changes in the electrical distribution system affect the stray voltage problem: Adding substations or changes in the areas serviced by particular substations frequently correlate with increases and/or decreases in stray voltage problems. Adding electrical services on a distribution line, especially to large users of electrical energy, increases stray voltage problems in the area of the additions. Electric utility personnel increase the number of grounds or replace damaged grounds on the distribution lines in order to decrease the primary neutral to earth voltages. Invariably when the net ground resistance for the system is decreased, problems on the dairy farms increase. In areas where unshielded, buried distribution lines are used, there tends to be a greater probability for stray voltage problems. Research has shown that within a few years after installation the neutrals become seriously corroded, requiring more of the neutral current to travel in the earth. The addition of new transmission lines is always associated with increases in problems proximate to these lines. Many dairy farmers and equipment suppliers documented significant increases in behavior, health, and production problems and human health problems after the activation of two different DC transmission lines in Minnesota. Both of these continuously employ some ground return and at times total ground control.

2. Certain physical characteristics correlate with more severe stray voltage problems: Either surface water, such as wetlands, lakes, streams or rivers, or shallow ground water is nearby. Farms either near the end of a distribution line or near a substation frequently experience the worst problems. One would expect that the greater the water concentration, the greater the electric current in the area. Measurements have shown that more electric current is transferred between neutral grounding wires and the earth at the ends of distribution lines and near substations. In locations where there are vacation cabins around lakes, dairy operators experience significantly greater stray voltage problems on weekends and vacation holidays. Frequently soil moisture is an important factor. Most often wet conditions are associated with more severe problems and dry with less severe. On occasion the opposite occurs.

3. Electrical use affects stray voltage problems. Increases in stray voltage problems are correlated with increases in electrical use in regions around dairy farms. For example, when the grain dryers are operating at harvest time, dairy operators encounter increases in behavior, health, and production problems of the dairy cows.

4. Attempts to mitigate stray voltage have produced mixed results: Behavior, health, and production problems in dairy herds are so common internationally that not only is every effort made by the dairy operator to prevent the problems, but numerous mitigation concepts have been developed to ameliorate the problems. Some of these are separating the primary and secondary neutrals, installing isolation transformers, separating the grounds and neutral on the farm, changing the grounding on the farm, equipotential plane, electronic grounding system, moving the utility transformer ground further from the farm, disconnecting primary grounding wires, placing electric current trap in the path of the current in the earth, a ring of interconnected ground rods surrounding the farm, and cattle housing that is electrically isolated from the earth. Except for the equipotential plane and the electronic grounding system, all of these mitigation concepts have developed, primarily, to reduce the exposure of the cattle to ground currents. Those that have been most successful have done the best job of reducing the amount of current reaching the cows through the ground. Since these are for mitigation, none are able to solve the basic problem and eliminate the effects.

5. General observations: Cutting off the electric power to the farm does not consistently reduce the measurable electricity in the barn to which the cows could be exposed. On some farms the magnitudes decrease and on others they increase. There are many sources for electricity capable of reaching the dairy cows when they are housed in the barn. When all electrical equipment and the total electrical system on the farm is functioning appropriately, electricity capable of reaching the cows is in direct relation to the current accessing the earth by means of the neutral wire. This amount of electricity is in direct proportion to the unbalanced 110 VAC loads on the farm. When there is no electrical use on the farm, no electric current reaches the cows by means of the farm system. Electrical current is also capable of reaching the cows from the electric utility system. Various conductors connected to the neutral side of the utility system are also connected to the farm neutral. A major connection is the common utility-farm neutral at the transformer. A fraction of the neutral current in the utility system, usually estimated at 40 percent, flows in the farm

neutral. With no wire connection, the electricity reaches the cows by means of earth pathways. The electricity in the earth caused by the general use of the earth to carry current in the electrical distribution system is literally reaching all living organisms, whether in the dairy barn or in other work or living spaces. This is another of many means by which living organisms are exposed to EM energy. In the dairy barn the ground connection may be a major source. Measurements of the electrical environment of the cows indicate the presence of both alternating currents and direct currents emanating from the earth (Dahlberg and Falk 1995).

Conclusions

The health of the environment is a determining factor in the health of all life in that environment. Under some circumstances human ingenuity in treatment of illnesses can delay and reasonably mitigate the effects of an unhealthy environment. Under other conditions or over time, however, the effects of an unhealthy environment may slowly or rapidly wear on the health of life in that environment. A population of well over 5 billion people in a world with no new frontiers is extremely vulnerable to unhealthy changes in the environment. This world condition is a compelling reason for seriously monitoring the changes in the environment and constantly assessing the effects of those changes. An important change, which has escalated since its inception over a century ago, is the addition of EM energy to the environment. An especially important aspect of this change is the extensive use of the earth to carry electric current. After nearly a century of the use of the earth to carry current, little is known about the paths of these currents or the effects of these currents on either the animate or inanimate world. In fact, archaic models still dominate the regulatory agencies' concept of how EM energies interact with life. Even in decisions regarding research directions, these outmoded models are still applied. Stray voltage research and the ground current connection have provided valuable insights for connecting exposure to EM energies associated, primarily, with electric currents in the earth to human and animal health and behavior. There is a clear need to test new models that are consistent with the electrical nature of living organisms and the complexity of our environment.

Campo-Cottonwood Sole Source Aquifer

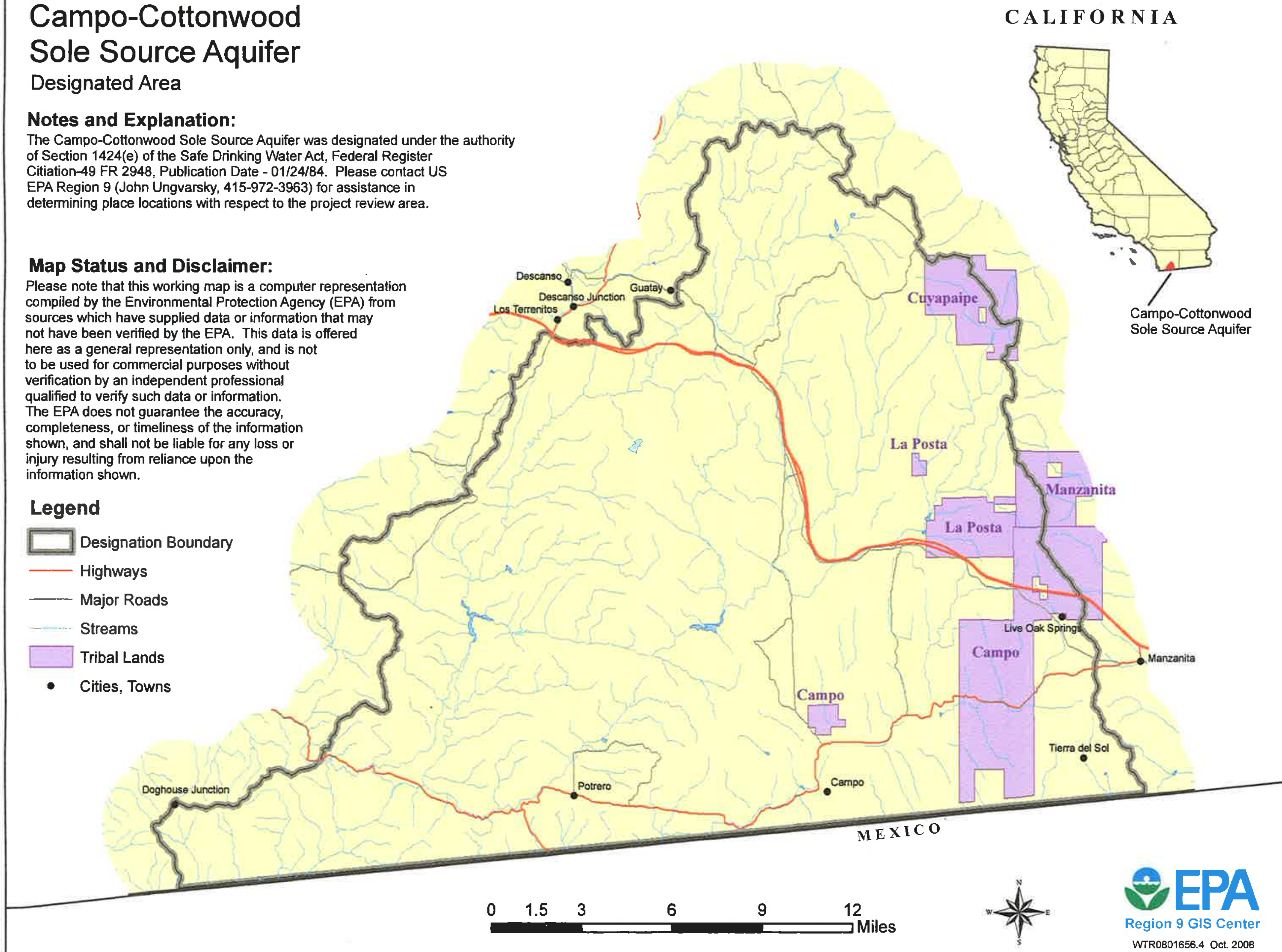
Designated Area

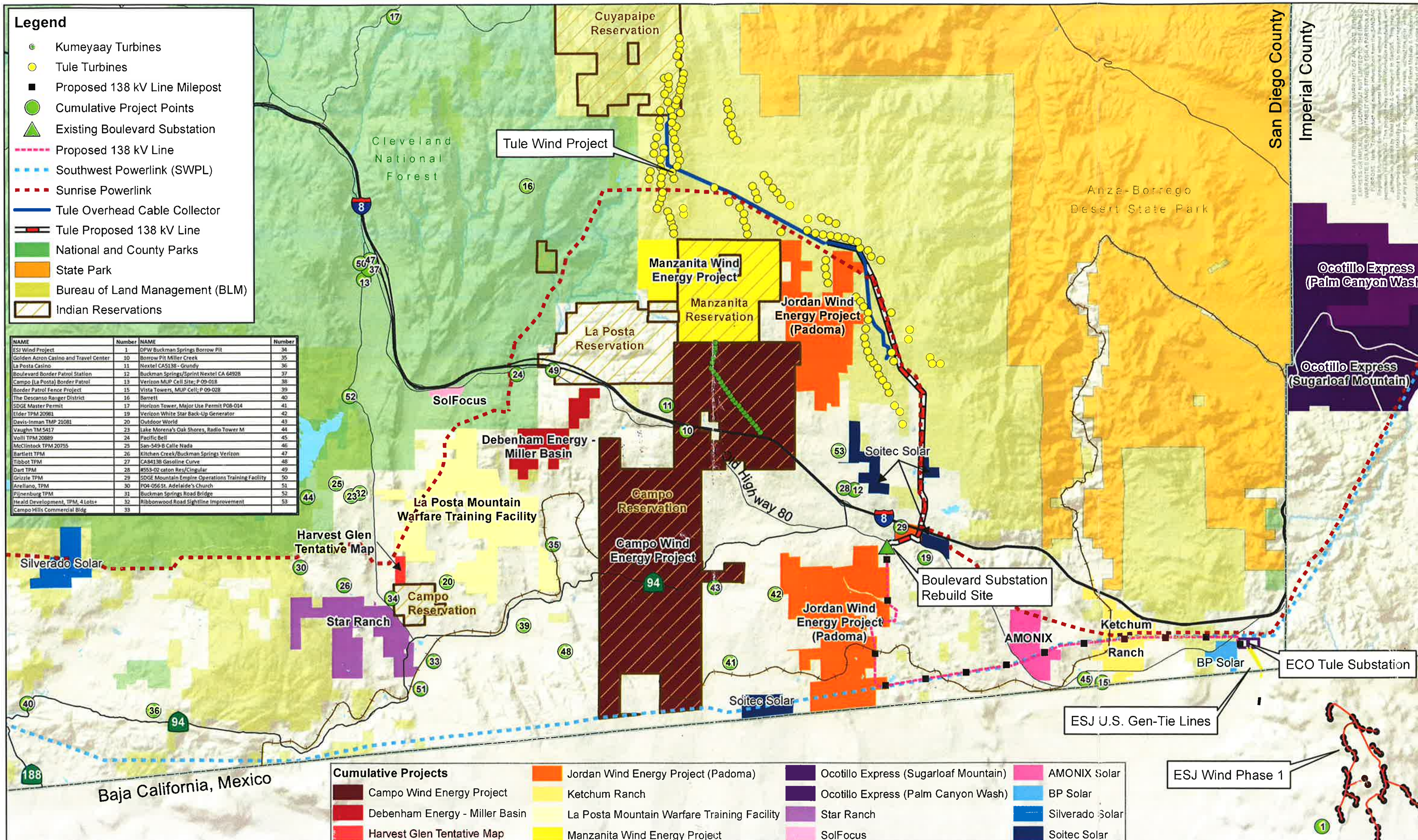
Notes and Explanation:

The Campo-Cottonwood Sole Source Aquifer was designated under the authority of Section 1424(e) of the Safe Drinking Water Act, Federal Register Citiation-49 FR 2948, Publication Date - 01/24/84. Please contact US EPA Region 9 (John Ungvarsky, 415-972-3963) for assistance in determining place locations with respect to the project review area.

Map Status and Disclaimer:

Please note that this working map is a computer representation compiled by the Environmental Protection Agency (EPA) from sources which have supplied data or information that may not have been verified by the EPA. This data is offered here as a general representation only, and is not to be used for commercial purposes without verification by an independent professional qualified to verify such data or information. The EPA does not guarantee the accuracy, completeness, or timeliness of the information shown, and shall not be liable for any loss or injury resulting from reliance upon the information shown.





NAME	Number	NAME	Number
ESJ Wind Project	1	DPW Buckman Springs Borrow Pit	34
Golden Acron Casino and Travel Center	10	Borrow Pit Miller Creek	35
La Posta Casino	11	Nextel CA5138 - Grundy	36
Boulevard Border Patrol Station	12	Buckman Springs/Sprint Nextel CA 64928	37
Campo (La Posta) Border Patrol	13	Verizon MUP Cell Site; P 09-018	38
Border Patrol Fence Project	15	Vista Towers, MUP Cell; P 09-028	39
The Descanso Ranger District	16	Barrett	40
SDGE Master Permit	17	Horizon Tower, Major Use Permit P08-014	41
Elder TPM 20981	19	Verizon White Star Back-Up Generator	42
Davis-Inman TMP 21081	20	Outdoor World	43
Vaughn TM 5417	23	Lake Morena's Oak Shores, Radio Tower M	44
Volli TPM 20889	24	Pacific Bell	45
McClintock TPM 20755	25	San-549-B Calle Nada	46
Bartlett TPM	26	Kitchen Creek/Buckman Springs Verizon	47
Tibbot TPM	27	CA84138 Gasoline Curve	48
Dart TPM	28	#553-02 caton Res/Cingular	49
Grizzle TPM	29	SDGE Mountain Empire Operations Training Facility	50
Arellano, TPM	30	P04-056 St. Adelaide's Church	51
Pijnenburg TPM	31	Buckman Springs Road Bridge	52
Heald Development, TPM, 4 Lots+	32	Ribbonwood Road Sightline Improvement	53
Campo Hills Commercial Bldg	33		

LUEGGIS

Cumulative Projects Overview Map

East County Substation/ Tule Wind/Energia Sierra Juarez

Source: Dudek, SanGIS, ESRI
File: K:\20120111_Tule\tule_wind.mxd 1/19/2012

EXECUTIVE SUMMARY

SCOPE OF PROJECT

The Campo Band of Mission Indians (Tribe), as a cooperating agency, has applied to the Bureau of Indian Affairs (BIA) for the approval of a lease agreement between the Tribe and Invenergy Wind California, LLC (IWC), to develop the proposed Shu'luuk Wind Project on the Campo Indian Reservation (Reservation). The proposed action for the purposes of the National Environmental Policy Act (NEPA) is the approval by the BIA of the lease agreement to develop the Shu'luuk Wind Project. The construction, operation, and eventual decommissioning of the Shu'luuk Wind Project is the proposed project that would be enabled by the approval of the lease agreement. This Environmental Impact Statement (EIS) evaluates the potential environmental effects, or "impacts," of the project alternatives. The terms "effects" and "impacts" are synonymous for the purpose of this document.

PURPOSE AND NEED

The purpose and need for the BIA's proposed action is to consider the Tribe's request for a lease of trust land consistent with its role overseeing trust lands and with federal leasing law/regulations. A secondary purpose in considering approval of the Tribe's proposed lease is to increase national and tribal renewable energy sources to increase federal energy independence and decrease greenhouse gas emissions as encouraged by state and federal law.

Federal law states that the Secretary of the Interior may approve leases of trust lands for a variety of uses that including public, religious, educational, recreational, residential, or business purposes. Prior to approval of any lease, the Secretary of the Interior is required to first determine that adequate consideration has been given to the factors in 25 USC 415(a).

The regulations implementing 25 USC 415 are located in 25 CFR Part 162. According to Part 162, in reviewing a proposed lease, the BIA will defer to the landowners' determination that the lease is in their best interest to the maximum extent possible. Approval of the proposed lease will satisfy several needs/interests, including improving the economic conditions of the Tribe through lease revenue and job creation, and utilizing the renewable resource (wind) that is found in abundance on the Reservation to meet existing and future regional electricity demands.

PROJECT LOCATION

All facilities proposed through the lease with IWC would be contained within the boundaries of the Reservation in southeastern San Diego County, approximately 60 miles east of San Diego, California, and in the vicinity of the unincorporated communities of Campo, Boulevard, and Live Oak Springs.

PROPOSED ACTION AND ALTERNATIVES

Three build alternatives and a No Action Alternative are analyzed in this document. The build alternatives differ in their overall energy generating capacity, the method of renewable energy generation, and the sizes of turbines that would be utilized, resulting in a variety of turbine layouts due to spacing needs for different sizes of turbines.

Alternative 1 would consist of constructing and operating wind turbines that would generate approximately 250 megawatts (MW), with up to 85 wind turbines capable of generating 3MW each.

Alternative 2 would consist of constructing and operating a combination of wind turbines and solar photovoltaic (PV) panels that would generate approximately 200MW, with up to 80 wind turbines capable of generating 2MW each (totaling 160MW) in combination with 40 solar PV panels capable of generating 1MW each (totaling 40MW).

Alternative 3 would consist of constructing and operating wind turbines that would generate approximately 160MW, with up to 71 wind turbines capable of generating 2.3MW each, or with a smaller number of turbines of higher individual generating capacity, up to 3MW.

No Action Alternative would consist of constructing and operating no electricity-generating facilities.

Table ES-1 compares the electricity-generating components of the three proposed build alternatives and the No Action Alternative.

TABLE ES-1 ALTERNATIVES COMPARISON

Alternative	Maximum Number of Potential Turbines	Wind Turbine Generating Capacity (MW)	Hub Height (feet)	Rotor Diameter (feet)	Tip Height (feet)	Maximum Number of Solar PV Panels	Solar PV Panel Generating Capacity (MW)	Total MW
Alternative 1	85	3	308	414	515	0	0	250
Alternative 2	80	2	279	338	448	40	1	200
Alternative 3	71	2.3–3	262–308	354–414	428–515	0	0	160
No Action Alternative	0	0	0	0	0	0	0	0

Table ES-2 describes project components that would be common to all three build alternatives.

A connected project undergoing separate environmental review under the California Environmental Quality Act is San Diego Gas & Electric's (SDG&E) proposal to upgrade the existing Campo to Boulevard transmission line. SDG&E's project is not a part of the proposed BIA action or of the proposed project and is not subject to NEPA. Electricity generated by the proposed project would be transmitted to SDG&E's proposed interconnection transmission line. The transmission line's general environmental effects are discussed in this EIS as a connected project.

TABLE ES-2 SUMMARY OF PROPOSED COMPONENTS COMMON TO EACH ALTERNATIVE

Project Component	Description
Roads	Approximately 25 miles of new roads that would range from 25 to 40 feet wide during construction and that would be reduced to 16 feet wide after construction.
Electrical Collection and Communications System	Approximately 52 miles of underground cables installed.
Project Substation	An on-Reservation substation would collect the energy generated and transform it from 34.5kV to 138kV. The completed structure would be 190 feet by 190 feet with a parking area.
Transmission Lines	Up to 5 miles of a new three-phase 138kV overhead interconnection transmission line.
Operations and Maintenance (O&M) Facility	An O&M facility would be constructed on the Reservation occupying approximately 2 acres.
Meteorological Towers	Up to three meteorological towers would be constructed and would occupy 0.1 acre each.
Water Collection	Water provided by existing on-Reservation groundwater wells, and possibly reclaimed wastewater, supplemented during construction with water purchased from Campo Materials and/or off-Reservation water purveyors. Water demand would be approximately 125,000 gallons per day during construction and 210 gallons per day during operation.
Temporary Batch Plant	A batch plant for supplying concrete, occupying 3.7 acres and operating only during construction.
Central Staging and Laydown Areas	A central staging area would occupy approximately 20 acres during construction. In addition, a laydown area at each turbine site would occupy an approximate 100-foot by 200-foot area during construction.
Connected Project	SDG&E Interconnect Project consisting of (1) the rebuilding of the existing SDG&E poles and transmission line TL6931; and (2) installation of poles to accommodate a 138kV interconnection power line.

AFFECTED ENVIRONMENT

The Reservation, which covers over 16,000 acres and includes lands both north and south of Interstate 8 (I-8) along the Tecate Divide, extends from the Manzanita Indian Reservation south to approximately 0.25 mile north of the United States (U.S.)/Mexico International Border. The project-related portion of the Reservation is in the vicinity of the communities of Boulevard and Live Oak Springs, and is bisected by Church Road. On-site elevation ranges from approximately 3,030 to 4,320 feet above mean sea level. Scattered, low-density commercial and residential developments are located within and adjacent to the Reservation.

The Reservation's topography exhibits moderate to steep relief on a semi-arid plateau adjacent to the Laguna Mountains. The area is in a desert transition zone, supporting a variety of habitat types and vegetation communities. The Reservation is in the central part of the Peninsular Ranges geomorphic province, where altitude and relief generally decrease from east to west. Earthquake activity, also known as seismicity, is common throughout the southern California region, but the portion of the Peninsular Ranges in the vicinity of the Reservation appears to be seismically quiescent at present.

Little surface water occurs on the Reservation during most of the year. Domestic water use on the Reservation is completely dependent on groundwater supplies. The Reservation is not connected to municipal water systems, but the Tribe operates four Public Water Systems that serve the Reservation.

The Reservation is within the boundaries of the San Diego air basin, but is not subject to the jurisdiction of the San Diego County Air Pollution Control District. The San Diego air basin has been designated by U.S. Environmental Protection Agency as a marginal nonattainment area for the 2008 primary and secondary federal ozone National Ambient Air Quality Standards. The western portion of the San Diego air basin is currently designated as a federal carbon monoxide attainment-maintenance area following its 1998 carbon monoxide redesignation from nonattainment to attainment. However, the project is located in the eastern portion of the San Diego Air Basin, outside of the designated carbon monoxide attainment-maintenance area.

Biologically, the Reservation is in a desert transition zone, with elevations ranging from approximately 3,000 to 4,300 feet above mean sea level, with large, intact expanses of relatively undisturbed habitats. Dense chaparral covers much of the undeveloped portions of the Reservation, with oak woodlands and riparian habitats present along scattered canyons. No federally listed plants are expected to occur on-site. Suitable habitat for the endangered Quino checkerspot butterfly is present, and the species has been observed on the Reservation. The Reservation has moderate potential for the endangered least Bell's vireo to use suitable habitat for breeding and foraging, but the species has not been observed on-site. The endangered southwestern willow flycatcher may use the Reservation for migration stopover but has not been observed on-site. There is low potential for the endangered California condor to use the Reservation for foraging, but the species has not been documented on-site.

Cultural resource records searches and surveys of the Reservation have identified 73 cultural resource sites in areas that could be affected by the proposed project. Socioeconomically, the lack of economic diversity and resulting lack of jobs on or near the Reservation contribute to a low level of employment and low incomes, leading to a high reliance upon government-funded programs and supplemental income. Revenue sources are limited; there are limited opportunities for farming and no significant mineral resources. Other than the Tribe's Golden Acorn Casino and the existing wind farm, few reliable income streams exist.

Partly due to the remote location and sparse population in and around the Reservation, public streets are few but street segments and intersections generally operate at acceptable levels of service. Noise sources in the project area include traffic on local and regional roadways, existing turbines, the Golden Acorn Casino, the La Posta Casino, farm equipment, off-highway recreational vehicles, civilian and military aircraft, and occasional gunfire from the La Posta Satellite Station/Navy Seal Mountain Training Center. Ambient noise levels on the Reservation range from approximately 44 to 62 A-weighted decibels Community Noise Equivalent Levels.

Much of the Reservation is open space with some ranching infrastructure that is no longer in use; principal development consists of I-8, the Golden Acorn Casino, and the existing Kumeyaay Wind Project, which are the only major sources of night lighting. A search of hazardous materials databases identified no recognized environmental conditions on the Reservation. The project alternatives would be in open land characterized by native vegetation, minimal development, and arid conditions, and would be generally susceptible to wildfires. The Campo Reservation Fire Protection District serves the Campo, La Posta, Manzanita, Jamul, and Ewiiaapaayp Indian Reservations and some surrounding unincorporated lands. The Campo Reservation Fire District are the structure fire service for the Reservation. Through statewide agreement and annual state wide operating plan between the BIA Pacific Region and California Department of Forestry and Fire Protection (Cal Fire), is the primary wildland fire response agency for all trust land except Hoopa and Tulie River. The BIA Pacific Region additionally has an agreement with Campo to provide wildland fire protection. Cal Fire has primary responsibility for responding to wildland fires on the Reservation.

SUMMARY OF EFFECTS AND MITIGATION MEASURES

This EIS examines the potential environmental effects as a consequence of the proposed project's development on land resources, water resources, air quality, biological resources, climate change, cultural resources, socioeconomic conditions, resource use patterns, traffic and transportation, noise, visual resources, public health and safety, and cumulative effects. This section provides an overview of the effects and mitigation measures identified in Chapter 4 of this EIS, and provides a summary of unavoidable adverse effects, significant effects, less than significant effects, and mitigation measures that would avoid or minimize effects.

UNAVOIDABLE ADVERSE EFFECTS

The proposed project would have unavoidable adverse effect related to biological resources, noise, and visual resources.

Biological Resources

Effect **BIO-3:** Each of the build alternatives could have an unavoidable adverse effect on a sensitive species afforded protection under federal law or regulation.

The red-tailed hawk is an avian species afforded federal protection under the Migratory Birds Treaty Act, is the most common raptor species nesting within the Reservation in 2010 and 2011, and accounted for over 50% of the raptor observations on-site. Raptors are vulnerable to collisions, often fatal, with wind energy facilities, especially with turbine blades. Given the abundance of red-tailed hawks, overall raptor mortality rates are expected to be at a level similar to the mean calculated for other projects in the western portion of the Pacific Flyway. Mitigation measures (MM) BIO-2(a) through MM BIO-2(b) and MM BIO-3(a) through MM BIO-3(g) (see Table ES-3), would reduce the severity of the impact, but the impact would remain significant. No practicable or feasible measures are available that would fully mitigate the effect.

Direct mortality to bat species associated with collisions and/or barotrauma as a result of wind turbine operation would be considered a significant adverse effect because bat species are considered sensitive wildlife species for the purposes of this EIS. The effect of this mortality on the local bat species populations would likely be minimal. MM BIO-2(a) through MM BIO-2(c) and MM BIO-3(d) are provided to avoid, minimize, and mitigate adverse effects to bats. Although measures would be implemented to reduce effects associated with bat collisions and/or barotrauma, these effects would be considered significant and unavoidable.

In addition, these effects of the proposed project to protected bird and sensitive bat species would represent a significant contribution incrementally to adverse cumulative effects to these species. The proposed project would result in a significant contribution incrementally to adverse cumulative effects on avian migration routes may reduce the number of avian migrants successfully migrating through the geographic scope

Socioeconomic Conditions

Impact **SOCIO-4**: Unavoidable noise and visual resources effects from the completed project would affect minority and/or low-income populations to a greater extent than the general population or would be predominantly borne by minority or low-income populations.

The visual and noise effects identified in this EIS (see "Noise" and "Visual Resources and Aesthetics" below) would be experienced equally among the affected population. The population of this area of San Diego County is identified in census data as predominantly low-income. Therefore, noise and visual effects on a low-income population would result from implementation of the proposed project that would be significant disproportionate, and unavoidable. The project may also have a beneficial effect on income of members of the Tribe, a minority and low-income population.

Noise

Effect **NOI-1**. Expose persons to or generate noise levels in excess of applicable standards. A day-night noise level (Ldn) of 55 A-weighted decibels (dBA) at any preexisting noise-sensitive area is established as the applicable standard based on U.S. Environmental Protection Agency application of standards developed by the Federal Energy Regulatory Commission. Each of the build alternatives would expose persons to or generate noise levels in excess of these applicable standards.

Impact **NOI-4.** Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project. Construction activities for each of the build alternatives would result in a substantial temporary increase in ambient noise levels in the project vicinity above levels existing without the project. A 12 dBA L_{eq} or greater increase in noise would be a substantial increase in ambient noise. Noise levels on and off the Reservation boundary would likely experience an increase in daytime ambient noise levels of between 18 and 44 dBA L_{eq}. Similarly, on-Reservation structures could be exposed to noise level increases of up to 20 dBA.

The effects related to exposure of persons to noise in excess of applicable standards and the substantial permanent and temporary increase in ambient noise levels in the project vicinity would be significant. No practicable and feasible mitigation that would fully mitigate these effects has been identified.

Visual Resources

Effect **VIS-1**: Each of the build alternatives could have an unavoidable adverse effect on a scenic vista.

Project-related construction and some of the wind turbines proposed under Alternatives 1, 2, and 3 would be visible from public and private vistas, and would represent a new and, from certain vantages, prominent element in a sparsely developed and rural area. The severity of this effect is reduced under Alternative 2, and further reduced under Alternative 3, as a consequence of the reduced number of proposed turbines. MM VIS-1a through MMVIS-1c as stated below in Table ES-3, would reduce this effect by limiting the visibility of construction activities and by proposing muted colors for project-related features. However, even with the implementation of mitigation, this effect would remain significant and adverse.

ADVERSE EFFECTS THAT CAN BE MITIGATED

Table ES-3 contains all significant effects for which mitigation is identified in this EIS. The impacts and mitigation listed here would be applicable to all build alternatives. Table ES-3 includes mitigation for issues related to biological resources, visual resources, and noise, but the mitigation for the specific impacts related to these resources identified in the preceding section would not reduce impacts to a level less than significant.

TABLE ES-3 SIGNIFICANT EFFECTS AND MITIGATION

Effect	Mitigation
Land Resources	
LR-4 The project has the potential to expose people or structures to adverse effects from seismic events (earthquakes), including fault rupture, and seismically induced ground shaking that resulted in landslides, liquefaction, settlement, lateral spreading, and/or surface cracking.	**LR-4** If high levels of ground shaking (such as Modified Mercalli Intensity VI or greater) are experienced on the Reservation or a major earthquake (magnitude 6.0 and above) occurs along the Elsinore Fault, it is recommended that a licensed professional geologist, geotechnical engineer, and/or structural engineer hired by the project applicant perform facilities inspections following the event. Careful examination would be conducted of all project facilities. Any required repair or needed improvements would be implemented as soon as feasible to ensure that the integrity of project facilities has not been compromised.
Biological Resources	
BIO-1 The project could have an adverse effect on any riparian habitat or other sensitive natural community regulated or protected under federal law and regulation	**MM BIO-2(a): Project Biologist(s):** It is recommended that a project biologist(s) approved by the USFWS and Tribe, be designated by IWC for the project. IWC would submit the names, documented experience, any permit numbers, and resumes for the project biologist(s) to the USFWS and Tribe for approval prior to initiation of construction. The project biologist(s) would be responsible for the following: • Conducting an environmental training program to make construction site personnel aware of sensitive biological resources occurring on-site and all permit requirements protecting these resources. • Regularly monitoring construction activities and ensuring that construction is proceeding in compliance with all permit requirements specific to biological resources. • Maintaining communications with the appropriate personnel (project manager, resident engineer) to ensure that issues relating to biological resources are appropriately and lawfully managed. • Reporting any noncompliance issues to the resident engineer, USFWS and Tribe. **MM BIO-3(a): Implementation of USFWS-issued Terms and Conditions:** All terms and conditions developed as part of the Section 7 consultation process with the USFWS and provided in the project's Biological Opinion would be implemented. Terms and conditions would apply to federally listed species that may be affected by the project (i.e., Quino, least Bell's vireo, southwestern willow flycatcher, and California condor). Ratios for habitat-based mitigation would be finalized during the Section 7 consultation process. See Section 4.4.2 (Effect BIO-3 for anticipated terms and conditions). Terms and conditions outlined in the project's Biological Opinion would take precedence over the measures outlined herein.
BIO-2 The project could have an adverse effect on federally regulated wetlands as defined by Section 404 of the Clean Water Act, through direct removal, filling, hydrological interruption, or other means.	**MM BIO-2(a): Project Biologist(s):** It is recommended that a project biologist(s) approved by the USFWS and Tribe, be designated by IWC for the project. IWC would submit the names, documented experience, any permit numbers, and resumes for the project biologist(s) to the USFWS and Tribe for approval prior to initiation of construction. The project biologist(s) would be responsible for the following: • Conducting an environmental training program to make construction site personnel aware of sensitive biological resources occurring on-site and all permit requirements protecting these resources. • Regularly monitoring construction activities and ensuring that construction is proceeding in compliance with all permit requirements specific to biological resources. • Maintaining communications with the appropriate personnel (project manager, resident engineer) to ensure that issues relating to biological resources are appropriately and lawfully managed. • Reporting any noncompliance issues to the resident engineer, USFWS and Tribe.

Effect	Mitigation
	MM-BIO-2(b): Environmental Training Program: It is recommended that a Worker Environmental Awareness Plan (WEAP) be developed and implemented prior to the start of construction. This plan would be used by the project biologist(s) to conduct environmental training for construction personnel. All construction site personnel would be required to attend the environmental training in conjunction with hazard and safety training prior to working on-site. **MM-BIO-2(c):Weed Management:** It is recommended that a Weed Management Plan be developed and approved by the Tribe prior to the commencement of construction activities. The plan would include a variety of measures that would be undertaken during construction, O&M, and decommissioning activities to prevent the introduction and spread of new weed species. The plan would also address monitoring and educating personnel on weed identification and methods for avoiding and treating infestations. Weed control methods may include both physical and chemical control. If mulch is used, it is required to be certified weed-free. **MM-BIO-2(d): Jurisdictional Waters and Wetlands Compensation:** Temporary and permanent effects to jurisdictional waters and wetlands would be mitigated per the project's CWA permit conditions. Temporary effects would be restored in place on-site to pre-activity conditions; permanent effects would be mitigated through an USACE-approved mitigation bank and/or in-lieu fee program.
BIO-3 The project could have an adverse effect on sensitive species afforded protection under federal law and regulation	**MM BIO-3(a): Implementation of USFWS-issued Terms and Conditions:** All terms and conditions developed as part of the Section 7 consultation process with the USFWS and provided in the project's Biological Opinion would be implemented. Terms and conditions would apply to federally listed species that may be affected by the project (i.e., Quino, least Bell's vireo, southwestern willow flycatcher, and California condor). Ratios for habitat-based mitigation would be finalized during the Section 7 consultation process. Terms and conditions outlined in the project's Biological Opinion would take precedence over the measures outlined herein. MM BIO-3(a)(i): Onsite Mitigation for Temporary Effects to Quino Habitat: Natural habitat (i.e., natural vegetation communities excluding disturbed and developed land) temporarily affected during construction or during unscheduled turbine maintenance would be revegetated in place with native species characteristic of suitable Quino habitat, including potential host plant species. A Revegetation and Habitat Management Plan would be developed and approved by the USFWS, Tribe, and IWC to guide revegetation efforts. The Revegetation and Habitat Management Plan would be developed to provide the USFWS with assurances that revegetation efforts would be successful and designed to meet specific objectives. MM BIO-3(a)(ii): Offsite Mitigation for Permanent Effects to Quino Habitat: Quino habitat permanently affected during construction of the project would be offset by off-site habitat acquisition and perpetual management, as determined in consultation with USFWS. A Quino Conservation Plan specifying offsite mitigation requirements for the species would be submitted to and approved by the USFWS, Tribe, and IWC prior to construction. MM BIO-3(a)(iii): Hilltopping Habitat Avoidance: During initial micro-siting efforts for ridgeline wind turbines located within mapped suitable Quino habitat where hilltopping micro-habitat may be present, a permitted Quino biologist familiar with hilltopping behavior and habitat would be present to ensure that wind turbines are initially micro-sited to avoid optimum hilltopping habitat for the species to the maximum extent practicable. Hilltopping habitat primarily used by Quino would be evaluated based on the slope grade; presence and location of shrubs, trees, and boulders; and extent of open, exposed ground. The permitted Quino biologist would make recommendations during the initial micro-siting effort to avoid effects to optimum hilltopping habitat.

Effect	Mitigation
	MM BIO-3(a)(iv): Construction Fencing, Signage, and Kiosks: Construction fencing and/or signage would be installed when construction of the project occurs immediately adjacent to mapped suitable Quino habitat to prevent unnecessary intrusion into suitable Quino habitat. Following construction, educational kiosks summarizing Quino biology and site restrictions designed to protect the species would be installed at primary access points to the site and at the O&M building. Signage would be installed where high-use areas of the lease area border suitable Quino habitat to prevent intrusion into sensitive habitat and remind personnel of restrictions regarding activities within these areas. MM BIO-3(c)(v):Seasonal Avoidance: To the extent practicable, all construction clearing and grubbing in mapped suitable Quino habitat associated with construction of the project would occur when adult and larval activity is reduced and host plants are not generally flowering or germinating, as determined by the USFWS. Vegetation management during the O&M phase of the project would also occur when adult and larval activity is reduced and host plants are not generally flowering or germinating, to the extent practicable. **MM BIO-3(b): Vegetation Clearing Seasonal Avoidance/Nest Clearance Surveys:** It is recommended that vegetation clearing take place outside of the general avian breeding season (February 15-August 15) when practicable. If it is not practicable to conduct vegetation clearing outside the general avian breeding season, it is recommended a project biologist, with a minimum of three years of experience conducting migratory bird surveys and implementing the requirements of the MBTA, conduct a nest clearance survey within 500 feet of a vegetation clearance area no more than 5 days prior to vegetation clearing. Vegetation clearing crews would coordinate with the project biologist prior to the start of construction to ensure the area has been adequately surveyed. If no active nests are discovered, vegetation clearing may proceed. If an active nest is discovered, the nest and an avoidance buffer (at least 300 feet for passerines and at least 500 feet for raptors) would be flagged or otherwise marked for avoidance. The project biologist would monitor any active nest discovered on at least a weekly basis to track the status of each nest. Vegetation clearing would not take place within the avoidance buffer until nesting is complete (i.e., nestlings have fledged or nest has failed), as determined by the project biologist. If clearing in a given area ceases for 5 or more consecutive days during the nesting season, repeat nest clearance surveys would be required to ensure new nesting locations have not been established. **MM BIO-3(c): Construction Seasonal Avoidance/Preconstruction Surveys:** Construction (non-vegetation clearing activities; see MM BIO-3(b) for vegetation clearing restrictions) that cannot occur outside the general avian breeding season (February 15 through August 15) would proceed under the following recommended protocols. If nest clearance surveys (see MM BIO-3(b)) have not been conducted within 5 days of the start of construction, the project biologist would conduct a preconstruction nest survey within 500 feet of the construction area no more than 5 days prior to the start of construction in a given area of the construction footprint. Construction crews would coordinate with the project biologist prior to the start of construction to ensure the area has been adequately surveyed. If no active nests are discovered, construction may proceed. If an active nest is discovered, the nest and an avoidance buffer (at least 300 feet for passerines and at least 500 feet for raptors) would be flagged or otherwise marked prior to the start of construction. The project biologist would coordinate with construction crews to determine the types of construction activities that may take place within the avoidance buffer. The following would be taken into consideration when determining whether a construction activity may take place within the avoidance buffer: (1) location of nest; (2) status of nesting; (3) species-specific sensitivity to potential disturbances associated with an activity; (4) type, duration, and timing of construction activity; (5) existing level of

Effect	Mitigation
	disturbances; and (6) influence of other environmental factors on potential disturbances. The project biologist would be responsible for monitoring any active nests discovered on at least a weekly basis to track the status of each nest. Should the project biologist determine that construction activities may disturb the nesting activity, then construction activities will cease within the buffer until nesting is complete. If construction in a given area ceases for 5 or more consecutive days during the nesting season, repeat preconstruction surveys would be required to ensure new nesting locations have not been established. **MM BIO-3(d): Bird and Bat Conservation Strategy:** It is recommended that a Bird and Bat Conservation Strategy (BBCS) be developed and implemented in coordination with USFWS. The BBCS would be developed to achieve the following objectives: 1. Prepare a written record of actions to avoid minimize and compensate for potential adverse effects. 2. Explain the analysis, studies, reasoning, that supports progressing from tiers. 3. Describe the steps taken to apply the guidelines to mitigate for adverse effects. 4. Describe postconstruction monitoring. **MM BIO-3(e): Removal of Overhead Powerlines:** It is recommended that, where possible, overhead power lines and poles no longer required for transmission or distribution of electricity be removed from the lease area. **MM BIO-3(f): Removal of Large Animal Carcasses:** It is recommended that all large animal carcasses (i.e., domestic livestock, feral animal, or big game) incidentally found within the lease area during O&M activities be removed from the site to prevent attraction of California condors and golden eagles. **MM BIO-3(g): Coordination with the San Diego Zoo ICR:** It is recommended that IWC coordinate with the San Diego Zoo ICR regarding the zoo's monitoring program for the condor population in Baja California. Detailed monitoring requirements would be outlined in the BBCS (MM BIO-3(d)). **MM BIO-3(h): Eagle Conservation Plan:** It is recommended that an Eagle Conservation Plan (ECP) be developed for the project, in coordination with the USWFS. The ECP would be developed to achieve the following objectives: 1. Document the results of preconstruction eagle studies for the project. 2. Estimate potential effects that could result from project construction, O&M, and decommissioning. 3. Describe measures that would be implemented during all stages of the project to avoid and reduce potential effects to eagles. 4. Describe postconstruction monitoring procedures to determine eagle fatality rates and compare with expected rates estimated during preconstruction assessments. 5. Develop an adaptive management plan to inform possible additional actions if mortality rates exceed those anticipated during preconstruction assessments.
Cultural Resources	
CUL-1 The project could indirectly displace, destroy, or alter known important cultural artifacts, features, sites, buildings, or structures that contribute to the eligibility of an archaeological or historic site.	**CUL-1a** When a known cultural resource site is located within proximity to construction operations, it is recommended that the project archaeologist or tribal monitor determine if additional steps should be taken to protect the resources based on the potential for construction operations to inadvertently encroach in to the cultural resource site. The project archaeologist or tribal monitor may require that the resource site be temporarily fenced during construction, posted with temporary

Effect	Mitigation
The project could directly or indirectly displace, destroy, or alter an unknown important cultural artifact, feature, or site that contributes to the eligibility of an archaeological or historic site.	signage notifying workers of proximity of the sensitive resource, facilitate a meeting with workers to clarify procedures, or recommend other measures deemed appropriate for resource protection. Realignment of the roadway that would otherwise impact resource SDI-20592 must be undertaken to avoid the resource. **CUL-1b** It is recommended that an archaeological and tribal monitor be present during all ground-disturbing activities. The tribal monitor would accompany a qualified archaeologist to identify, and determine the significance of, cultural resources and/or sacred lands. Both the archaeologist and tribal monitor would observe ground-disturbing activities and/or other scientific surveying that may occur in preparation for construction activities. Should a previously unknown archaeological deposit and/or feature be encountered during construction activities, the tribal monitor and archaeologist would have the authority to divert or halt ground-disturbing activities for the purposes of determining the significance of the resource. Isolated artifacts and minor (nonsignificant) deposits would be documented in the field, allowing grading to proceed. If determined to be potentially significant resource, an ADRP would be prepared and implemented in consultation with the Tribe's cultural resources experts. Ground-disturbing activities would cease until implementation of the ADRP to the satisfaction of the Tribe's cultural resources experts.
CUL-2 The project could directly or indirectly disturb any human remains, including those interred outside of formal cemeteries or other known burial sites.	**CUL-2** If human or nonhuman remains are found, it is recommended that construction be immediately suspended within a minimum 25-foot radius of the discovery and the San Diego County Coroner shall determine if the remains are human or nonhuman. For human remains, the archaeologist and tribal monitor would protect discovered remains and/or burial goods remaining in the ground from additional disturbances, as required under NAGPRA. Further construction would be halted in areas in which Native American remains and/or burial goods are discovered until further examination and appropriately identified actions are taken. Excavation or removal of the human remains and other cultural items may take place only with the consent of the Tribe and by a qualified archaeologist, and must follow the requirements of ARPA (16 USC 470aa et seq.) and its implementation regulations.
	Socioeconomic and Environmental Justice
SOCIO – 4 The project would disproportionately affect a minority or low-income population (noise and visual effects)	**SOCIO – 4** See **NOI-4** and **VIS-1**
	Traffic and Transportation
TRA-2 The project could degrade road conditions as a result of construction vehicles on public roads causing conditions such as pot holes.	**TRA-2** Repair roadways damaged by construction activities. It is recommended that the Tribe and the BIA Roads Branch perform site inspection before project start and after project completion to insure quality of roadways are not compromised by construction traffic. If damage to roads occurs, it is recommended that the applicant coordinate repairs with the affected Tribal and public agencies to ensure that any impacts to area roads are adequately repaired at the applicant's cost, pursuant to the lease and all applicable permits. It is recommended that roads disturbed by construction activities or construction vehicles be properly restored to ensure long-term protection of road surfaces. This would include consideration of damage to roadside drainage structures. BIA streets would be repaired, resurfaced, and restriped by the contractor prior to release of project.
TRA-3 The project could result in hazardous traffic conditions during the transportation of large components delivery on specialized oversized vehicles.	**TRA-3** Implement a traffic control plan that identifies the route of oversized trucks; estimated travel speeds and times; and coordination with Caltrans, California Highway Patrol, and County officials, including the Sheriff's department. A contracted transport company would be responsible for surveying the route to determine how turns on existing roads would be accomplished and ensuring that is reflected in the traffic control plan.

Effect	Mitigation
	Noise
NOI-1 The project would expose persons to or generate noise levels in excess of applicable standards.	None feasible or practicable.
NOI-4 The project would result in a substantial temporary or periodic increase in ambient noise levels.	**NOI-4:** General construction equipment. All internal combustion engines on construction equipment should be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine should be operated on the project without said muffler. Noise abatement devices such as noise barriers and blankets should also be used to the maximum extent practicable. If traffic control and construction signs that require power for lighting or flashing are located near residences, the source of power should be batteries, solar cells, or another quiet source. Gas or diesel-fueled internal combustion engines should not be used.
	Visual Resources
VIS-1 The project could have a substantial adverse effect on a scenic vista.	**VIS-1a** It is recommended that a phased construction sequence be implemented to limit the time between construction and reclamation and to increase the effectiveness of reclamation following completion of construction activities. The reclamation of one area would occur concurrently with the construction of other areas as practicable in order to reduce visible disturbance and the amount of time that exposed soils and erosion create color and textural contrasts with the surrounding existing vegetation. **VIS-1b** Upon completion of construction, it is recommended that a Reclamation Plan be implemented to restore land contours to a condition that replicates preexisting landforms, and to reduce visual contrasts from disturbed soils. **VIS-1c** Monopole structures and overhead collector line structures should be treated to have a muted, darker color than conventional galvanized steel or laminated wood to reduce color contrasts. The recommended paint color for transmission structures is Shadow Gray from the BLM Standard Environmental Colors Chart CC-00 or an equivalent color. Steel pole equivalents used in the installation of the overhead electric collector lines should be finished with paint or a self-weathering finish that will harmonize with colors of the surrounding landscape (i.e., approximate the color of wood when used with wood overhead collector lines). When not used with wood poles, the recommended paint color for power line structures is Shadow Gray from the BLM Standard Environmental Colors Chart CC-00. Conductors should have a nonreflective finish.
VIS-3 The project could be incompatible with the existing visual character.	See **VIS-1b** and **1c.**
	Public Health and Safety
PH&S-1 The project could use, store, or dispose of petroleum products and/or hazardous materials in a manner that results in a release to the aquatic or terrestrial environment in an amount that is equal to or greater than the reportable quantity for that material, or that creates a substantial risk to human health.	**PH&S-1a** Prior to approval of final construction plans, it is recommended that the applicant and/or contractor(s) prepare a Hazardous Materials Management Plan for the construction phase of the proposed project, which would be reviewed and approved by the coordinating agencies. The plan would be included as part of all contractor specifications and final construction plans to the satisfaction of the appropriate agency. The plan would include the following components: • The plan would identify all hazardous materials that will be present on any portion of the construction site, including, but not limited to, fuels, solvents, and petroleum products. The plan would address storage, use, transport, and disposal of each hazardous material anticipated to be used at the site. The plan would establish inspection procedures, storage requirements, storage quantity limits, inventory control, nonhazardous product substitutes, and disposition of excess materials. • The plan would identify secondary containment and spill prevention countermeasures, as well as a contingency plan to identify potential spill hazards, how to prevent their occurrence, and responses for different quantities of spills that may occur. Secondary containment and

Effect	Mitigation
	countermeasures would be in place throughout construction so that if any leaks or spills occur, responses will be made immediately. Emergency spill supplies and equipment would be clearly marked and located adjacent to all areas of work and in construction staging areas. • The plan would identify adequate safety and fire-suppression devices for construction-related activities involving toxic, flammable, or explosive materials (including refueling construction vehicles and equipment). Such devices would be readily accessible on the project site, as specified by the Campo Reservation Fire Protection District (CRFPD) and per the Uniform Building Code and Uniform Fire Code. Prior to construction, the applicant/all contractor and subcontractor personnel would receive training regarding the components of the HMMP, as well as applicable environmental laws and regulations related to hazardous materials handling, storage, and spill prevention and response measures. The applicant or applicant's contractor would designate a qualified environmental field representative who would be on-site to observe, enforce, and document adherence to the plan for all construction activities. The plan would be submitted to the appropriate agencies at least 30 days prior to construction. **PH&S-1b** Prior to approval of final construction plans, it is recommended that the applicant or applicant's contractor(s) prepare a Health and Safety Program (HSP) for each phase of the project (i.e., construction, operation, and decommissioning). The HSP would be developed to protect both workers and the general public during all phases of the project, and would be implemented to educate construction workers about the hazards associated with the particular project site and the safety measures that must be taken to prevent injury. The HSP would include standards regarding occupational safety, safe work practices for each task, hazard training requirements for workers, and mechanisms for documentation and reporting. Regarding occupational health and safety, the program would identify all applicable federal and Tribal occupational safety standards; establish safe work practices for each task (e.g., requirements for personal protective equipment and safety harnesses; OSHA standard practices for safe use of explosives and blasting agents; and measures for reducing occupational electromagnetic field exposures); establish fire safety evacuation procedures; and define safety performance standards. The HSP would include a training program to identify hazard training requirements for workers and establish procedures for providing required training to all workers. The HSP would include worker training regarding how to identify potentially contaminated soils and/or groundwater. Documentation of training and a mechanism for reporting serious accidents to appropriate agencies would be established. The program would identify requirements for temporary fencing around staging areas, storage yards, and excavation areas during construction or decommissioning activities. Such fencing would be designed to restrict transient traffic, off-highway vehicle use, and the general public from accessing areas under construction and would be removed once construction or decommissioning activities are complete. The HSP would also identify appropriate measures to be taken during operation of the project to limit public access to hazardous facilities (e.g., permanent fencing, locked access).
PH&S-4 The project would have the potential to expose people residing or working in the proposed project area or structures to safety hazards.	**MM PH&S-4:** Prior to commencing construction activities, it is recommended that the applicant or applicant's contractor(s) prepare a safety assessment to describe potential safety issues associated with the project, how safety prevention measures would be implemented, where medical aid kits would be located, the appropriate response action for each safety hazard, and procedures for notifying the appropriate authorities and agencies involved. The safety assessment would address issues such as site access/hazards, construction hazards, safe work practices, security, heavy equipment transportation, traffic management, emergency procedures, and fire control.

<table>
<tr><th>Effect</th><th>Mitigation</th></tr>
<tr><td>PH&S-5 The project could expose people or structures to a significant risk of loss, injury, or death involving wildland fires.</td><td>See MM PH&S-1b and MM BIO-2j.

PH&S-5 It is recommended that the applicant or contractor develop and implement a Fire Prevention and Protection Plan (FPPP), in consultation with Campo Reservation Fire Protection District, to the satisfaction of the appropriate reviewing agencies (i.e. BIA, CEPA). The applicant would monitor construction activities to ensure implementation and effectiveness of the plan. The final FPPP will be approved by the reviewing agencies prior to the initiation of construction activities and would be implemented during all construction activities, throughout operation, and during decommissioning activities for the project. At minimum, the plan should include the following:
Procedures for minimizing potential ignition
vegetation clearing (both temporary during construction, and permanent for fire management)
fuel modification establishment
parking requirements
smoking restrictions
hot work restrictions
Red Flag Warning restrictions
Fire coordinator role and responsibility
Fire suppression equipment on-site at all times work is occurring
Emergency response and reporting procedures
Emergency information
Worker education materials; kick-off and tailgate meeting schedules prior to construction, post construction, prior to operations, and prior to decommissioning
Additional restrictions would include the following:
During the construction phase of the project, the contractor would implement ongoing fire patrols. The contractor would maintain fire patrols during construction hours and for 1 hour after end of daily construction and hot work.
Fire Suppression Resource Inventory – The contractor would maintain and update in writing a 24-hour contact information inventory and on-site fire suppression equipment, tools, and personnel list on a quarterly basis and provide it to CRFPD.
During Red Flag Warning events, which are issued daily by the National Weather Service in SRAs, all nonessential, nonemergency construction and maintenance activities would cease or be required to operate under hot work procedures specified in the plan.
All construction crews and inspectors would be provided with radio and/or cellular telephone access that is operational throughout the project area to allow for immediate reporting of fires. Communication pathways and equipment would be tested and confirmed operational each day prior to initiating construction activities at each construction site. All fires would be reported to the fire agencies with jurisdiction in the project area immediately upon ignition.
Each crew member would be trained in fire prevention and fire reporting. Each member would carry at all times a laminated card listing pertinent telephone numbers for reporting fires and defining immediate steps to take if a fire starts. Information on contact cards would be updated and redistributed</td></tr>
</table>

Effect	Mitigation
	to all crew members as needed, and outdated cards destroyed prior to the initiation of construction activities on the day the information change goes into effect. • Each member of the construction crew would be trained and equipped to extinguish small fires with hand-held fire extinguishers in order to prevent them from growing into more serious threats. Each crew member would at all times be within 100 feet of a vehicle containing equipment necessary for fire suppression as outlined in the final Construction Fire Prevention/Protection Plan. • Water storage tanks would be installed and operational at the time of start of construction. The project applicant would provide a draft copy of the FPPP to the cooperating agencies including the BIA, CEPA, and CRFPD for review and comment a minimum of 90 days prior to the start of any construction activities.
PH&S-8 The project could result in risks due to the breaking of a rotor blade.	**PH&S-8** Prior to approval of final construction plans and as part of the HSP (MM PH&S-1b), it is recommended that the applicant demonstrate to the Tribe adequate setbacks for wind turbine generators from residents and occupied buildings, roads, ROWs, transmission lines, and other public access areas, in compliance with the Tribe's Land Use Code and sufficient to prevent accidents from the operation of wind turbine generators. Plans detailing the proposed setbacks would be submitted to the Tribe for review and approval at least 30 days prior to construction.
PH&S-9 The project could create undue risk of potential collapse of a wind turbine.	**PH&S-8** Prior to approval of final construction plans and as part of the HSP (MM PH&S-1b), it is recommended that the applicant demonstrate to the Tribe adequate setbacks for wind turbine generators from residents and occupied buildings, roads, ROWs, transmission lines, and other public access areas, in compliance with the Tribe's Land Use Code and sufficient to prevent accidents from the operation of wind turbine generators. Plans detailing the proposed setbacks would be submitted to the Tribe for review and approval at least 30 days prior to construction.

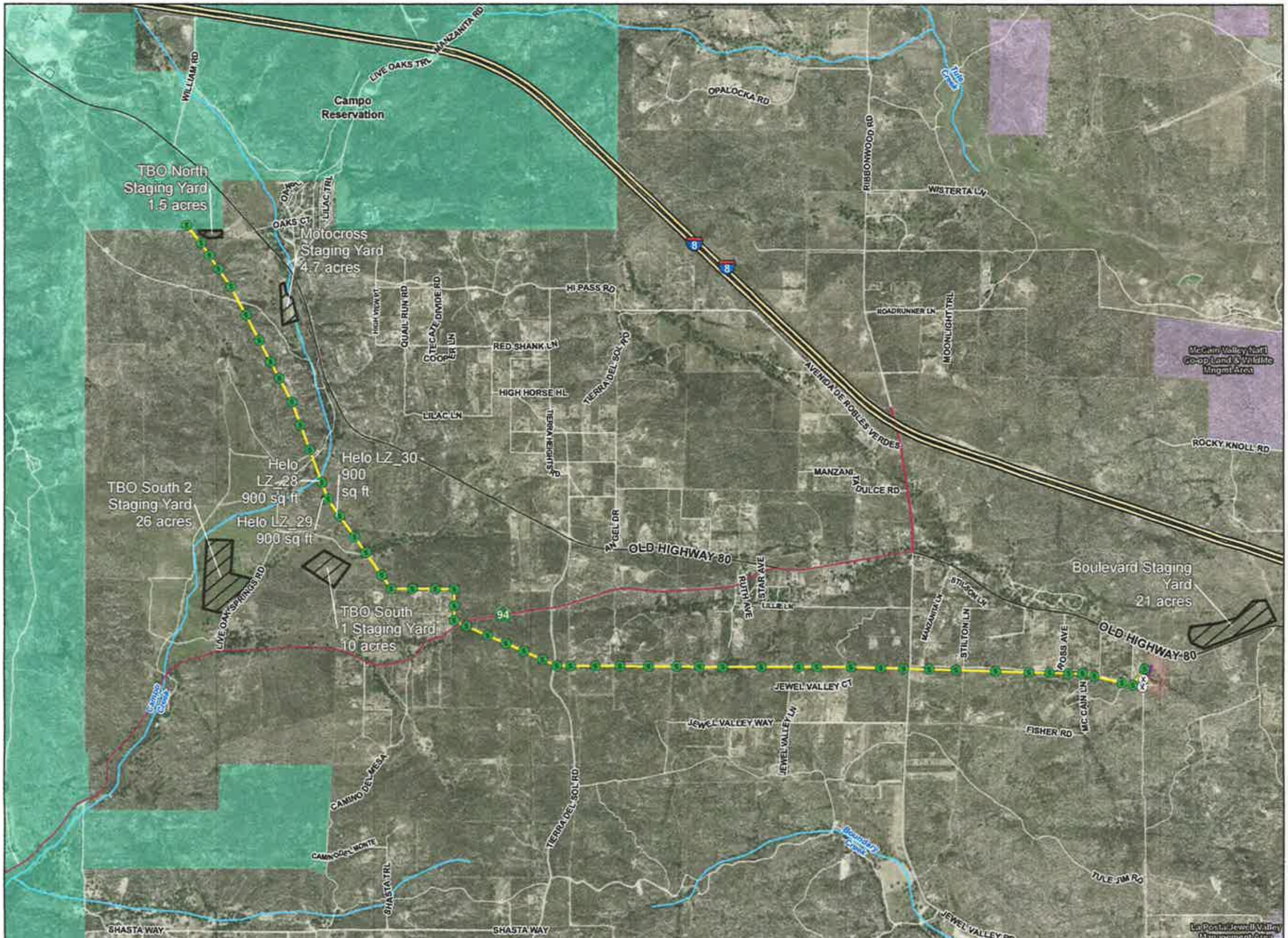
Effects Found Not To Be Significant

This EIS concludes that each of the build alternatives would not result in significant effects requiring mitigation related to water resources, air quality, climate change, socioeconomic conditions, and resource use patterns, nor to any of the EIS impact areas not listed in the sections headed "Unavoidable Adverse Effects" and "Adverse Effects that can be Mitigated," above. The No Action Alternative would not result in any of the project-related environmental effects stated in this EIS, but would not preclude future development of this portion of the Reservation that would be subject to separate environmental review.

Areas of Environmental Controversy

The BIA published the Notice of intent (NOI) for the proposed action in the Federal Register on May 20, 2011, with the comment period beginning May 20, 2011, and ending July 5, 2011. The NOI included notice of two public scoping meetings to solicit input from the public as to the issues that should be considered within the scope of the EIS. Public meetings were held on June 21 and 22, 2011. Notice of the meetings and the NOI was provided in newspapers of local circulation in east San Diego County consisting of the San Diego Union Tribune, Alpine Sun, and Back Country Messenger. A number of environmental issues were identified during the public scoping process.

The public identified the following issues of concern: Air Quality; Biological Resources; Cultural Resources; Environmental Justice; Hazardous Waste; Land Use; Socioeconomics; Traffic; Water Quality; Vegetation and Wildlife (Biological Resources); and Public Health and Safety, including fire hazards. Each of the environmental issues addressed within this EIS is subject to controversy. Chapter 4 evaluates impacts, including the severity of the effects related to these issues.



TL 6931 Project
Wood to Steel/ Wind Gen

Version Date: 12/12/2012

Overview

Project Length: 5.4 miles

1 inch = 2,000 feet @ 11" x 17"

0 500 1,000 2,000 3,000
Feet

Legend

Tieline
- Tieline
- Temporary Alignment

Proposed UG
- UG Route
- Vault

Proposed Pole
- Steel
- Temp
- Staging Yard

Land Ownership
- SDG&E Fee Owned, Leased
- US Forest Service
- BLM
- DOD
- USFWS
- Other Federal
- State Parks
- CDFG
- Other State
- County
- City
- Special District
- BIA Trust Land

Water Resources
- Water Centerline

SDG&E
A Sempra Energy utility

SDG&E is providing this map with the understanding that the map is not survey grade.

Requested By: Tom Carr