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SECTION ACRONYMS/ABBREVIATIONS

ACRONYM/ ABBREVIATION	DEFINITION
AFC	Application for Certification
BACT	Best Available Control Technology
CAISO	California Independent System Operator
Caltrans	California Department of Transportation
CCR	California Code of Regulations
CEC	California Energy Commission
CO	Carbon Monoxide
CTG	Combustion Turbine Generator
°F	Degrees Fahrenheit
FPUD	Fallbrook Public Utility District
GE	General Electric
gpm	Gallons per Minute
HHV	Higher Heating Value
hp	Horsepower
I	Interstate
kV	Kilovolt
LHV	Lower Heating Value
LORS	Laws, Ordinances, Regulations and Standards
LOS	Level of Service
MW	Megawatt
NO_x	Nitrogen Oxides
Orange Grove Energy	Orange Grove Energy, L.P.
OTSG	Once Through Steam Generators
Project	Subject of this AFC, Orange Grove Project
Project Site	Approximately 8.5 acre parcel to be leased for the power plant Site (a.k.a. “Site”)
ppmvd	Parts per Million Volume Dry
RFO	Request for Offers
RMWD	Rainbow Municipal Water District
RO	Reverse Osmosis

ACRONYM/ ABBREVIATION	DEFINITION
SCR	Selective Catalytic Reduction
SDG&E	San Diego Gas & Electric
Site	Approximately 8.5 acre parcel to be leased for the power plant Site (a.k.a. “Site”)
SPRINT	Spray Intercooling
SR	State Route
SWRCB	State Water Resources Control Board
VOC	Volatile Organic Compounds
WWTP	Wastewater Treatment Plant

5.0 ALTERNATIVES ANALYSIS

This section addresses the alternatives evaluated by Orange Grove Energy, L.P. (Orange Grove Energy) during the development of the Project.

As described in Section 2.1, the Orange Grove Project's basic objectives are to:

- Provide environmentally sound, efficient and reliable power generation using commercially available proven technology to respond to the San Diego Gas & Electric (SDG&E) request for offers (RFO) for new generating capacity to support reliability in an environmentally responsible and economically feasible manner;
- Use a site location within SDG&E's service territory that has infrastructure with available capacity and ability to reliably support Project electric transmission, fuel supply and water needs with minimal impact on existing infrastructure systems or required new construction;
- Use a site that is commercially available, including control for reasonable access and linear facility easements;
- Develop a site that has compatible zoning, compatible adjacent land uses, and is located away from sensitive receptors; and
- Maximize the capacity of the classes of equipment to be used, consistent with good engineering practice.

The facility is a peaking power plant that is expected to operate only about 60 days per year. Therefore, operational impacts of the Project are already minimal. However, as required by 14 California Code of Regulations (CCR) 15126.6(a), selection of alternatives for consideration in this analysis focused on a reasonable range of alternatives which would feasibly attain most of the basic objectives of the Project described in Section 2.1 but would avoid or substantially lessen any significant effects of the Project. The scope of alternatives is further governed by the rule of reason, which requires an environmental document to "set forth only those alternatives necessary to permit a reasoned choice" (14 CCR 15126.6[f]). The key issue is whether the selection and discussion of alternatives fosters informed decision-making and public participation based on various economic, environmental, social and technological factors involved. An alternative need not be considered where the effect cannot be reasonably ascertained and where implementation is remote and speculative (14 CCR 15126.6[f][3]) For purposes of this analysis, a reasonable range of alternatives was considered to be:

- The No Project Alternative
- Power Plant Site Alternatives
- Water Supply Alternatives
- Alternative Cooling Technologies
- Electric Transmission Line Alternatives
- Generation Technology Alternatives
- Alternative Emission Control Technologies

- Additional Alternatives Identified to Reduce Trucking
- Gas Pipeline Alignment Alternative

These alternatives are described in the following sections.

5.1 NO PROJECT ALTERNATIVE

The Project is needed by SDG&E to support reliability and meet growing load requirements within its service territory. The Project is proposed in response to the SDG&E RFO. Specifically, SDG&E initiated the RFO in response to the California Public Utilities Commission concerns that there is a need for additional peaking capacity after the unusually hot summer of 2006. With normal load growth in the SDG&E service area, a repeat heat storm could pose reliability issues within the SDG&E service territory. Delay or cancellation of the Project would leave the system vulnerable to heat events. Appendix 5-A provides a letter of support for the Project from SDG&E and outlines the Project's importance and urgency.

The "No Project" Alternative was considered but rejected in view of SDG&E objectives to enhance the reliability and efficiency of power supply to its customers. While the No Project Alternative would not have the specific environmental impacts addressed in the Application for Certification (AFC) for the proposed Project, the No Project Alternative would delay SDG&E's efforts to support reliability within its service territory. In addition, physical impacts would be displaced to a future proposal to provide needed energy in the region and would be dependant on the specific proposal. Until the needed generation capacity is online, the No Project Alternative would result in greater potential environmental impacts, including socioeconomic impacts of potential electric supply shortfalls, and increased air pollution levels because new, cleaner peaking generation plants would not be placed in service to replace older, less efficient peaking power plants with greater emission levels. Finally, the No Project Alternative would not meet the basic objectives of the proposed Project.

5.2 POWER PLANT SITE ALTERNATIVES

The proposed Site was selected because it meets all of the Project's basic objectives and avoids significant environmental impacts through the following characteristics:

- The Site provides nearby infrastructure for clean-burning natural gas fuel and electric transmission, for interconnection to the power plant with minimal impact on existing infrastructure systems or required new construction.
- The Site has compatible zoning, compatible land uses, and is away from sensitive receptors.
- The Site is commercially available with good access on existing roads.
- While the selected Site does not currently provide for a feasible water supply pipeline, it does satisfy the basic Project objective of obtaining a reliable water supply from infrastructure that has available capacity and ability to support Project electric

generation with minimal impact on existing infrastructure systems and minimum required new construction.

- The Site is adequately sized and configured to fit the Project's generating capacity.
- An SDG&E substation adjacent to the Site has an open bay for interconnection of a potential generating facility. As a result, the Site will require minimal work at the substation to interconnect new generating capacity.

The Project is proposed in response to SDG&E's RFO, which solicited offers for development on a selection of four sites already owned and in preliminary development by SDG&E (SDG&E, 2006). The Applicant considered each of the offered sites, plus additional sites. The alternative sites include the following as described in the following sections:

- SDG&E RFO –Offered Sites
- Rainbow Site
- GCL North Site
- GCL South Site

5.2.1 SDG&E RFO-Offered Sites

The SDG&E RFO that the Orange Grove Project is responding to invited respondents to evaluate and consider four sites for development, or select their own site(s). The Applicant evaluated each of the four sites offered in the RFO, which include the:

- Miramar Site
- Margarita Site
- Borrego Springs Site

The Miramar Site is located in the City of San Diego, approximately 34 miles south of the Project site. The Miramar site is 1.5 acres and is graded. There is interconnection access to 69 kilovolt (kV) transmission and there is natural gas supply at the site. The SDG&E RFO judged that only "minor" transmission system upgrades would be required for up to 49 Megawatt (MW). There is an existing peaker at this location and this site contains room for an additional 48 MW unit. This alternative site was not selected for the Project because it is not capable of supporting the development of the 96 MW generation capacity preferred by SDG&E for responsiveness to their RFO.

The Margarita Site is located approximately 33 miles west-northwest of the Project site in southern Orange County. The Margarita Site is 3.0 acres and is undeveloped. The SDG&E RFO judged that only "minor" transmission system upgrades would be required for up to 99 MW. Interconnection at 138 kV is available and natural gas is available 1.5 miles from the site. The Applicant did not select this site because it did not meet some of the Project's basic objectives.

The Borrego Site is located in Borrego Springs, California, in the desert of eastern San Diego County. The Borrego Site is a 2.0 acre facility that SDG&E proposed for a 15 MW standby service generator to run on diesel fuel. The SDG&E RFO judged that only "minor" transmission system upgrades would be required for up to 15 MW. Interconnection at 12 kV is available and diesel fuel would have to be trucked to and stored onsite. This site was not selected for the Project because it is not capable of supporting the development of the 96 MW generation capacity preferred by SDG&E for responsiveness to their RFO.

These sites, and the proposed Site, were the only Sites offered in the RFO. The proposed Site was selected from these alternative sites based on compatibility with the Project's basic objectives.

5.2.2 Rainbow Site

The Rainbow site is owned by SDG&E and is located in an area 4.5 miles due north of the Orange Grove site (Figure 5.2-1). The Rainbow site is located in a remote area at an elevation of approximately 1,600 feet above mean sea level. It is located within a bowl-shaped plateau surrounded by steep rugged terrain. The Rainbow site does not have an identified reliable water supply, except for trucking of water to the site. Transmission is available. There is no gas supply near the site. Use of this site would require construction of a gas pipeline covering a minimum of 2.2 air miles. This would be the shortest possible route with a generally straight-line configuration as shown in Figure 5.2-2. Considering the rugged terrain and private property ownership, up to 4 or more miles of pipeline could be required based on more detailed engineering. This site occurs in remote terrain requiring access through various privately-owned properties. Securing easements for access and gas line construction would involve numerous landowners, making feasibility questionable. The Rainbow site would require construction of a new substation to tie into an existing 230 kV line that is located at the site. Figure 5.2-2 shows a project footprint for the Rainbow site. Access to this site would require substantial road improvement and may not be feasible. Considering the questionable feasibility of developing the Rainbow site and potentially extensive infrastructure improvements that would be required, this site is not capable of meeting most of the Project basic objectives.

5.2.3 GCL North Site

The GCL North Site is owned by Gregory Canyon Ltd. and is located approximately 0.65 mile west-southwest of the Orange Grove site on the north side of State Route (SR) 76 (Figure 5.2-3). The GCL North Site is located in a small developed area associated with the former dairy farms located southwest of the Site. The GCL North Site would use generally the same gas pipeline route as the proposed Project, but the pipeline would only be approximately 1.6 miles long. The interconnection for this site would still be to the 69 kV Pala substation, so a transmission line interconnection would be required that would be approximately 0.5 mile, with overhead lines following the existing 69 kV transmission route to the Pala substation. The GCL North Site does not have an identified reliable water supply, except for trucking of water to the site. With trucking of water, this alternative site could satisfy the Project's basic objectives.

5.2.4 GCL South Site

The GCL South Site is owned by Gregory Canyon Ltd. and is located approximately 0.65 mile south-southwest of the Orange Grove site on the south side of SR 76 (Figure 5.2-3). The GCL South Site is located on a disturbed area with the former dairy farms located southwest of the Site. The GCL South Site would use generally the same pipeline route as the proposed Project, but the pipeline would be approximately 1.7 miles long. The interconnection for this site would still be to the 69 kV Pala substation, so a transmission line interconnection would be required that would be approximately 0.5 mile long. The GCL South Site does not have an identified reliable water supply, except for trucking of water to the site. With trucking of water, this alternative site could satisfy the Project's basic objectives.

5.2.5 Conclusions

Table 5.2-1 provides a summary of the evaluation screening results for power plant site alternatives. Screening of each alternative consisted of evaluating each alternative with respect to compatibility with the following screening criteria:

- Feasibly attaining most of the basic objectives of the Project.
- Potential for the alternative to avoid or substantially lessen environmental effects of the Project.

Alternative sites that are not compatible with both of these goals were screened out and not further evaluated. Alternative sites that were retained from initial screening are described further in Section 5.10.

Table 5.2-1 – Power Plant Site Alternatives

ALTERNATIVE	COMPATIBILITY WITH SCREENING CRITERIA	BASIS FOR COMPATIBILITY	RETAINED/ELIMINATED FROM FURTHER CONSIDERATION
Miramar Site	Not Compatible	This site is not commercially available.	Eliminated
Margarita Site	Not Compatible	This site does not meet Project basic objectives.	Eliminated
Borrego Springs Site	Not Compatible	This site is offered at only 15 MW and does not meet the Project's basic objectives.	Eliminated
Rainbow Site	Not Compatible	Questionable feasibility of developing this site and required infrastructure improvements make it not capable of meeting most of the Project's basic objectives.	Eliminated
GCL North Site	Compatible	This site could be capable of meeting the Project's basic objectives.	Retained
GCL South Site	Compatible	This site could be capable of meeting the Project's basic objectives.	Retained

5.3 WATER SUPPLY ALTERNATIVES

The Project evaluated all identified potential alternatives for the supply of water, with emphasis on potential sources of brackish water, reclaim water, or other non-fresh water sources. The relatively isolated geographic location of the Project largely controls the available sources of non-fresh water, since there is limited infrastructure in the Project vicinity. No ground water remediation sites are known nearby that could potentially provide a feasible water source. No natural brackish waters occur in the vicinity. The Project is designed to use relatively small amounts of water. The Expected Use Case is 21.1 acre feet per year of fresh water and 12.1 acre feet per year of reclaim water, as detailed in Section 2.6. The water will be obtained from the Fallbrook Public Utility District (FPUD) and trucked to the site.

Potential sources of water that were identified in the area and considered for the Project include:

- Wastewater treatment plant at the Pala casino
- Other wastewater sources in the vicinity
- Potential fresh water supplies

5.3.1 Pala Casino

One potential reclaim water source that was identified was secondary-treated sewage from the Pala Casino and Spa Resort, about 1.5 miles east of the Project site. Orange Grove Energy met with the Pala Band of Mission Indians to discuss the Project and determine the availability of potential wastewater. Project staff were informed that there is no wastewater available (Volturno, 2007). The wastewater from the treatment plant currently is discharged to percolation ponds after secondary treatment. The Tribe is preparing to modify the wastewater treatment plant to provide tertiary treatment with reuse of all water for agriculture and landscaping. Therefore, no water is available for the Project from this potential source.

5.3.2 Other Wastewater Sources

There are currently no sources for reliable reclaimed water supply in the site vicinity. The closest reliable reclaim water supply is the selected supply from FPUD, located approximately 15.6 road miles from the Site. This water is currently being discharged to the Pacific Ocean (see Section 6.5, Water Resources). Due to the relatively remote location of the Project site, no closer potentially feasible reclaimed water sources were identified. There are other potential sources of reclaim water in the region, but they are further from the Project and they were not explored because of increased environmental impacts with longer water trucking hauls. The Rainbow Municipal Water District (RMWD) has long-term plans to develop water treatment and a reclaimed water supply, including plans for a reclaim water pipeline near the intersection of SR 76 and Interstate (I) 15. However, this is not funded and is not foreseeable in the short term. This system, if constructed, could provide a closer source of reclaim water for the Project. This and other potential future opportunities to reduce or eliminate the trucking of water will continue to be evaluated by the Applicant; each will need to be evaluated on its own merit.

5.3.3 Potential Freshwater Supplies

Potential alternative freshwater supplies that were identified in the Project area and considered for the Project include:

- RMWD
- Groundwater from the alluvial aquifer in the San Luis Rey River Valley

The remoteness of the location proved to be a problem in sourcing even RMWD water from their existing potable water infrastructure. The Site is located in RMWD and numerous discussions with RMWD resulted in the determination that an adequate supply of water is available via an existing pipeline with 3,000 gallons per minute (gpm) capacity near the ridge line north of the Site on Pala del Norte Road. This water main is shown in Figure 5.3-1. Transporting water from this location via pipeline was extensively pursued and determined not feasible at this time because a property owner controlling the majority of the potential pipeline route will not grant an easement. Pala del Norte Road is a private road and RMWD does not automatically have the right to install infrastructure in or along the road as it does with public roadways. The property through which the pipeline would have to run (and which is making this alternative not feasible at this time) is currently for sale. If and when the land is sold, the new owner may be amenable to routing the water pipeline through the property, reducing the need to truck water to the Site.

The Applicant also investigated installing a RMWD potable water pipeline to the Project from a location on Rice Canyon Road approximately 1.0 mile north of the intersection with SR 76, and then paralleling the fuel gas pipeline to the facility (Figure 5.3-1). This option was rejected because inadequate shoulder width exists along Rice Canyon Road to install the pipeline and an easement could not be gained from the affected landowner. RMWD will not use eminent domain proceedings to serve only the Project.

Ground water was also considered as an alternative supply source, but this alternative was judged not feasible because use of local ground water is not likely to be permittable or acceptable, since ground water in the area in heavily used and in short supply. The water in the former mine pits south of SR 76 is, in general, a physical extension of ground water across the mine pits and, therefore, would be similar to use of ground water, so this option was eliminated when potential water sources were being screened.

5.3.4 Water Supply Alternatives Summary

Table 5.3-1 provides a summary of the evaluation screening results for water supply alternatives. Screening of each alternative consisted of evaluating each alternative with respect to compatibility with the following screening criteria:

- Feasibly attaining most of the basic objectives of the Project.
- Potential for the alternative to avoid or substantially lessen environmental effects of the Project.

In summary, no currently feasible alternative to the water supply has been identified that could avoid or substantially lessen Project impacts (Table 5.2-1). The only additional feasible water supply identified would involve trucking of water from longer distances, which would not reduce environmental impacts. Therefore, none of the alternatives considered for water supply passed initial screening.

Table 5.3-2 – Water Supply Alternatives

ALTERNATIVE	COMPATIBILITY WITH SCREENING CRITERIA	BASIS FOR COMPATIBILITY	RETAINED/ ELIMINATED FROM FURTHER CONSIDERATION
Pala Casino	Not Compatible	No reliable source of water is available.	Eliminated
Other wastewater treatment plants (WWTPs) located further from the Site	Not Compatible	Would achieve most Project objectives, although less efficiently than the proposed Project, and would increase impacts to traffic, air quality and consumption of non-renewable fuel resources compared to the proposed Project. Therefore, this alternative is not capable of reducing environmental impacts.	Eliminated
Potential future RMWD WWTP and Reclaim Water Distribution System	Not Compatible	No reliable source of water is currently available. This alternative could be compatible with screening criteria in the future if the water treatment plant and reclaim water distribution infrastructure are ultimately completed. This is not compatible with the Project goal of a reliable water supply.	Eliminated (potentially available to the Project in the future, if constructed)
RMWD Potable Water	Not Compatible	Land control issues are preventing the feasibility of a pipeline from the existing RMWD infrastructure, and RMWD has indicated that they will not support trucking of water to the power plant. In addition, RMWD policies do not allow for the issuance of will serve letters or any guarantee to any user for delivery of water for an extended period of time. This is not compatible with the Project goal of a reliable water supply.	Eliminated (potentially available to the Project in the future, when controlling property changes ownership)
Ground Water from San Luis Rey River Alluvium	Not Compatible	The limited supply and ongoing use of ground water in the San Luis Rey River basin are judged to make it not likely that this source of water would be permittable or acceptable. This is not compatible with the Project goal of a reliable water supply.	Eliminated
Surface Water from Former Mine Pits South of SR 76	Not Compatible	The limited supply and ongoing use of ground water in the San Luis Rey River basin are judged to make it not likely that this source of water would be permittable or acceptable. This is not compatible with the Project goal of a reliable water supply.	Eliminated

5.4 ALTERNATIVE COOLING TECHNOLOGIES

5.4.1 Once-Through Cooling

Because of the limited supply of water available to the Project, Once-through cooling was determined to be infeasible. This cooling technique has been used when large sources of cooling water, such as an ocean or river, are adjacent to the proposed plant. No such source exists in the vicinity of the Project.

5.4.2 Air-Cooled Condenser

The combustion turbine generator (CTG) combustion inlet air chiller condensers utilize a circulating water system and relatively small evaporative cooling tower for rejection of heat to the atmosphere. All other plant heat dissipation systems use air and oil-to-air-cooling technology or automotive-style radiators. Use of a dry cooling system for the air chiller condensers would reduce Project reclaim water consumption. However, the use of dry cooling technology would adversely affect other areas of environmental and general importance including power generation capability, fuel efficiency, air emissions, visual resources, and noise. For these reasons, this technology has low compatibility with the Project's basic objectives, as described in more detail in Section 5.4.10.

5.4.3 Hybrid Wet/Dry System

A "wet-dry" system is a hybrid of the evaporative cooling and dry cooling systems whereby either water is sprayed on the exterior of the fin-fan heat exchanger to improve heat rejection, or a supplemental evaporative cooling tower is employed on hot days. Use of a wet-dry cooling system would reduce Project water consumption beyond that already accomplished. However, the use of wet-dry cooling technology would adversely affect other areas of environmental importance including:

- Visual impact – hybrid cooling would require an increase of the footprint of the Project and the dry cooling system would be a substantially larger piece of equipment compared to the proposed small evaporative cooling tower. If an evaporative cooling tower is included in the hybrid system, then visual impacts would be greater than for dry cooling alone.
- Cycle (fuel) efficiency – the additional horsepower (hp) requirements of a wet-dry system will result in poorer Project cycle efficiency, i.e. significantly increased fuel usage for a given net power output as compared to an evaporative system. This is particularly true during hot weather, when a peaking power facility is most likely to be activated.
- Power generating capability – use of a wet-dry system will result in reduced Project power output as compared to an evaporative system; for a peaking power facility, maximum hot-day performance is naturally a paramount consideration.

- Noise – the air-cooling component of this technology requires many times the airflow of evaporative cooling, accomplished through fans. Such fans tend to be very noisy as compared to an evaporative cooling tower.
- Based on an analysis of projected water consumption numbers for the Project, it is estimated that the use of hybrid wet/dry cooling could potentially reduce water consumption when compared with wet cooling. The actual reduction would depend on the specific design of the system, but this reduction would be less than that provided by dry cooling. However, the technology would increase the parasitic power consumption when compared with wet cooling. As noted above, the greatest parasitic load would occur when peaking power is most needed, during hot weather periods.

Overall, the impacts of this alternative technology are the same as intermediate to wet and dry cooling, since hybrid cooling is a combination of both.

5.4.4 Thermal Storage

Thermal storage is the practice of making cold liquid or ice during the off-peak hours with a conventional chiller, storing it in an insulated tank, and then utilizing that chilling capacity during the day when the combustion turbines may be operating. The Applicant investigated thermal storage as an avenue towards reducing water consumption and truck trips or providing additional operating flexibility to shifting truck trips hours. Thermal storage was rejected due to:

- Inability to reasonably assure that combustion turbine performance would be maintained over a full, 12-hour run day. Although the chiller equipment would not be operated while the Project was operating, initially resulting in approximately 2 net MW additional capacity, by its very nature the thermal capacity stored would decay as it is used, resulting in a decrease in combustion turbine output as the operating day progressed. It is conceivable that during the hottest part of the operating day little or no chilling capacity would be left resulting in a plant with just 84 net MW capacity. This is not compatible with the Project's basic objectives.
- The need to run the chilling equipment is merely shifted to the off-peak hours. Moreover, rather than the Project supplying the electricity to operate the chiller equipment, electricity would come from the grid. This is an additional expense to the Project.
- An additional storage tank of approximately 1 million gallons would be required, driving up capital costs and requiring a much larger plant footprint. This tank would be twice as large as any other tank planned for the Site.
- Chilling equipment would be required to operate at night. This is not desirable given the rural setting. (Although no permitting will prevent the Project from nighttime operations, and such operation may be necessary on rare occasions, such nighttime operation is not generally expected.)
- Although an air-cooled condenser could be used to eliminate the water use associated with the conventional cooling tower proposed for the Project, air-cooled condensers

are significantly noisier than conventional condenser/cooling tower equipment. Operating such equipment at night is not compatible with the rural setting of the Project.

5.4.5 Conclusion

The Project is consistent with the use preference hierarchy and water quality protection measures of the State Water Resources Control Board (SWRCB) Resolution 75-58 on the use and disposal of inland waters used for power plant cooling. This policy is provided for planning of new power generating facilities to protect beneficial uses of the state's water resources and to keep the consumption of fresh water for power plant cooling to that minimally essential for the welfare of the citizens of the state. The cooling water use is consistent with the California Energy Commission's (CEC's) integrated energy policy recognizes SWRCB Resolution 75-58 as reflective of the state's concerns over discharges from power plant cooling, as well as the conservation of fresh water for cooling purposes. The CEC has adopted a policy of approving the use of fresh water for power plant cooling purposes only where alternative water supply sources and alternative cooling technologies are shown to be "environmentally undesirable" or "economically unsound" (CEC, 2003).

As discussed above, wet cooling has been selected in part due to the negative impacts of dry cooling, including the higher parasitic load and lower power output associated with dry cooling that would be most pronounced during hot weather periods when peaking power is especially needed.

Orange Grove Energy has evaluated the SWRCB and CEC water policy requirements in the context of the design of the entire plant, and has designed the plant to minimize water consumption to the maximum extent that is consistent with the welfare of the citizens of the state. The plant will use water cooling only for the air inlet chiller system and will use reclaim water currently being discharged to the ocean at a rate of 1,200 acre-feet per year. Air inlet cooling is essential to the welfare of the citizens of the state in that it will augment power output of the units during hot weather when the power is needed most.

Orange Grove Energy has evaluated all potential sources of water in the Project area and the selected water sources for reclaim and fresh water are the only identified sources that can provide a reliable long-term source. During operations, Orange Grove Energy will continue to evaluate potential water source alternatives and will implement an alternative water supply to reduce or eliminate trucking of water if an appropriate supply becomes available.

Table 5.4-1 provides a summary of the evaluation screening results for alternative cooling technologies. Screening of each alternative consisted of evaluating each alternative with respect to the following screening criteria:

- Compatibility with feasibly attaining most of the basic objectives of the Project.
- Compatibility with the potential for the alternative to avoid or substantially lessen any significant environmental effects of the project.

Alternative cooling technologies that are not compatible with both of these goals were screened out and not further evaluated. Alternative cooling technologies that were retained from initial screening are described further in Section 5.10.

Table 5.4-1 –Alternative Cooling Technologies

ALTERNATIVE	COMPATIBILITY WITH SCREENING CRITERIA	BASIS FOR COMPATIBILITY	RETAINED/ELIMINATED FROM FURTHER CONSIDERATION
Once Through Cooling	Not Compatible	No feasible source of once-through cooling water.	Eliminated
Air Cooled Condenser	Low Compatibility	Substantially lower efficiency and power output, particularly in design summer conditions.	Retained
Hybrid Wet/Dry System	Low Compatibility	This alternative is intermediate to the proposed Project and the air cooled condenser alternative and, therefore, is already represented in the range of alternatives evaluated.	Eliminated
Thermal Storage	Not Compatible	This alternative could result in a shortage of cooling capacity when it is needed most, would be more expensive to build and operate, and would increase environmental impacts in some resource areas.	Eliminated

5.5 ELECTRICAL TRANSMISSION LINE ALTERNATIVES

Orange Grove Energy submitted its interconnection request to the California Independent System Operator (CAISO) on April 19, 2007. The request identified the Pala substation as the primary interconnection point. The feasibility study, System Impact Study and Facilities Study have been completed and are presented in Section 3.0. Following the interconnection agreement between the Project and SDG&E, the interconnection facilities will be constructed by SDG&E. The interconnection facilities will include upgrades to the Pala substation and any system reinforcement required by CAISO.

Alternative transmission options would involve above ground lines and/or new substations. The 69 kV system was selected over the 230 kV system for interconnection due to the relatively minor upgrades that will be required. An open bay is available at the Pala substation to accommodate the interconnection. Interconnection to the 230 kV system would require more infrastructure improvements. A 230 kV circuit passes approximately 0.25-mile east of the Site, but it does not enter the Pala substation. Connection with the 230 kV circuit would require aboveground lines and a new substation.

Interconnecting to the 230 kV system does not appear to provide any reduced environmental impacts, and additional infrastructure construction and surface disturbance would be needed for the new 230 kV substation that would be required for this alternative. Therefore, this alternative was eliminated from further consideration.

5.6 GENERATION TECHNOLOGY ALTERNATIVES

5.6.1 Selection Methodology

The generation technology proposed for the Project is simple-cycle combustion turbine technology. This technology uses a combustion turbine to drive a generator. Air is compressed in the compressor section of the combustion turbine, passes into the combustion section where fuel is added and ignited, and the hot combustion gases drive a turbine, which in turn drives not only the compressor section of the combustion turbine but also a generator. The combustion turbines have a relatively low capital cost with efficiencies of 37 percent or higher in the larger units. Because the combustion turbines are fast starting and have a relatively low capital cost, they are used primarily for meeting high-peak demand (3,000 hours per year or less), when their relatively low efficiency is not as great a concern. This technology and its ability to quickly cycle in response to peaking electric power needs make it well suited for responding to SDG&E's RFO. The cost of generation is relatively high, approximately 5.5 to 7.5 cents per kilowatt-hour, depending on fuel costs. However, this technology typically is used to generate electrical power during peak-demand periods, when electricity costs are typically higher. The selected technology is proven reliable and commercially available, can be implemented at the identified site, and is a good fit for satisfying the basic Project objectives.

The proposed nominal 96-MW configuration of the Project is the result of a variety of design and operating considerations. The LM6000 PC SPRINT was selected due to:

- High output – the LM6000 PC SPRINT units specified will result in a Project capable of generating approximately 96 net MW. By comparison, the LM6000 PD (non-SPRINT) would limit the Project to just 82 net MW.
- Efficiency and good operating economics – the LM6000 is among the most efficient combustion turbines available, with a full-load efficiency of approximately 40 percent (Lower Heating Value [LHV]).
- Lack of technology risk – over 600 LM6000s are in service which have accumulated over 10 million operating hours. While all rotating machinery presents maintenance issues from time to time, the LM6000 is a relatively known quantity.
- Staff familiarity with LM6000 units – operating and management personnel with LM6000 experience are relatively plentiful given the large number of similar facilities in operation. As well, training times can be expected to be relatively short which should deliver a more reliable project sooner.

Alternative generation technologies considered were those that could provide rapidly available peak or mid-merit power to meet, as closely as practical, SDG&E's stated needs in the RFO.

The alternatives considered included other fuels, ranging from coal and biomass to oil and waste fuels. These fuels, however, do not provide the Project with the environmental benefits of natural gas, and were rejected.

Alternative technologies for power generation were also considered. These included solar, wind, hydroelectric, nuclear, and fuel cell generation, all of which were determined to be cost prohibitive and infeasible for this Project. In addition, bio-diesel was determined to be infeasible as its use would not comply with air quality limits, and fuel supply is limited.

5.6.2 Alternative Natural Gas-Fired Technologies

5.6.2.1 Combined-Cycle Generating Technology

This technology integrates the Brayton cycle (simple-cycle combustion turbine) with the Rankine cycle (steam turbine) to achieve higher overall plant efficiencies. The simple-cycle combustion turbine normally exhausts spent gases directly to the atmosphere, although a considerable amount of energy is still present. In the combined-cycle technology, the exhaust gas is passed through a heat recovery unit creating steam that is used to drive a steam turbine/generator. The resulting efficiency for the combined system is 50 to 60 percent, which is considerably greater than most other alternatives. The combined-cycle system, therefore, is usually one benchmark against which other technologies are compared.

While this technology is commercially available, and some systems that include once-through steam generators (OTSG) allow for relatively rapid start-up times, at least to part load, considerable quantities of water are required in steam production, and plant footprint and vertical height are greatly increased, adversely affecting visual impact. Considering these factors, the proposed Project does not incorporate combined-cycle technology.

5.6.2.2 Conventional Boiler-Steam/Turbine

A conventional boiler was determined to be unsuitable for this Project due to required quick ramp rates for peaking operations and environmental reasons (e.g., water consumption).

5.6.2.3 Supercritical Boiler-Steam/Turbine

A supercritical boiler was determined to be unsuitable for this Project due to required quick ramp rates for peaking operations and environmental reasons (e.g., water consumption).

5.6.2.4 Advanced Gas Turbine Cycles

Numerous efforts in the industry have been made to enhance the performance and/or efficiency of gas turbines by injecting steam, intercooling, and staged firing. These include the massively steam-injected gas turbine (Cheng cycle), the recuperated combustion turbine, the intercooled combustion turbine, the chemically recuperated gas turbine, and the humid air turbine cycle, as further described below:

- The Cheng cycle, which combines the Brayton and Rankine cycles into one unit based on a modified Rolls Royce (formerly Allison) flight engine, is commercially available from Cheng Power Systems. It is a small unit (6 MW nominal) with efficiency approaching that of the LM6000. Its small size disqualifies it from

consideration, as does the fact that all steam used in the unit is lost to the atmosphere through the stack, meaning that water needs are very high. Clearly, this is unacceptable for this Project. Cheng and General Electric (GE) have teamed to offer similar technology using GE's LM2500 unit, for power production similar to that of the LM6000 at greater efficiencies. Unfortunately, the total loss of water disqualifies it from consideration.

- A recuperated unit, the Mercury 50, is commercially available from Solar Turbines, Inc. This is a small unit (5.5 MW) and cycle efficiency, while excellent for a small unit, is no better than that available with the LM6000. Therefore, this technology was eliminated from consideration.
- The intercooled combustion turbine is available in the form of the GE LMS 100, discussed more fully below. As noted, this unit received careful consideration for use at the Project but was ultimately rejected because of the relative technology risk as compared to the LM6000, the increased footprint requirement when equipped with an air-cooled intercooler, and the marginal expected efficiency increase when equipped with an air-cooled intercooler.
- Staged combustion, whereby fuel is introduced at two points in the combustion zone, is available in the Alstom GT 24. This is a very large industrial unit (180 MW) and does not meet the Project requirements for a peaking unit.

5.6.3 Alternative Combustion Turbine Technologies

The GE LMS 100 received careful consideration for use in the Project. The LMS 100 is a new offering from GE combining the core (high pressure compressor, combustor, high pressure turbine, intermediate pressure turbine) of a CF6-80E flight engine, which is a very close relative of those components installed in the LM6000, with a low pressure compressor derived from the GE Frame 6 heavy-duty CTG, and a new, industrial power pressure turbine derived from the GE90 flight engine. (The generator is driven from the power turbine in a hot-end-drive configuration.) Flow from the low pressure compressor is ducted outside of the unit through an intercooler and then back into the combustor, greatly increasing mass flow. The intercooler can be either air- or water-cooled, although at the Project site air-cooling would be required. The LMS 100 was evaluated in detail for the Project and the following conclusions were made:

- Technology risk – the LMS 100 was introduced into service in 2005 and only a very few machines are in commercial operation. Major parts life is not yet known. Many newly introduced CTG technologies have required several years of manufacturer-sponsored improvement before achieving an adequate service life.
- Footprint – two LM6000s have a smaller footprint than a single LMS 100 when an air-cooled intercooler is incorporated into the LMS 100 design.
- Efficiency – the LMS 100 has significantly higher published full-load efficiency than does the LM6000 when a water-cooled intercooler is employed, 46 percent vs. 40 percent Higher Heating Value (HHV) considering the CTG alone. However, at the Project site, an air-cooled intercooler would be required, and fuel gas compressors of

higher hp would be required due to the higher combustion pressures encountered in the LMS 100. Therefore the net installed advantage to the LMS 100 would be expected to be no more than approximately 2 percent. While this is significant, the applicant does not believe that it outweighs the other factors under consideration.

Other simple cycle combustion turbines considered included:

- The Rolls Royce RB211-6761 produces lower output than does the LM6000 SPRINT and so would require three units to provide the output of two LM6000s. The increased footprint required to site three units and lack of North American market acceptance disqualified it from further consideration.
- The Rolls Royce Trent 60, while slightly more efficient than the LM6000 SPRINT and of a comparable size, has experienced technological problems which have prevented its widespread commercial acceptance. Therefore, the Applicant viewed its technology risk as unacceptable.
- The Pratt and Whitney FT8 TwinPack, while having a published output similar to the LM6000, is actually comprised of two combustion turbines driving a common generator. Thus the Project would be made up of four combustion turbines and two generators, likely reducing reliability and nearly doubling CTG maintenance costs. As well, efficiency is some 3 percent lower than that of the LM6000. For these reasons, the FT8 TwinPack was dropped from further consideration.
- Non-SPRINT variants of the LM6000 are identical to the units selected for the Project but without the SPRINT water delivery, atomization and control systems installed. SPRINT is Spray Intercooling, which is the injection of very finely atomized, ultra-pure water into the low pressure compressor section of the engine. This reduces the heat of compression, increasing mass flow through the unit and thus power output. The use of SPRINT adds approximately 5 MW output per unit, or 10 MW for the Project with virtually no parasitic load and at a very low capital cost. Non-SPRINT units were rejected because achieving maximum hot-day power output is of paramount importance to a peaker project such as Orange Grove.

Table 5.6-1 provides a summary of the evaluation screening results for generation technology alternatives. Screening of each alternative consisted of evaluating each alternative with respect to compatibility with the following screening criteria:

- Feasibly attaining most of the basic objectives of the Project.
- Potential for the alternative to avoid or substantially lessen environmental effects of the Project.

Alternative generation technologies that are not compatible with both of these goals were screened out and not further evaluated. Alternative generation technologies that were retained from initial screening are described further in Section 5.10.

Table 5.6-1 – Generation Technology Alternatives

ALTERNATIVE	COMPATIBILITY WITH SCREENING CRITERIA	BASIS FOR COMPATIBILITY	RETAINED/ELIMINATED FROM FURTHER CONSIDERATION
Alternative Fuels (oil, coal, biomass, waste, etc.)	Not Compatible	Coal, biomass and waste to fuel technologies are not suited for the efficient and quick start-up and shut-down cycles for peaking power needs. There is no fuel oil source nearby and, therefore, oil-burning technology would increase impacts related to delivering fuel to the Site, and fuel burning also would increase air emissions compared to the selected natural gas fuel and would not be capable of avoiding or substantially lessening Project environmental Impacts.	Eliminated
Solar, wind, hydroelectric, nuclear, and fuel cell technologies	Not Compatible	None of these technologies are suited for the efficient and quick start-up and shut-down cycles for peaking power needs.	Eliminated
Combined Cycle	Low Compatibility	More efficient generating technology, but less suited to quick start-up and shut-down cycles for peaking power needs, with considerably higher water consumption which is not practical for this Site. This technology does not appear to be capable of avoiding or substantially lessening Project environmental Impacts.	Eliminated
Conventional Boiler/Steam Turbine	Not Compatible	Not capable of achieving quick start-up and shut-down cycles for peaking power needs, with considerably higher water consumption which is not practical for this Site. This technology does not appear to be capable of avoiding or substantially lessening Project environmental Impacts.	Eliminated
Supercritical Boiler/Steam Turbine	Not Compatible	Not capable of achieving quick start-up and shut-down cycles for peaking power needs, with considerably higher water consumption which is not practical for this Site. This technology does not appear to be capable of avoiding or substantially lessening Project environmental impacts.	Eliminated

ALTERNATIVE	COMPATIBILITY WITH SCREENING CRITERIA	BASIS FOR COMPATIBILITY	RETAINED/ELIMINATED FROM FURTHER CONSIDERATION
Advanced Gas Turbine Cycles - Cheng Cycle	Not Compatible	Increased use of water with this technology compared to the proposed technology make it incompatible with the basic Project objectives. This technology is available on 6 MW units, so many units would be required to provide the power that SDG&E has requested, which would result in substantially larger Project site footprint and increased environmental impacts. This technology would not be capable of avoiding or substantially lessening Project environmental impacts.	Eliminated
Advanced Gas Turbine Cycles - Recuperated Mercury 50 Units	Not Compatible	This technology is available on 5.5 MW units, so many units would be required to provide the power that SDG&E has requested, which would result in substantially larger Project site footprint and increased environmental impacts. This technology would not be capable of avoiding or substantially lessening Project environmental impacts.	Eliminated
Advanced Gas Turbine Cycles - GE LMS 100	Low Compatibility	This unit does not provide the proven technology record compared to the selected technology and, therefore, has low compatibility with the Project's basic objectives. In addition, this technology would require an increased footprint requirement compared to the proposed Project when equipped with an air-cooled intercooler. This technology would not be capable of avoiding or substantially lessening Project environmental impacts	Eliminated
Advanced Gas Turbine Cycles - Staged Combustion	Not Compatible	This technology is commercially available on large units that do not meet the SDG&E requirements for a peaking unit.	Eliminated
Alternative Simple Cycle Combustion Technologies- Rolls Royce RB211-6761	Not Compatible	The lack of North American market acceptance makes this technology incompatible with the Project basic objectives.	Eliminated
Alternative Simple Cycle Combustion Technologies- Rolls Royce Trent 60	Not Compatible	This technology has experienced problems which has prevented its widespread commercial acceptance and makes it incompatible with the Project's basic project objective of providing reliable power generation using proven technology.	Eliminated

ALTERNATIVE	COMPATIBILITY WITH SCREENING CRITERIA	BASIS FOR COMPATIBILITY	RETAINED/ELIMINATED FROM FURTHER CONSIDERATION
Alternative Simple Cycle Combustion Technologies - Pratt and Whitney FT8 TwinPack	Low Compatibility	With this technology, the Project would be made up of four combustion turbines and two generators, reducing reliability and nearly doubling CTG maintenance costs, with reduced efficiency compared to that of the LM6000.	Eliminated
Non-SPRINT variants of the LM6000	Low Compatibility	This technology would reduce Project power generating capacity by approximately 10 MW with no parasitic load benefit and no substantial capital cost reduction. With this technology, the Project would provide power to approximately 7,500 homes during times of peak demand. Therefore, this technology has low compatibility with the Project's basic objective of providing efficient power generation in an economically feasible manner and the objective of responsiveness to SDG&E's RFO.	Eliminated

5.7 Alternative Emissions Control Technologies

As described in Section 2.0, the proposed CTG will feature the use of water injection to the turbine in order to reduce Nitrogen Oxides (NO_x) formation. Turbine NO_x emissions will be further controlled by the use of a Selective Catalytic Reduction (SCR) system, and carbon monoxide (CO) and volatile organic compound (VOC) emissions will be controlled by an oxidation catalyst system. This control strategy for NO_x, CO and VOC emissions is widely used in CTG projects and has a demonstrated track record of success in the industry. For this reason, both the regulatory community and gas turbine manufacturers recognize this combination of technologies as the Best Available Control Technology (BACT) standard.

The LM6000 PD SPRINT is a derivative of the LM6000 series that incorporates a dry low-NO_x combustion system that achieves a similar level of NO_x reduction as the proposed water injection technology. The dry low NO_x PD SPRINT was seriously considered for the Project but ultimately was rejected in favor of the PC SPRINT variant due to reliability concerns (approximately 1.5 percent to 2 percent lower availability factor), lower output (approximately 2 MW per machine, or 4 MW for the Orange Grove Project) and increased maintenance expense. With the 4 MW higher output for this Project, the selected technology will result in the plant having the capacity to serve approximately 3,000 homes more than the dry low-NO_x technology. These 3,000 additional homes would be provided with power when it is needed most during peak use hours. The LM6000 PD SPRINT technology does not improve the level of NO_x reduction compared to the proposed water injection technology and the PD requires frequent (sometimes daily) re-tuning to achieve the best combination of low NO_x emissions and low CO emissions. Emissions from both the LM6000 PC SPRINT and the LM6000 PD SPRINT would be reduced to the same value by back-end NO_x and CO catalysts.

Two emerging technologies received consideration in the Project. XONON is a flameless catalytic system for NO_x emissions control developed by Catalytica Combustion Systems and has achieved 4 parts per million volume dry (ppmvd) and lower NO_x emissions in a 1.5 MW Kawasaki simple-cycle turbine. The technology was acquired by Kawasaki in 2006. There is no experience yet on a large scale commercial turbine, and the technology is not offered for the LM6000 series. For these reasons, this technology was eliminated.

SCONOX is another new technology for NO_x emissions control, and was developed by Goal Line Environmental Technologies. SCONOX uses a catalyst with a potassium carbonate absorption coating. NO_x is reacted with the coating to form potassium nitrites and nitrates, without the use of ammonia, in a temperature window between 280 to700 degrees Fahrenheit (°F). These reaction products deposit on the coating, so it must be regenerated later in order to sustain its performance. The regeneration step involves formation of new potassium carbonate, thereby refreshing the coating with no net consumption of the potassium carbonate. This temperature range of 280 to 700 °F, however, is much lower than the LM6000 operating temperatures of 837 °F (at 100 percent load) to 956 °F (at 50 percent load), rendering the technology unsuitable for the Project. In addition, SCONOX has not been demonstrated in simple-cycle peaking turbine operation. Consequently, the technology was not selected for use in the Project.

Table 5.7-1 provides a summary of the evaluation screening results for emission control technology alternatives. Screening of each alternative consisted of evaluating each alternative with respect to compatibility with the following screening criteria:

- Feasibly attaining most of the basic objectives of the Project.
- Potential for the alternative to avoid or substantially lessen environmental effects of the Project.

Alternative emission control technologies that are not compatible with both of these goals were screened out and not further evaluated. Alternative sites that were retained from initial screening are described further in Section 5.10.

Table 5.7-1 – Emission Control Technology Alternatives

ALTERNATIVE	COMPATIBILITY WITH SCREENING CRITERIA	BASIS FOR COMPATIBILITY	RETAINED/ELIMINATED FROM FURTHER CONSIDERATION
Dry Low NO_x	Low Compatibility	This technology has lower reliability (approximately 1.5 to 2 percent lower availability factor), lower output (approximately 2 MW per machine) and increased maintenance expense compared to the selected technology	Retained
XONON	Not Compatible	Technology is not proven and, therefore, does not satisfy the basic Project objective of reliable power generation using commercially available proven technology.	Eliminated
SCONOX	Not Compatible	Technology is neither proven nor appropriate for the Project equipment and, therefore, does not satisfy the basic Project objective of reliable power generation using commercially available proven technology.	Eliminated

5.8 ALTERNATIVES IDENTIFIED TO REDUCE TRUCKING OF WATER

The Applicant has carefully evaluated identified alternatives to potentially eliminate or reduce the trucking of water to the Site. As described in Section 5.3, no feasible and reliable water supply was identified that could supply the Project with minimal impact on existing infrastructure. A water pipeline is not currently feasible to eliminate trucking because of land access issues and other considerations described in Section 5.3. In addition to the range of alternatives considered for water supply, additional alternatives were considered to determine if water trucking could be minimized, as described further below.

Cooling technology alternatives are analyzed in Sections 5.4 and 5.10 and include evaluations of water use and water hauling. Absorption chilling was also investigated and rejected for the Project. Absorption chilling, using ammonia or lithium bromide as the refrigerant, uses a heat

source to power the cycle. Such heat source can be direct-fueled (natural gas, for example) or indirect (steam, including waste steam at combined-cycle facilities). The Applicant believes that additional consumption of natural gas is to be avoided, and steam is not available at this peaking facility.

The applicant has recently been made aware that GE intends to test the use of combustion turbine exhaust gas as the absorption chiller heat source, however there are no facilities operating as yet with this technology. Due to unacceptable technology risk and possible unavailability within the requisite timeframe, the Applicant rejected absorption chilling using exhaust heat as the cycle driver.

As described in Section 5.3, a single landowner is unwilling to provide reasonable access to a potential water line route in Pala del Norte Road (Figure 5.3-1) that could reduce or eliminate the need for trucking of fresh water. This alternative pipeline route would be approximately 1.5 miles long and would be installed within the bed of Pala del Norte Road. The large property holding along Pala del Norte Road that is preventing access is currently for sale. If this property were to change ownership and an easement obtained, the Project could use this alternative in the future. This would be a modification to the Project that would have to be evaluated on its own merit at that time. Currently, this alternative is infeasible. Furthermore, because RMWD policy does not provide for long-term commitment of water to any user, the proposed Project water supply provides a more reliable water source and would likely be retained in some form as a back-up water supply, even if the RMWD pipeline alternative were to become feasible.

While the reclaim water supply for the Project will be trucked from approximately 15.6 miles, it has the major benefit of using wastewater that is currently being discharged to the ocean instead of using a fresh water supply. There are no closer sources of reclaim water available. The RMWD has long-term plans to develop water treatment and a reclaimed water supply, including plans for a reclaim water pipeline near the intersection of SR 76 and I-15. This system, if constructed, could provide a closer source of reclaim water for the Project in the future. However, this is not funded and is not foreseeable in the short term. This and other potential future opportunities to reduce or eliminate the trucking of water will continue to be evaluated by the Applicant; each will need to be evaluated on its own merit.

Water storage capacities for the Project have been engineered to provide a reliable water source onsite for fire protection and Project operations needs considering that water will be trucked to the Site. The water storage capacity onsite has been substantially increased compared to a previous project design that assumed a water pipeline could be constructed. As described in Section 2.10.1, Reliability and Safety Systems, the plant is designed with water capacity to run 50 hours at summer design conditions. This water storage capacity provides substantial reliability and flexibility for operations. In addition to water storage, various water truck sizes were also considered. The Project has selected an approximately 6,500 gallon water truck size. This truck size is designed to minimize the number of water truck trips using a single-trailer semi-truck. Single-trailer is preferred over double-trailer for this Site because of some sharp corners on SR 76. The selected water truck size will allow water hauling frequency to be reduced to a peak of approximately 1 truck per hour each for reclaim and fresh water. This

would be the peak when the plant is operating and 2 water trucks are utilized. On average, for each 1 hour of run time that the plant operates at full capacity in summer design conditions, 0.9 truck of fresh water and 0.6 truck of reclaim water hauling will be needed. Based on SDG&E experience, peaker plants in their service area typically run between 2 to 8 hours on days when they run. Based on this, when the plant runs, the typical water truck traffic will be between 2 to 7 fresh water trucks and between 1 to 5 reclaim water trucks, for a total of 3 to 12 trucks per day. This would primarily be in the summer months when peak usage is most common. Smaller water trucks were included in the Project design, but 6,500 gallon trucks are now proposed to minimize truck hauling.

Table 5.8-1 – Alternatives to Reduce Trucking of Water

ALTERNATIVE	COMPATIBILITY WITH SCREENING CRITERIA	BASIS FOR COMPATIBILITY	RETAINED/ELIMINATED FROM FURTHER CONSIDERATION
Water Supply alternatives	Not Compatible	See Table 5.3-1	Eliminated
Cooling Technology Alternatives	Not Compatible to Low Compatibility	See Table 5.4-1	See Table 5.4-1
Absorption Chilling	Not Compatible	No practical source of heat for traditional absorption chilling, and use of heat from turbine exhaust is unproved technology that is not commercially available.	Eliminated
Pala del Norte Road Water Line	Not Compatible	See Table 5.3-1	Eliminated (potentially available to the Project in the future)
RMWD Reclaim Water	Not Compatible	See Table 5.3-1	Eliminated (potentially available to the Project in the future)
Hauling and Storage Alternatives	Not Compatible	Smaller storage and water truck hauling capacities originally included in the Project design were rejected due to reduced water supply reliability and increased truck traffic impacts.	Eliminated

5.9 GAS PIPELINE ALIGNMENT

Figure 5.9-1 shows an alternative gas Pipeline alignment that was considered for the Project. The alternative gas alignment follows SR 76 from the Site to Rice Canyon Road. For this alternative, the pipeline would be constructed in the roadbed or road shoulders of SR 76, within the Caltrans ROW. This route was originally proposed for the Project but was eliminated due to concerns over construction traffic and California Department of Transportation (Caltrans) requirements. For this alternative, the westernmost portion of the pipeline would be the same as proposed near Rice Canyon Road, but the entire pipeline route would follow the highway. The total pipeline length would be approximately 2.0 miles, which is 0.4 mile shorter than the proposed route. This alternative would eliminate direct disturbance of the gas pipeline to native habitat. However, much of the road is winding and follows the base of the granitic rock slopes, with narrow shoulders and topographic constraints, making construction difficult. The pipeline would be

primarily in road fill, but areas of shallow and irregular bedrock occur along the roadway. Lane closure would be required for most of the approximately 3 months of pipeline construction, with delays for control of one-lane traffic that would interrupt local businesses and residents. Blasting could be required in some areas due to the irregular basement rock terrain. The constructability issues associated with this alternative make it not consistent with the Project's basic objectives. The proposed gas pipeline route was selected over this alternative because the proposed route resolves the traffic, constructability and linear facility easement issues associated with the SR 76 route.

5.10 SUMMARY OF ALTERNATIVES AND COMPARATIVE MERITS

Sections 5.1 through 5.9 identify the range of alternatives evaluated for the Project and those alternatives that passed the initial screening based on compatibility with the following screening criteria:

- Feasibly attaining most of the basic objectives of the Project.
- Potential for the alternative to avoid or substantially lessen environmental effects of the Project.

The alternatives passing the screening analysis are identified and compared in Table 5.10-1 as described further in following sections.

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Table 5.10-1 - Comparative Analysis of Alternatives Compatible with the Screening Criteria

ALTERNATIVE	RELATIVE ENVIRONMENTAL IMPACT COMPARED TO THE PROJECT																
	Air Quality	Geology Hazards and Resources	Agriculture and Soils	Water Resources	Biological Resources	Cultural Resources	Paleontological Resources	Land Use	Socioeconomics	Traffic and Transportation	Noise	Visual Resources	Waste Management	Hazardous Materials	Public Health	Worker Safety	Transmission System
NO PROJECT	●	❍	❍	❍	❍	⊗	⊗	⊗	●	❍	❍	❍	❍	❍	❍	⊗	❍
ALTERNATIVE SITES																	
• GCL North Site	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	❍	⊗	⊗	⊗	⊗	⊗	●
• GCL South Site	⊗	⊗	⊗	●	❍	⊗	⊗	⊗	⊗	⊗	❍	●	⊗	⊗	⊗	⊗	●
ALTERNATIVE COOLING TECHNOLOGIES																	
• Air Cooled Condenser	●	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	❍	●	●	⊗	⊗	⊗	⊗	●
EMISSION CONTROL TECHNOLOGY ALTERNATIVES																	
• Dry Low NOx	●	⊗	⊗	❍	⊗	⊗	⊗	⊗	⊗	❍	⊗	⊗	⊗	⊗	⊗	⊗	●

LEGEND: ❍ = Less adverse impact than the proposed Project; ⊗ = Same or Similar Impact as the proposed Project; ● = Greater adverse impact than the proposed Project.

5.10.1 No Project Alternative

The No Project alternative would not meet the Project's basic objectives. It is included in this analysis only to provide a baseline for reasoned decision-making. The Project is needed by SDG&E in order to meet growing load requirements in the local area. Delay or cancellation of the Project would leave the system vulnerable to heat events.

The No Project Alternative would not have the specific environmental impacts addressed in the AFC for the proposed Project. There would not be Orange Grove Project emissions to air, water usage, surface disturbances, wildlife impacts, land used, traffic, noise, visual impacts, waste generation, hazardous materials handling or transmission system upgrades. There also would be no socioeconomic benefits of the Project, and delaying reinforcement of SDG&E's service area by not permitting the Project could result in significant adverse socioeconomic impacts if the grid is not capable of supporting demand. Commerce and public health can be significantly impacted by power outages.

In addition, the Project physical impacts would not be permanently avoided, but instead would only be displaced to a future proposal to provide needed energy in the region. The nature and extent of impacts at a future proposal site would be dependant on the specific proposal. Until the needed generation capacity is online, the No Project Alternative would result in greater potential environmental impacts, including socioeconomic impacts of potential electric supply shortfalls, and increased air pollution levels because new, cleaner peaking generation plants would not be placed in service to replace older, less efficient peaking power plants with greater emission levels.

5.10.2 Alternative Sites

5.10.2.1 GCL North Site

The GCL North Site is located on the north side of SR 76 approximately 0.65 mile west-southwest of the Orange Grove site (Figure 5.2-3). The GCL North site is located in a small developed area associated with the former dairy farms. The estimated site grading footprint for this alternative is 6.0 acres, of which approximately 3.0 acres is disturbed and 3. 0 acres is Diegan coastal sage scrub. Approximately 3 additional acres of coastal sage scrub would be impacted for a fire protection fuel modification zone (125 feet). Blasting would likely be required for construction at this location because of topographic constraints and shallow irregular granite basement rock. The GCL North site would use the same gas pipeline route as the proposed Project, but the pipeline would be shortened to approximately 1.6 miles. The interconnection for this site would still be to the 69 kV Pala substation, so a transmission line interconnection would be required that would range from 0.5 to 0.7 mile, depending on the route taken. An overland route to the northeast could disturb additional coastal sage scrub. The GCL North site does not have an identified reliable water supply, except for trucking of water to the site. With trucking of water, this alternative site could satisfy the Project's basic objectives.

At this alternative site, project impacts related to air quality, geologic hazards and resources, agriculture and soils, water resources, land use, socioeconomics, traffic, waste management, hazardous materials, public health, and worker safety would be generally the same as for the proposed Project. The same general types and magnitudes of impacts would occur, but the physical impacts (e.g., emission source locations) would be displaced to the new site location. This site is zoned for a solid waste facility and is owned by Gregory Canyon Ltd. The length of the water trucking haul route would be reduced by approximately 1.0 mile, which would reduce air emissions and fuel burning from water trucking, but the would be no measurable difference in air quality.

This alternative would disturb approximately 6 acres of coastal sage scrub, plus additional acreage of coastal sage scrub if a direct overland route northeast to the Pala substation is taken. Six acres of coastal sage scrub disturbance would be 3.3 less acres of disturbance than the proposed Project. However, this would result in 6.6 acres less mitigation (2:1 mitigation ratio).

Much of the GCL North site was within the corridor where cultural resource surveys were completed and no resources were found. Neither the Project nor the GCL North Site would be expected to impact cultural resources. It is expected that construction would need to be monitored full-time at this site similar to the proposed Project and, if important resources were to be found they would need to be avoided or managed in accordance with laws, ordinances, regulations and standards (LORS).

The GCL North site is located on granitic basement rock. Therefore this site would not affect paleontologic resources. The granitic basement rock does not contain paleontological resources. Neither the proposed Project nor the GCL North site is expected to affect paleontologic resources.

The GCL North site is located further from the closest residences than the proposed Site. The nearest residences to the GCL North Site are located almost 1.0 mile distant. Therefore, this Site would reduce noise impacts of the Project on residences.

The GCL North site has even less visibility than the proposed Project site. Only two residences have been identified that would be able to see the power plant at the GCL North site, compared to about 5 houses that can see the proposed Site. However, this alternative would include a 0.5 to 0.7 mile transmission line that would add to the visual presence of the Project. Considering the low number of resident viewers for either site, the overall visual impacts for the GCL site and the proposed Site are similar.

There would be additional transmission system infrastructure needed for the GCL North site compared to the proposed Project site because the Project would need to interconnect to the Pala substation located approximately 0.5 mile northeast.

Overall, compared to the proposed Project, the GCL North site would have similar impacts in most environmental resource areas, but less impacts for noise and greater impacts on transmission infrastructure. Noise impacts of the Project are already low. Noise is mitigated to achieve County noise ordinance limits and CEC criteria for nighttime noise limits. Therefore,

the GCL North site does not offer any substantial environmental benefit. Furthermore, it is unknown if an agreement could be reached with the owner to develop the GCL North site, as it is not currently on the market for development.

5.10.2.2 GCL South Site

The GCL South site is situated on the south side of SR 76 approximately 0.65 mile south-southwest of the Orange Grove site (Figure 5.2-3). The GCL South site is located on a disturbed area with the former dairy farms located southwest of the Site. The GCL South site would use generally the same pipeline route as the proposed Project, but the pipeline would be approximately 1.7 miles. The interconnection for this site would still be to the 69 kV Pala substation, so a transmission line interconnection would be required that would range from 0.5 to 0.7 mile, depending on the route taken. The GCL South site does not have an identified reliable water supply, except for trucking of water to the site. With trucking of water, this alternative site could satisfy the Project's basic objectives.

At this alternative site, project impacts related to air quality, geologic hazards and resources, agriculture and soils, land use, socioeconomics, traffic, waste management, hazardous materials, public health, and worker safety would be generally the same as for the proposed Project. The same general types and magnitudes of impacts would occur, but the physical impacts (e.g., emission source locations) would be displaced to the new site location. This site is zoned for a solid waste facility and is owned by Gregory Canyon Ltd. The length of the water trucking haul route would be reduced by approximately 1.0 mile, which would reduce air emissions and fuel burning from water trucking, but the would be no measurable difference in air quality.

The GCL South site would not disturb any coastal sage scrub or other sensitive natural habitat. This would be 9.3 acres less coastal sage scrub disturbance than for the proposed Project. However, this would result in 18.6 acres less mitigation (2:1 mitigation ratio).

The GCL South site was within the corridor where cultural resource surveys were completed and no resources were found. Neither the Project nor the GCL South site would be expected to impact cultural resources. It is expected that construction would need to be monitored full-time at this site similar to the proposed Project and, if important resources were to be found they would need to be avoided or managed in accordance with LORS.

The GCL site is located on Holocene alluvium partially within the mapped 100-year flood plain. The site would need to be filled to place the plant higher than the 100-year flood elevation. This could result in increased traffic impacts during construction to import fill, but this impact would be short term and not significant.

This site would not affect paleontologic resources. The Holocene alluvium that this site is located on is too geologically young to yield important paleontologic resources (see Section 6.8, Paleontology. Because neither the proposed Project nor the GCL South site is expected to affect paleontologic resources, there would be no difference in impact expected.

The GCL South site is located further from the closest residences than the proposed Site. The nearest residences to the GCL South site are located almost 1.0 mile distant. Therefore, this site would reduce noise impacts of the project on residences.

The GCL South site would increase visual impacts of the power plant site. At this site, the power plant would be built on the south side of SR 76, lower than the road, on flat terrain, offering a clear view of the site for travelers on SR 76. This would moderately increase visual impacts of the project. Several sparsely spaced rural residences have been identified that would be able to see the power plant at the GCL South site. This alternative would include a 0.5 to 0.7 mile transmission line that would add to the visual presence of the Project.

There would be additional transmission system infrastructure needed for the GCL South site compared to the proposed Project site because the Project would need to interconnect to the Pala substation located approximately 0.6 mile northeast.

Overall, compared to the proposed Project, the GCL South site would have similar impacts in most environmental resource areas, but increased impacts in the areas of water resources, visual resources and transmission system infrastructure, and reduced noise impact. Water resource impacts would be the same as for the proposed Project except for the presence of the plant within the 100-year flood plain. Visual impacts would be increased primarily for travelers on SR 76. Transmission system impacts would be increased because of a transmission line to the Pala substation. Noise impacts of the Project are already low. Noise is mitigated to achieve County noise ordinance limits and CEC criteria for nighttime noise limits. Therefore, the GCL South site does not offer any substantial environmental benefit and has some minor drawbacks. Furthermore, it is unknown if an agreement could be reached with the owner to develop the GCL South site, as it is not currently on the market for development.

5.10.3 Air Cooled Condenser

Combustion inlet air chiller condensers on the Project's CTGs utilize a circulating water system and relatively small evaporative cooling tower for rejection of heat to the atmosphere. Evaporative cooling systems at the plant have been kept to this minimum duty for efficiency, and other plant heat dissipation systems use air and oil-to-air-cooling technology or automotive-style radiators. Use of a dry air cooling system for the air chiller condensers would reduce Project reclaim water consumption. However, the use of dry cooling technology would adversely affect other areas of environmental and general importance including:

- Power generating capability – use of a dry system will result in a reduction in Project power output by approximately 3.2 net MW as compared to an evaporative chiller cooling system. This is because of both an increase in parasitic power consumption (from approximately 1.8 MW to 3.0 MW) and a decrease in combustion turbine gross output attributed to the inlet chilling system (to 10 MW from 12 MW). This would substantially reduce the power output of the facility when it is needed most during times of peak usage.

- Cycle (fuel) efficiency – the additional hp requirements and reduced combustion turbine output of a dry chiller cooling system will result in approximately 3.0 percent poorer Project cycle efficiency. This increases environmental impacts, because the parasitic load is higher with the air-cooled alternative (less power available for export to the grid) and also because although the maximum amount of power available from the combustion turbines is lower with the air-cooled alternative, fuel flow will not decrease at the same rate. (This is a function of the Brayton cycle, and an effect common to all combustion turbines.) This results in increased consumption of non-renewable fuel per unit of power generated. This is particularly true during hot weather, when a peaking power facility is most likely to be activated.
- Visual impact – inclusion of dry cooling would increase of the footprint of the Project and the dry cooling system would be a substantially larger piece of equipment compared to the proposed small evaporative cooling tower. The footprint required for the air-cooled chiller condenser would require approximately 1,500 square feet more than the proposed Project.
- Noise – air-cooling requires many times the airflow of evaporative cooling, accomplished through fans. Such fans tend to be very noisy as compared to an evaporative cooling tower.
- Relatively unproven technology – while the Applicant is aware of at least one LM6000-based project operating in a similar climate where air-cooled chillers have been incorporated (Niland, California), that facility has not yet operated through a summer season and so the technology cannot as yet be considered commercially acceptable.

The air cooled condenser alternative would have approximately the same environmental impacts as the proposed Project in the areas of geologic hazards and resources, agriculture and soils, water resources, biological resources, land use, socioeconomics, waste management, hazardous materials, public health, and worker safety. The air cooled condenser alternative would not benefit water resources because the reclaim water that would be saved is otherwise being discharged to the ocean. As for the proposed Project, this alternative would not be expected to impact cultural or paleontologic resources.

The air cooled condenser alternative would have increased impacts compared to the proposed Project in air quality, because more fuel would be burned by the plant and more plant emissions would occur per unit of power output. With this alternative, the plant output would be approximately 3.2 MW lower than for the proposed Project, which would supply approximately 2,400 less homes during times of peak demand. Until additional capacity is built, the reduced capacity would need to be made up by other plants, including older plants with higher rates of emissions to air per unit output. The lower output of the plant would be an adverse impact to grid reliability compared to the proposed Project.

The air cooled condenser alternative would incrementally increase visual impacts of the Site, due to the presence of more large equipment. However, the difference would not be significant.

The air cooled condenser alternative would increase noise levels for the Project and, in particular, nighttime noise levels at the few residences that occur in the Site vicinity.

The air cooled condenser alternative would eliminate the need for trucking of reclaim water to the Site. This would eliminate approximately 0.6 truck trip of water per hour of operation at summer design conditions. This would save non-renewable fuel and reduce air emissions related to water hauling. This would eliminate the expected peak reclaim water truck hauling of approximately 1 truck per hour. Overall, the reclaim water hauling of 0.6 truck trip per hour of summer design operation does not result in significant impacts. The low truck count will not measurably affect level of service (LOS). Therefore, the air cooled condenser would not reduce any significant environmental impact, and would increase impacts in some resource areas.

5.10.4 Dry Low NO_x

The dry low-NO_x alternative PD SPRINT would reduce fresh water consumption compared to the proposed Project.

However, the use of dry cooling technology would adversely affect other areas of environmental and general importance including:

- Power generating capability – This technology has lower reliability (approximately 1.5 to 2 percent lower availability factor), lower output (approximately 2 MW per machine) and increased maintenance expense compared to the selected technology. This would substantially reduce the power output of the facility when it is needed most during times of peak usage.
- Increased maintenance - the LM6000 PD SPRINT technology requires frequent (sometimes daily) re-tuning to achieve the best combination of low NO_x emissions and low CO emissions. The greatly increased number of sensors and control valves leads to lower reliability.
- Cycle (fuel) efficiency – even though the PD SPRINT has 3 percent better efficiency than the PC SPRINT, the gross improvement is not enough to compensate on a net basis – the parasitic loads would be relatively the same between the two CTG models. Therefore, the net plant efficiency would be approximately 1.2 percent poorer compared to the proposed Project. This increases environmental impacts related to fuel consumption and increases consumption of non-renewable fuel used by the plant per unit of power generated. This is particularly true during hot weather, when a peaking power facility is most likely to be activated.

The dry low-NO_x alternative would have approximately the same environmental impacts as the proposed Project in the areas of geologic hazards and resources, agriculture and soils, biological resources, land use, socioeconomics, noise, visual resources, waste management, hazardous materials, public health and worker safety. As for the proposed Project, this alternative would not be expected to impact cultural or paleontologic resources.

The dry-low NO_x alternative would have increased impacts compared to the proposed Project in air quality because more fuel would be burned by the plant and more emissions would occur from the plant per unit of power output. With this alternative, the plant output would be approximately 4 MW lower than for the proposed Project, which would supply 3,000 less homes during times of peak demand. Until additional capacity is built, the reduced capacity would need to be made up by other plants, including older plants with higher rates of emissions to air per unit output. The lower output and reduced reliability of the plant would be an adverse impact to grid reliability compared to the proposed Project. The dry-low NO_x alternative technology does not improve the level of NO_x reduction compared to the proposed water injection technology. Emissions from both the LM6000 PC SPRINT and the LM6000 PD SPRINT would be reduced to the same value by back-end NO_x and CO catalysts.

Approximately two-thirds of the Project's proposed fresh water use will be for NO_x control. Based on the Project's Expected Use Case (see Table 2.6-1), the dry-low NO_x alternative would reduce fresh water consumption by an estimated 14 acre feet per year, and would reduce the need for trucking of fresh water to the Site by 0.6 truck trip per hour of operation at summer design conditions. With the dry-low NO_x alternative, a 12 hour day of operations at summer design conditions would require 3.7 fresh water haul trucks instead of 11.2 for the proposed Project. Overall, the fresh water hauling of 0.9 truck trip per hour of summer design operation for the proposed Project does not result in significant impacts. The low truck count will not measurably affect LOS. Therefore, the dry-low NO_x alternative would not reduce any significant environmental impact, and would increase impacts to air quality and transmission system reliability.

5.10.5 Conclusions

An extensive array of alternatives were considered for the Project including the No Project Alternative, five alternative power plant sites, alternative water supplies, alternative cooling technologies, electrical transmission line alternatives, generation technology alternatives, emissions control technology alternatives, alternatives to reduce water trucking, and gas pipeline alignment alternatives. Several diverse alternatives were retained from the original screening of alternatives for the Project. The alternatives that passed the original screening evaluations include:

- No Project Alternative
- GCL North Site
- GCL South Site
- Air Cooled Condenser Alternative
- Dry Low NO_x Alternative

Each of these alternatives was evaluated for comparative environmental merits and to determine if any of these alternatives would be capable of significantly reducing environmental impacts of the proposed Project. With the exception of the No Project Alternative, evaluations of these alternatives concludes that the environmental benefits compared to the proposed Project would be minor and would be offset by greater impacts in a number of resources areas. The No Project

Alternative was considered but rejected in view of SDG&E objectives to enhance the reliability and efficiency of power supply to its customers. While the No Project Alternative would not have the specific environmental impacts addressed in the AFC for the proposed Project, the No Project Alternative would delay reinforcement of SDG&E's service area with related adverse effects. In addition, physical impacts would be displaced to a future proposal to provide needed energy in the region and would be dependant on the specific proposal. Until the needed generation capacity is online, the No Project Alternative would result in greater potential environmental impacts, including socioeconomic impacts of potential electric supply shortfalls, and increased air pollution levels because new, cleaner peaking generation plants would not be placed in service to replace older, less efficient peaking power plants with greater emission levels.

5.11 REFERENCES

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G:\Orange_Grove-125158\MXD\Alt_Vicinity.mxd

Site Boundary
Alternate Sites

N
W
E
S

Figure 5.2-1

Alternates Vicinity Map

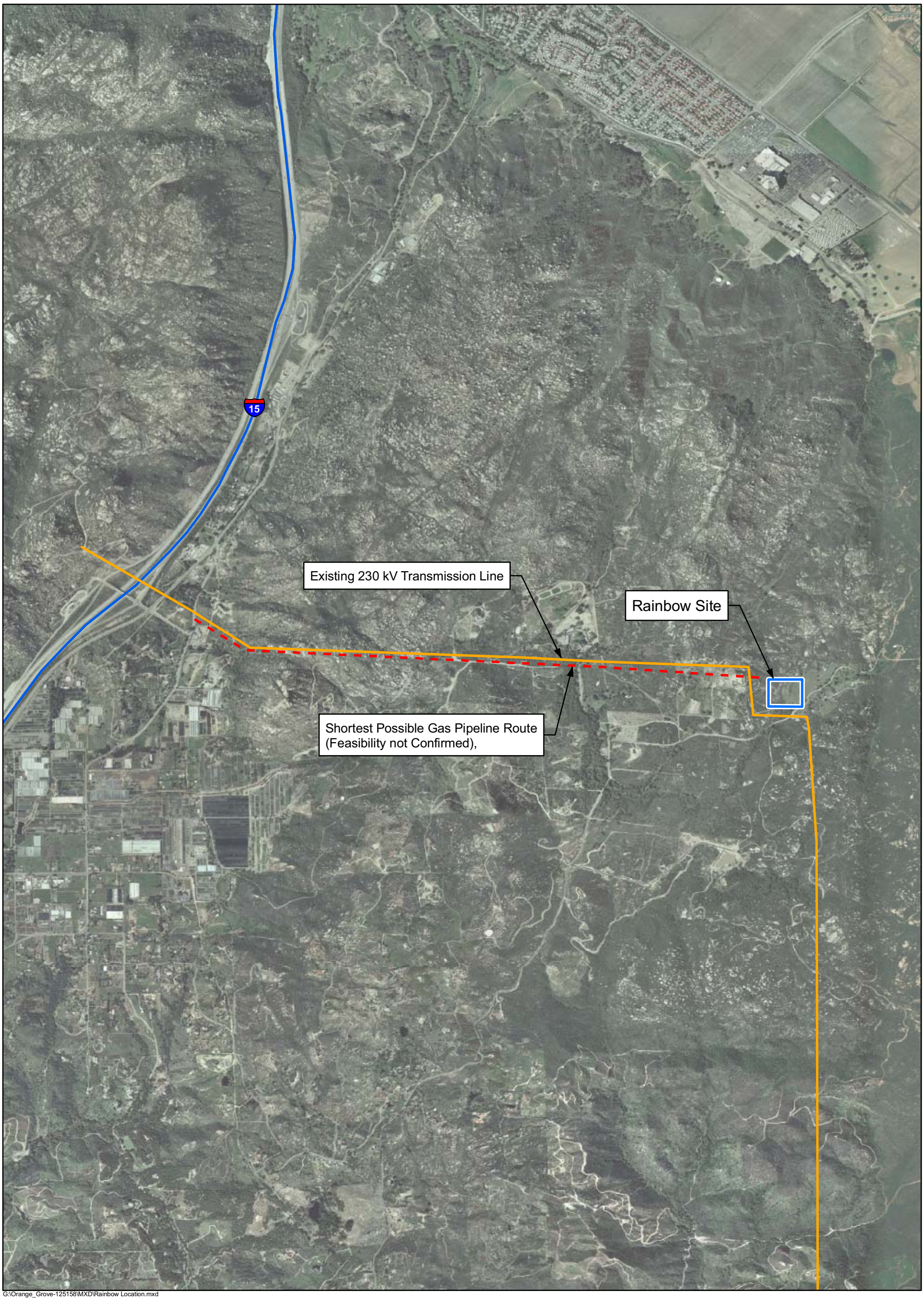
Orange Grove Project

1" = 0.5 Miles

0.5 0.25 0 0.5 1 Miles

Source:
Aerial Imagery from ESRI_Imagery_World_2D

TRC



G:\Orange_Grove-125158\MXD\Rainbow Location.mxd

Existing Electrical Transmission Line
Alternate Gas Lines
Alternate Sites

N
W E
S

Figure 5.2-2

Rainbow Site Location

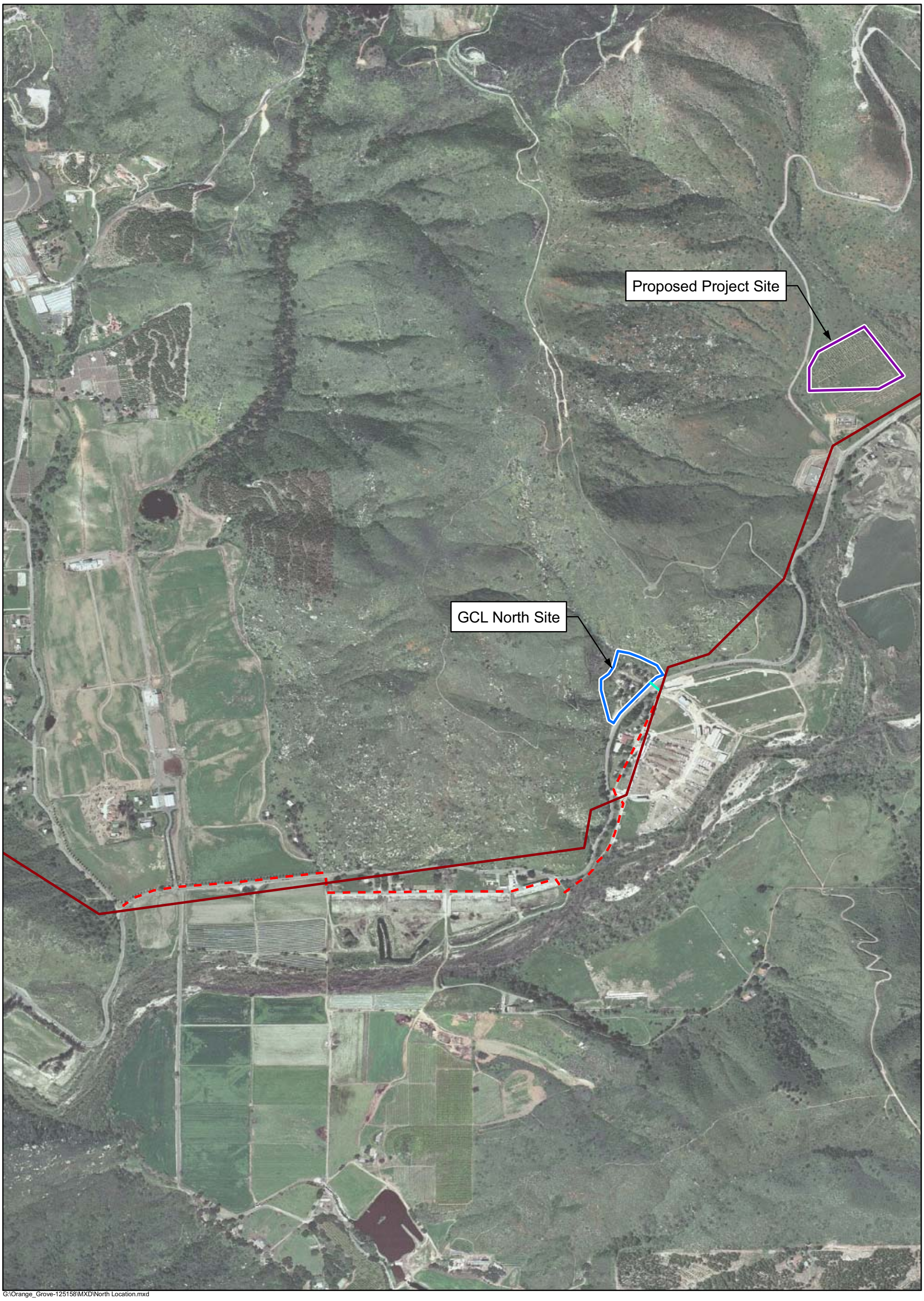
Orange Grove Project

1" = 2,000'

2,000 1,000 0 2,000 4,000 Feet

Source:
Aerial Imagery from ESRI_Imagery_World_2D

TRC



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Site Boundary
North Alternate Site
Alternate Electrical Transmission Line
Alternate Gas Line
Existing 69 kv Transmission Line

N
W E
S

Figure 5.2-3

North Alternate Location Map

Orange Grove Project

1" = 1,000'

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

Source:
Aerial Imagery from ESRI_Imagery_World_2D

TRC

G:\Orange_Grove-125158\MXD\South Location.mxd

Site Boundary
South Alternate Site
Alternate Electrical Transmission Line
Alternate Gas Line
Existing 69 kv Transmission Line

N
W E
S

Figure 5.2-4

GCL South Site Location

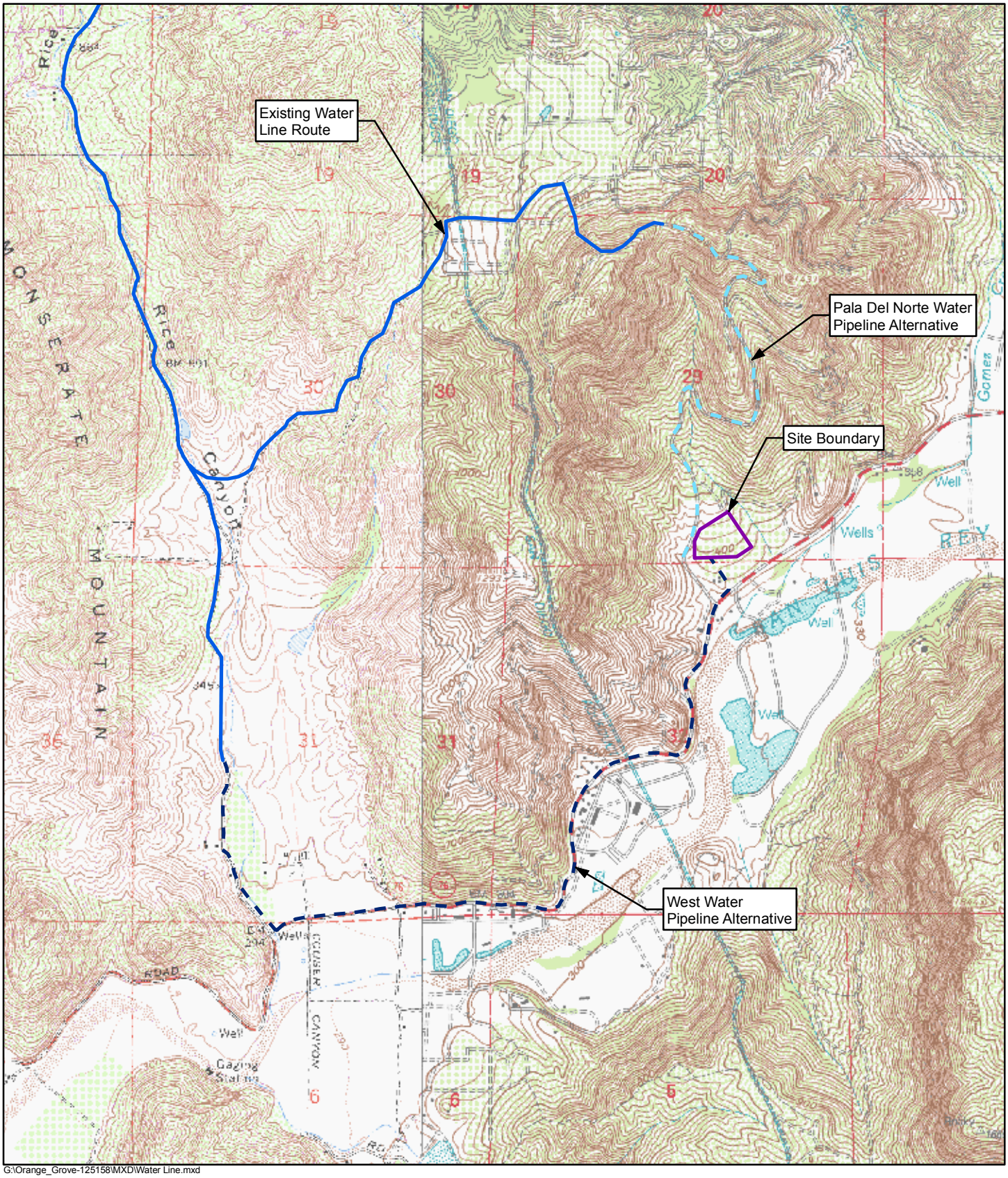
Orange Grove Project

1" = 1,000'

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

Source:
Aerial Imagery from ESRI_Imagery_World_2D

TRC



G:\Orange_Grove-125158\MXD\Water Line.mxd

Figure 5.3-1

RMWD Water Pipeline Alternatives

Orange Grove Project

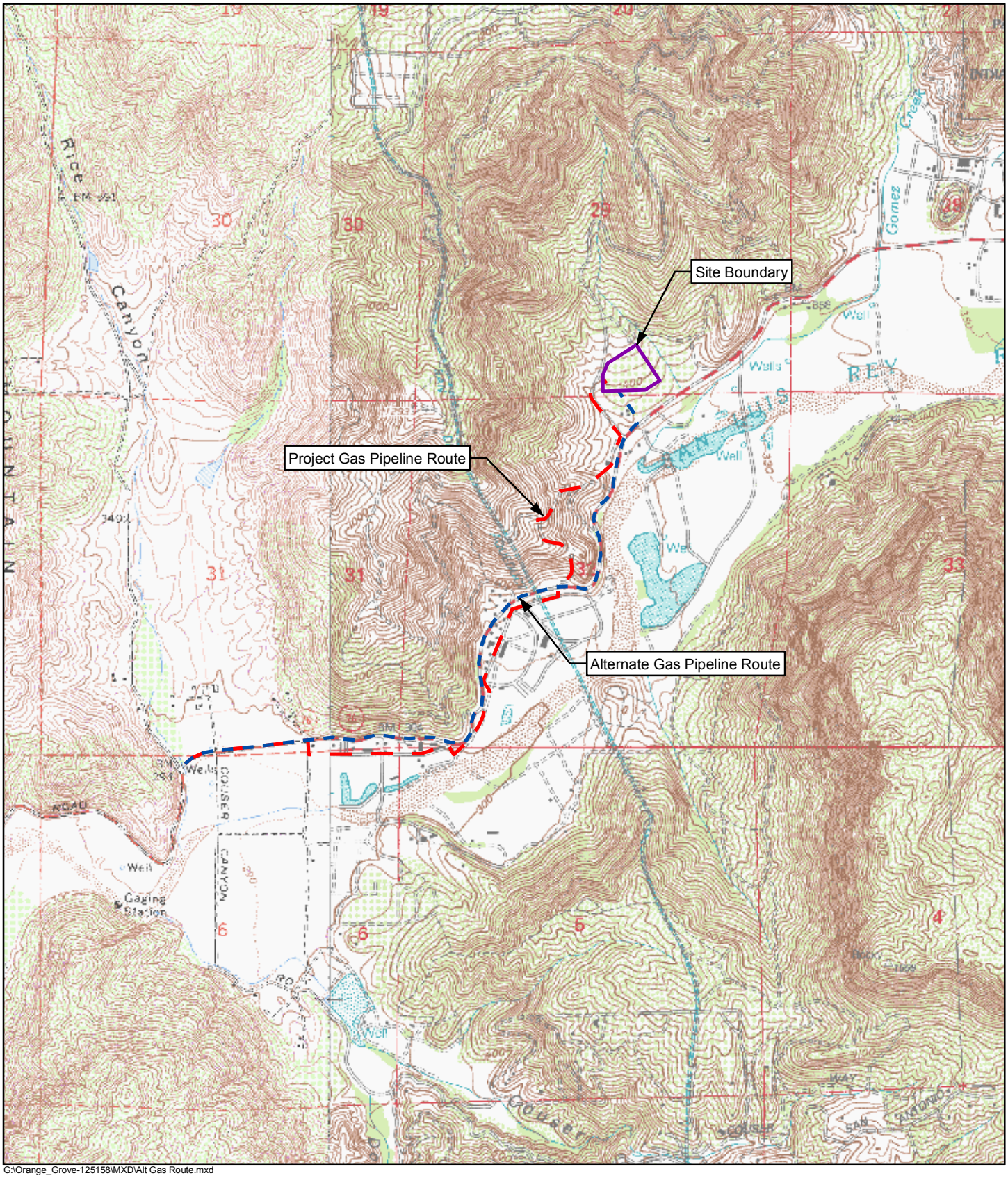
N W E S

1" = 2,000'

2,000 1,000 0 2,000 4,000 Feet

Source:
USGS Topographical Quardrangles:
Pala, Bonsall

TRC



G:\Orange_Grove-125158\MXD\Alt Gas Route.mxd

Figure 5.9-1

Alternative Gas Pipeline Route

Orange Grove Project

N
W E
S

1" = 2,000'

2,000 1,000 0 2,000 4,000 Feet

Source:
USGS Topographical Quardrangles:
Pala, Bonsall

TRC