Prepared for: Beacon Solar, LLC

Project Design Refinements

Docket No. 08-AFC-2

AECOM, Inc.
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1.0 Introduction

On April 1, 2009, the Preliminary Staff Assessment (PSA) for the Beacon Solar Energy Project (BSEP or Project) was issued. The BSEP PSA contains the analyses and proposed Conditions of Certification for the Project that have been compiled by the Energy Commission's Staff (Staff). Staff provided Status Report #8 on June 1, 2009. This Status Report contains a list of information that Staff has indicated is needed in order to prepare the Final Staff Assessment by the end of July 2009.

Beacon Solar, LLC (Beacon) has prepared this document along with the supporting attachments, at the request of Staff, to provide information for several Project design refinements that the PSA and/or Status Report #8 indicates are needed. The project design refinements addressed in this document fall into two categories:

1. Refinements suggested by Staff
2. Applicant proposed refinements

Section 2.0 describes the Project refinements and Section 4.0 discusses the potential differences in impacts from those described for the Project in the Application of Certification (AFC) and subsequent responses to data requests.

In addition to the project design refinements, Section 3.0 of this document provides additional information related to two of the water supply options proposed by Staff, and Section 4.3 discusses the potential environmental impacts associated with those alternatives. The two alternatives are:

- Obtaining poor-quality groundwater from the vicinity of Koehn Lake,
- Obtaining tertiary treated reclaimed water from the Community of Rosamond's wastewater treatment facility (located about 40 miles south of the Project power plant site)

If determined to be viable, either of these alternative water sources could be used in lieu of or as a supplement to the use of on-site groundwater as proposed by Beacon. Because there will be other environmental impacts associated with these two alternative water supply sources, it should be noted that Beacon continues to consider the use of on-site ground water to be the environmentally preferred scenario.

Section 5.0 presents conclusions related to the design refinements and environmental discussions.

A number of Attachments to this report are also provided which include additional information on the analyses performed.

2.0 Project Design Refinements

This section presents suggested and proposed Project design refinements.

2.1 Staff Suggested Design Refinements

The following refinements to the Project design were suggested by Staff:

- Refinement of the engineering, design and modeling for re-routing of Pine Creek Wash, along with supplemental information on associated hydrological and biological mitigation.
- Incorporation of a partial zero liquid discharge (ZLD) system and on-site water treatment facility, with resultant reduction in the size of the proposed evaporation ponds.
- Addition of storm water retention facilities, including updating of the drainage plan to address soil erosion and discharge runoff to adjacent properties.
- Addition of a second access road for emergency purposes.
- Description of the rerouting of the SCE distribution line.
- Confirmation of Land Treatment Unit design.
- Revision of the BSEP site layout to accommodate the above refinements.
- Confirmation of accessibility to adequate telecommunications facilities.
- Revisions to the vehicles proposed for solar field maintenance activities during operation.
- Mitigation for potential visual impacts.

2.1.1 Diversion Channel Redesign

Pine Creek Wash, a State-jurisdictional water, currently bisects the BSEP, running southwest to northeast across the Project site. The wash will be re-routed around the solar field as part of the Project. A detailed, FEMA-compliant hydrology and hydraulics analysis has been conducted to characterize existing site conditions and proposed site conditions. The evaluation has been used to properly evaluate the potential impacts of rerouting the wash and to facilitate a design for the rerouted wash that will convey the 100-year storm event. A sediment transport study was also conducted to evaluate sediment scour and deposition and to assess the fluvial geomorphological conditions at the site. These studies have been used to redesign the rerouted wash to achieve both flood flow conveyance and restoration opportunity as mitigation for impacts to Waters of the State. The redesign includes shallower slopes and drop structures to control flows. The slopes and drop structures have been designed to facilitate wildlife movement. A description of the analyses performed is provided in **Attachment 1a**. Biological/hydrological mitigation for the rerouted wash is discussed in **Attachment 1b.**

2.1.2 Water Treatment and Discharge Facilities

As a result of Staff's review, Beacon has evaluated several design changes related to the water supply and discharge features. Previous BSEP facilities were designed based on the use of on-site groundwater with discharge to evaporation ponds. Beacon has determined that a partial ZLD system (Configuration 1) is feasible. A partial ZLD system will reduce the amount of on-site groundwater needed for cooling and will reduce the amount of water discharged to the evaporation ponds, therefore reducing the evaporation pond size.

Although it has not yet been determined, if the use of off-site water supplies are viable, an alternative treatment process would be required due to the higher concentration of total dissolved solids (TDS) in the poorer quality water. This system would consist of pre and post treatment clarifiers (Configuration 2). The two design configurations of the water treatment facilities have been designed such that a range of water quality (i.e., from low to high TDS) can be used. Configuration 1 (C1) would be sufficient if on-site groundwater is used. Configuration 2 (C2) would be needed if high TDS water such as might be available near Koehn Lake is used. It is assumed that use of reclaimed water (e.g., from Rosamond) would be somewhere between these two configurations.

The water treatment systems and evaporation pond changes for C1 are summarized below. A summary explanation of the water treatment system that would be required if high TDS water were to be used is provided in Section 3.0 below. Water balance diagrams with instantaneous flows are shown in **Figure 1** and **Figure 2** for both treatment options.

2.1.2.1 Water Treatment Facilities for Configuration 1

C1 has the same pre-treatment systems as analyzed in the PSA; however, a partial ZLD system is included for post-treatment. The pre-treatment ion exchange unit will be required to reduce scale-forming species from entering the cooling water system. The pre-treatment system will contain cation exchange vessels, a degasifier, and anion exchange vessels, along with associated piping, pumps, valves and tanks. This design allows for the removal of silica as well as hardness, and enables cycling up of the cooling tower water impurities to approximately 15 cycles of concentration (COC). Similarly, some of the water feeding the cooling tower bypasses the ion exchange components and flows directly to the tower basin to provide some alkalinity and buffering capacity to protect the cooling tower's materials of construction.

To further inhibit mineral scale formation, an organic phosphate inhibitor solution may be fed into the circulating water system in an amount proportional to the circulating water blowdown flow. The inhibitor solution feed equipment includes a bulk storage tank and two full-capacity metering pumps. To inhibit biofouling, sodium hypochlorite is shock-fed into the circulating water system as a biocide. The sodium hypochlorite feed equipment also includes a bulk storage tank and two full capacity metering pumps.

The new addition to this process since the PSA submission is the post-treatment brine concentrator system, which allows C1 to be classified as a partial ZLD system. The discharge from the brine concentrator system consists of a concentrated liquid that is directed to evaporation ponds for further drying.

Estimated annual water usage for C1 would be approximately 1,388 acre-feet per year (AFY),

2.1.2.2 Water Treatment Facilities for Configuration 2

Water treatment facilities required for C2 are described in Section 3.1.1.

2.1.2.3 Evaporation Pond Sizing

For C1 wastewater will discharge into the evaporation ponds at a summer peak discharge rate of 52 gallons per minute (gpm) and an annual discharge rate of 44 gpm. TDS in the discharge water could be up to approximately 70,000 milligrams per liter. In order to accommodate this flow, three evaporation ponds will be required, each with a nominal surface area of two acres, for a total surface area of six acres.

A further discussion of evaporation pond sizing is included in Section 3.1.2.

2.1.2.4 Evaporation Pond Design for Configurations 1 and 2

Regardless of the final size of the evaporation ponds, they will be designed in accordance with Lahontan Regional Water Quality Control Board (RWQCB) requirements. The ponds will be designed with an average depth of eight feet which allows for two feet of freeboard, three feet of wastewater and three feet of accumulated solids. For safety and operational purposes, the ponds will be cleaned when three feet of precipitated solids are accumulated in the base of the ponds, which is estimated to be every 4.5 years for C1, or 3.5 years for C2. Multiple ponds are planned to allow plant operations to continue in the event that a pond needs to be taken out of service (e.g., needed maintenance or solids removal). Each pond will have enough surface area so that the evaporation rate exceeds the cooling tower blowdown rate at maximum design conditions and at annual average conditions.

The pond liner system is expected to consist of a 60 mil high density polyethylene (HDPE) primary liner and a minimum 40 mil HDPE secondary liner. Between the liners is a synthetic drainage geonet that is used as part of the leachate collection and removal system (LCRS). There will be a hard surface protective layer on top of the 60 mil HPDE, which will consist of a non-woven geotextile, one foot thick granular fill/free draining material and a one foot thick hard surface such as roller-compacted concrete. The hard surface provides protection against accidental damage to the HDPE from falling objects, varying climatic conditions and worker activities during cleanout and maintenance. Monitoring of the evaporation ponds will be required to detect the presence of liquid and/or constituents of concern.

Attachment 2 contains the calculations related to the sizing of the evaporation ponds. Additional information on the design of the evaporation ponds is contained in the Amendment to the Report of Waste Discharge (ROWD) (**Attachment 6**). The Amendment to the ROWD is also being submitted to the Lahontan RWQCB.

2.1.2.5 Chemical Deliveries and Waste Haulage

C2 will require more chemical deliveries than C1 due to the chemical requirements in the clarifier. It is anticipated that 30 roundtrip deliveries per month would be required for C2. C2 will also have more waste haulage than C1 due to the higher concentration of TDS. 700 truck trips will be required to remove the accumulated solids at the anticipated clean out rate of every 3.5 years.

2.1.3 Stormwater Retention and Erosion Control

Storm water management for the completed facility will be provided through the use of source control techniques, site design and treatment control. A Conceptual Grading and Retention Study has been prepared and is included as **Attachment 3.**

Locations within the power block with the potential for chemical or oil releases will be fully contained. Rainfall within the containment areas will be allowed to evaporate or will be drained through an oil water separator. Locations within the power block where “contact” storm water may occur will be contained within a system of curbs or trenches. Drains from these curbed areas or containment trenches will be directed to an oil water separator. The oil separated and captured within the oil water separator will be trucked off-site to a licensed disposal/recycling facility. Clean water discharged from the oil water separator will be used on site by discharging it to the cooling tower or to the raw water storage tank. The water discharge from the oil water separator will not be discharged to the storm water system.

Off-site storm flows will be separated from on-site storm flows. This will allow for treatment control of the flows from the entire solar collector array, and ensure that off-site flows do not come into contact with the solar collector array area (locations where the potential for storm water to contact the heat-transfer fluid

(HTF) exist). Pine Creek Wash will be rerouted around the solar collector field to the south and east. Further details of the rerouted wash plan are included as **Attachment 1a.**

The storm flows from the solar collector arrays will be treated through the use of multiple retention ponds. These retention ponds will be linked via shallow, gradually sloped ditches that will enhance the treatment of the storm flows.

2.1.4 Emergency Access Road

The PSA indicates that a second access road is needed for emergency access. The primary access is off of State Route (SR)-14 on the western side of the BSEP plant site. At the request of Staff, Beacon has identified a route along the northern edge of the facility on the eastern side of the plant site connecting to Neuralia Road.

Beacon has completed biological, cultural, and paleontological surveys of the land required for the access road. The results of the surveys are provided in **Attachments 4a**, **4b**, **4c**, and **4d**, and the impacts are summarized in Section 4.1 of this document.

2.1.5 SCE Distribution Line

An existing SCE distribution line currently crosses the BSEP property. Beacon has had several discussions with SCE, and SCE is agreeable to having the distribution line moved so that it does not cross over the solar arrays. On April 16th 2009, the applicant met with Mark Gowin, Service Planner for SCE, to identify the existing electrical distribution easement and equipment and to discuss options for rerouting the line. At the conclusion of the meeting, SCE agreed that rerouting the line around the north boundary of the property was the best option. This was the path identified in the AFC in Figure 2-4, General Arrangement Site Plan. SCE has a preference, but not requirement, for the easement to be outside of the project perimeter fence line. This would allow SCE to access their line without the need to enter into the restricted project area. The applicant confirmed that a minimum of 25 feet will be left between the project fence line and the north property boundary. The minimum width required by SCE for a distribution line easement is 10 feet. Therefore, the area is more than sufficient to accommodate an SCE easement between the perimeter fence and the northern property boundary.

2.1.6 Land Treatment Unit

As a result of a review from the Department of Toxic Substances Control (DTSC), the sampling process and hazardous waste classification for HTF-impacted soil has been revised. The land treatment unit facilities will cover an area of approximately 590 feet by 590 feet, which includes a staging area. The HTF-impacted soils must be characterized as hazardous or non-hazardous waste prior to determination of whether the material can be treated at the site or must be removed for off-site disposal. This can be accomplished using generator knowledge supplemented by initial sampling of the waste to confirm its characteristics prior to placing it in the Land Treatment Unit (LTU).

HTF-affected soils will be relocated to the staging area and characterized following standards provided in California Code of Regulations Title 22, Section 66262.11 “Hazardous Waste Determination.” Initially, samples would also be analyzed for ignitability and toxicity using appropriate state and federal methods to characterize the waste as either hazardous or non-hazardous. Once a sufficient data set has been accumulated to allow characterization of the material as hazardous or non-hazardous based on HTF content and generator knowledge, the DTSC will be petitioned for a determination of waste classification for HTF-affected soils generated at the facility. At the Kramer Junction SEGS facility, DTSC issued a letter dated April 4, 1995 stating that soil contaminated with HTF “poses an insignificant hazard” and classifies the waste as non-hazardous for soils with a concentration of less than 10,000 mg/kg HTF pursuant to CCR Title 22, Section 66260.200(f). The Kramer Junction facility is 30 miles southeast of the Project, located just north of the intersection of Highways 58 and 395 in San Bernardino County. While this information from Kramer Junction alone may not be sufficient to characterize the waste material generated at the BSEP, Beacon anticipates that future waste characterization at BSEP will yield a similar result.

If the soil is characterized as a hazardous waste, the affected soils will be transported from the Project site by a licensed hazardous waste hauler for disposal at a licensed hazardous waste landfill. No HTF-affected soil characterized as hazardous waste will be disposed or treated on-site in the LTU. Based on past experience with a similar waste stream at the Kramer Junction SEGS facility, it is anticipated that soil containing 10,000 mg/kg HTF or more will be managed as hazardous waste, and that soil containing less than 10,000 mg/kg HTF will be non-hazardous waste and can be managed at the site.

The LTU will be constructed with a prepared base consisting of two feet of compacted, low permeability, lime treated material and be surrounded on all sides by a two foot high compacted earthen berm with slopes of approximately 3:1 (horizontal: vertical). Treatment of the HTF-affected soil in the LTU will involve moisture conditioning and may involve addition of nitrogen and phosphorous nutrients (i.e., fertilizers) as needed to simulate consumption of HTF by the indigenous bacteria.

2.1.7 Site Layout Adjustments

Adjustments to the site layout of the solar arrays and other facilities are needed due to several factors. These factors include the rerouting of Pine Creek Wash, the placement of the stormwater retention basins in the solar field, and relocation of the evaporation ponds and LTU. Note, revisions to the site layout were not needed to account for the Kern County right-of-way setbacks from the property boundaries per the Kern County General Plan circulation element along the south and east property boundaries. A revised site layout is provided in **Figure 3**.

The evaporation pond size requirements have reduced due to the reduction in wastewater discharge flow from the previous Beacon submission. The ponds have been relocated from the locations in previous BSEP submissions to provide the space required for solar arrays. The new locations are east of the administration building, which facilitates three equal sized ponds near access roads which do not conflict with the drainage lines.

In addition, the land treatment unit has been relocated next to the evaporation ponds. This will facilitate a simpler groundwater monitoring program, allow stormwater to be easily moved from the LTU to the evaporation ponds, and minimize inspection, sampling and maintenance activities.

2.1.8 Telecommunications System

Communications with the LADWP at the Beacon Switching Station and SCE for protective relaying, metering, and, if required automatic generator control (AGC) requirements will be determined during detail relaying and metering design, but may be done over optical ground wire (OPGW), by using power line communications (PLC) which is the transmission of high frequency radio communication over the transmission line conductors, or over a standard Integrated Services Digital Network (ISDN) telephone line strung under the current-carrying conductors.

Based on Beacon's available power purchase agreement (PPA) references including the draft PPA that was developed with PG&E for Tesla, the SEGS contracts with SCE, and the POSDEF contract with PG&E, a specific requirement for fiber optic links for data transfer to the Buyer does not exist for Beacon's California projects. Accordingly, Beacon does not expect such a requirement for the BSEP. In locations around the

U.S. outside of California where requirements for a backup dedicated communication link does exist, this is usually addressed using cell phone, microwave, or satellite communications. Beacon does expect the final BSEP PPA to require real-time monitoring to be available to the Buyer, but this will be handled via a data link using conventional phone service.

Beacon's standard communication link protocol is to have the LEC (local exchange carrier) provide 50 wire pairs (or the equivalent fiber optic link) either at the property boundary or from a drop point on the site for both phone and data service. From there all that is needed is a drop box at the pole and underground lines to a SMART jack located in the telecommunications room in the administrative or control building. Currently there are distribution power poles along SR 14 to the west of the site on which the LEC has existing cable. One of these cables formerly served the residential units that were a part of the past agricultural operations on the BSEP site. To the east of the site, along Neuralia Road, the LEC also has an existing cable run. Both sets of poles have adequate space to accommodate service sufficient for the Project site communication needs, and no new poles off the property are expected to be needed.

Verizon is the Local Exchange Carrier in the area of the BSEP. Verizon has a central office in the California City area which serves the city, the Honda Proving Center and Cantil among others. Beacon is working with Donald Chung, Network Engineering & Planning Engineer, to evaluate the possibility of providing service for the required 50 pair. According to Mr. Chung, there are 25, 50 and 100 pair lines in the area. He verified that Verizon would be able to provide service to the BSEP but that it is premature to determine whether or not there is capacity on the existing lines. He also stated that it is premature to determine the extent of the upgrades that may be required at the time that service is needed.

2.1.9 Solar Field Maintenance Vehicles

Staff proposes that BSEP be required to use gasoline powered light trucks for parabolic mirror washing activities and facility maintenance (PSA AQ-SC6). This issue has been addressed in Beacon's Comments on the PSA (May 1, 2009). The parabolic mirror solar energy facilities at Kramer Junction and Harper Lake have significant operating experience and have developed the design of the water wash trucks and other apparatus to maximize efficiency. The hauling capacity of ½ ton trucks is not sufficient for some activities such as transporting the welding rigs. In addition, the use of 4,000 gallon water trucks that have been especially designed for mirror washing will be more efficient than using a smaller truck hauling a trailer. The smaller trucks could only carry about 1,000 gallons of water, and hence would need to make four times the number of trips to a central water supply area. The fugitive PM10 emissions from the 4,000 gallon water trucks are less than one ton per year (tpy) and emissions would increase to 2.7 tpy with the use of the smaller trucks making four times as many trips. While it might be possible to install water piping throughout the solar field to deliver the deionized water to more locations and cut down on the number of trips, a piping system would be significantly more costly, would likely require some pumping, would not be as efficient, and would only reduce PM10 emissions by less than two tpy. Likewise, past experience with using electric all terrain vehicles in the existing solar fields has shown that they need to be replaced frequently and cannot be air conditioned, which is a safety concern in this area where the temperatures get quite high in the summer. Requiring that electric vehicles be used for support in the solar field would reduce only a tiny fraction of the negligible 0.01 tpy of NOx estimated from the exhaust of all of the on-site vehicles expected to be used during operation.

2.1.10 Visual Impacts Reduction

In order to help improve the visual character of the area surrounding the Jawbone Visitors' Center, and subject to confirmation with applicable agencies, Beacon will plant and maintain native vegetation as follows: four, eight, and 12 foot tall Joshua trees will be arranged in naturalistic groups and patterns to accomplish screening and filtering of the view toward the BSEP from the Jawbone Visitor Center. The

Joshua trees will be grouped along the entry road, the parking lot, the restrooms, the visitor center, the walkways, and as necessary, in the areas across the Jawbone Canyon Road to provide maximum screening. Creosote bush and other larger native shrub species will be grouped in typical naturalistic spacing to contribute an indigenous appearance to the entry road, parking lot, and visitor center environment. Adequate irrigation will be provided during the first several years, as needed, and monitored by a qualified arborist.

The other Key Observation Point (KOP) that was identified as a concern in the PSA is a hiking trail more than two miles away on Bureau of Land Management (BLM) land (KOP 6). One of the factors that Staff considered in assessing the visual impacts from this KOP was the number of trail users. Staff assumed 25 per day, and Beacon understands that this was used because there was no readily available information on user numbers. However, Beacon believes that the user numbers are much lower and is in the process of discussing this further with the BLM. Beacon continues to believe that the visual impacts from this particular KOP would not be significant given the already disturbed nature of the project area and the few number of "receptors" that would be impacted. Nevertheless, Beacon is happy to explore visual impact mitigation measures with the BLM and CEC Staff. For example, if allowable under BLM riles and guidelines, BLM may be interested in reclaiming and rerouting the affected portion of the trail in accordance with BLM's cultural modification removal and desert landscape restoration program and Beacon could play a role in funding/implementing that effort. Beacon is in the process of trying to establish a dialogue with the appropriate BLM representatives to discuss this option. Beacon is committed to mitigating all significant impacts down to "less-than-significant" and looks forward to working with CEC and BLM staff to find an acceptable solution to this issue.

2.2 Beacon Proposed Project Refinements

In addition to the Project refinements requested by Staff, Beacon proposes to make some other minor adjustments to its Project design at this time. This section describes the following refinements to the design proposed by Beacon:

- The use of propane in place of natural gas as fuel for the boilers,
- Additional HTF expansion tanks,
- Selection of transmission line Option 1.

2.2.1 Propane Alternative

Beacon had proposed to construct an approximately 17-mile long pipeline to bring natural gas to the Project site in order to provide fuel for the boilers used for startup and HTF heating (freeze protection). The construction of this pipeline would be quite costly, and could potentially increase the risk of environmental impact in the area. Instead, Beacon now proposes to use propane to fuel the boilers. The propane storage and delivery system will consist of an unloading station, storage tanks, vaporizing skids, and other ancillary equipment. Safety pressure relief valves, regulators, excess flow valves, and an emergency shutdown system are provided with the storage and delivery system. Two storage tanks will be designed per ASME Section VIII, and each tank will be a horizontal carbon steel tank sized for 18,000 gallons (gross). Annual propane usage is expected be 410,000 gallons per year. It is expected that seven roundtrip deliveries via 5,000 gallon propane trucks will be required monthly.

Two equipment layout plans are provided for comparison. **Figure 4** shows the addition of propane facilities, while **Figure 5** shows the equipment layout without the propane facilities. The environmental impacts of propane usage compared to natural gas are described further in Section 4.2.

2.2.2 HTF Expansion Tanks

The BSEP AFC indicated that six HTF Expansion tanks would be needed. Further review of the design has determined that 22 of these tanks are needed. The number of HTF expansion tanks was increased due to revise preliminary estimates regarding HTF expansion during operation of the plant and the logistics in transportation of larger vessels to the site. Although the number of expansion tanks has increased, the amount of VOC emissions from the tanks is not expected to increase from the levels reported in the AFC. This is because the prior emissions were based on the overall amount of HTF used in the solar plant, where the emissions were scaled based on the amount of HTF used at the existing SEGS facilities and the fact that all tanks will still be vented to a collection system that incorporates vapor control equipment. These tanks are also shown in **Figure 4** and **Figure 5**.

2.2.3 Electrical Transmission Line Route

Because Beacon was uncertain as to which parcels could be obtained for the transmission line to interconnect with the Barren Ridge switching station, Beacon originally proposed two potential options for the route. Both routes were fully analyzed in the BSEP AFC. A parcel needed for the Option 1 route was recently put to auction and Beacon was the successful bidder to purchase the property. Therefore, Beacon is dropping Option 2 from consideration. The project one line diagram has been revised to reflect the removal of Option 2 as shown in **Figure 6**.

3.0 Alternative Water Sources

The PSA indentified seven potential alternatives that might reduce the need for water by the BSEP. These alternatives included dry cooling, photovoltaic solar technology, and use of alternative water supplies using water from a degraded aquifer. Since the PSA was issued, CEC Staff have identified reclaimed water from a water treatment facility as another potential alternative.

Beacon has already gone on record with its position that the alternatives presented in the PSA are not “feasible” under CEQA. Regarding the newly-identified alternative of reclaimed water, Beacon believes that this alternative is also not feasible based on available information. Nevertheless, at the request of Staff, Beacon is providing additional information related to the water supply alternatives.

One alternative is to use groundwater from the area in the immediate vicinity of Koehn Lake, where historic data indicates water with higher TDS levels than the groundwater found in the wells on the BSEP plant site. The other alternative is to obtain tertiary treated reclaimed water from the Rosamond waste water treatment plant. Only preliminary information has been obtained to date on these alternatives.

3.1 Koehn Lake Alternative

The CEC has concluded from limited historic data that there is a potential source of high TDS groundwater (i.e., TDS concentrations greater than 1,000 parts per million (ppm)) or degraded water in the vicinity of Koehn Lake, and that there may be sufficient yield of this water to support the project water needs in the area of T30S/R38E, Sections 7, 8, 17 and 18 (**Figure 7**). To support water supply from this area groundwater must be degraded and aquifer yield must be able to support seasonal water supply requirements that range up to 4,000 gpm during peak summer demand. The historic data does not clearly indicate that areas with suspected degraded groundwater can yield water at a rate to support the Project. The CEC has therefore proposed to conduct a groundwater sampling program of wells in the area of Koehn Lake to close the data gap. The sampling program has been designed to document existing groundwater quality and provide an understanding of the groundwater production capability from sampled wells. The field program includes obtaining permission from the well owners for access, determining well status and condition, collecting groundwater samples and analyzing them for TDS and other constituents to determine the suitability of water to support the Project. The wells that will be considered are in Sections 7, 8, 17 and 18, and north of the Garlock Fault west of Koehn Lake. The focus of the study will be wells that are in Sections 7, 8, 17 and 18, and north of the Garlock Fault west of Koehn Lake.

It is important to note that while degraded water could potentially be supplied from this area, there will be attendant environmental impacts. The pipeline to supply water would be seven to nine miles in length to reach the area around Koehn Lake that is being investigated for degraded water supply. While the routing is uncertain, environmental impacts associated with this line are uncertain, as the pipeline would at some points likely have to travel cross country, cross under the railroad and would travel through several washes that cross Randsburg Road.

Another important consideration is the potential impact of groundwater pumping were it to occur in the area of Koehn Lake. If production were to move toward the west side of Koehn Lake, it is probable there would likely be more impact on surrounding single family wells as the density of wells is higher in that area (**Figure 7**). By comparison, the proposed BSEP pumping center is located at a point in the basin where it affects many fewer offsite water supply wells. Further, the Project site is located in an area of significant recharge, and as such is in an area that would least affect the groundwater basin in terms of drawdown impacts.

As described in Section 2 above, water supplied from a degraded source will require additional treatment as the part of the partial ZLD system. The degraded water quality from a source around Koehn Lake could produce a hazardous wastewater from the partial ZLD system (see **Attachment 6** - Amendment to the ROWD). The Toxic Pits Cleanup Act prohibits the discharge of liquid hazardous waste into a surface impoundment in California. As such, additional treatment or blending of the water supply would be required to allow discharge from the partial ZLD to the evaporation ponds. Additionally, the high TDS concentrations from a degraded water source also increases the potential for emissions of toxic air contaminants from the cooling tower (see Section 4.3.1 below and **Attachment 7d**).

These environmental impacts should be considered in the exploration of an offsite source of groundwater for the Project.

3.1.1 Water Treatment Facilities for Configuration 2

C2, using high TDS water such as is found near Koehn Lake, would require a different pre- and post-treatment design from C1. The pre-treatment design includes a cold lime softener for pre-treatment upstream of the cooling tower. For the pre-treatment system, the site's feedwater is chemically treated with lime ($Ca(OH)_2$), soda ash (Na_2CO_3), caustic (NaOH), magnesium chloride ($MgCl_2$), and polymer into a series of tanks with rapid mixing capabilities. The low-solubility species form precipitates and are allowed to settle in a clarifier to form a sludge that contains hardness (Ca and Mg), suspended solids (TSS) and silica (SiO_2). The waste stream, which is 6-10 percent solids is pumped to a filter press, where liquid is returned to the cooling tower basin while the dewatered solids are discharged to a truck for disposal offsite. The product from the clarifier is pumped to a multi-media filter (MMF), for reduction in the concentration of suspended solids, and then to the Treated Water Storage Tank, and finally to the cooling tower.

The post-treatment clarifier is designed for treatment of the cooling tower blowdown, which has been cycled up approximately 10 COC from the Treated Water Storage Tank. A series of tanks will be chemically treated with $Ca(OH)_2$, Na_2CO_3, NaOH, ferric chloride ($FeCl_2$), and polymer and vigorously mixed to allow precipitates to form, and then allowed to settle in a clarifier. The settled sludge slurry will be discharged to the evaporation ponds, while the remaining product would be pumped to a MMF for removal of the outstanding solids. Upon discharge from the MMF, most of the remaining hardness will be removed in a weak acid cation (WAC) ion exchange softener, which will be regenerated with hydrochloric acid (HCl), and then with NaOH to be in the sodium form. The WAC is intended to remove metals and hardness, and the remaining product containing silica and TDS will be discharged to a reverse osmosis unit where the remaining species are greatly reduced in the product stream, containing approximately 75 percent of the flow, while the waste stream containing 25 percent of the flow will contain the majority of the silica and TDS, and will be fed to the evaporation ponds.

Estimated annual water usage for C2 would be approximately 1,407 AFY.

3.1.2 Evaporation Pond Size for Configuration 2

To handle the wastewater discharging into the evaporation ponds with a TDS of approximately 110,000 mg/L, at a summer peak discharge rate of 56 gpm, and annual discharge rate of 46 gpm, three evaporation ponds each with a nominal surface area of 2.7 acres are required, for a total top area of eight acres.

3.2 Rosamond Waste Water Alternative

The Community of Rosamond, through the Rosamond Community Services District (RCSD), currently operates a secondary wastewater treatment facility that generates approximately 1.6 million gallons per day (MGD) of wastewater. A project is currently underway to convert 0.5 MGD of this flow to Title 22 quality tertiary treated reclaimed water by August of this year, and there are tentative plans to expand the facility to produce only Title 22 water by the end of 2011. In addition the RCSD has agreements with other water districts in the Antelope Valley for purchase and exchange of reclaimed water, up to as much as 13 MGD. A total of 3.3 MGD of water is considered by Rosamond to be readily available for commitment in the near term. Total plant water demand, depending on water quality and treatment options, is estimated at three MGD during summer peak periods. Initial indications are that the reclaimed water quality from Rosamond and their potential secondary suppliers will be of adequate quality for power plant operations, although information on several critical quality parameters is not readily available, but has been requested.

In order to use this water, it would be necessary to construct an approximately 40 mile long pipeline. The pipeline route under consideration leaves the Rosamond waste water treatment facility on Patterson Road and follows 10th Street W (unimproved roads), to Rosamond Boulevard and Sierra Highway (improved roads), followed by a path along unimproved roads in county easements past Edwards Air Force Base, 10th Street E, and 20th Street E, intersecting with the corridor proposed for the BSEP natural gas pipeline west of California City. Although about 17 miles of this route has been analyzed with respect to the proposed gas pipeline, another approximately 23 miles of new route would need to be assessed for environmental impacts such as biological and cultural resources and land use.

Initial discussions have been conducted with Rosamond in order to assess the viability of this alternative. Additional information will be needed prior to further environmental, economic, or legal review or analyses.

4.0 Environmental Review

It is expected that the project design refinements described in Section 2.0 will have similar or reduced impact on the environment than the originally proposed Project. However, the alternative water supply options described in Section 3.0 are projected to have a greater impact on some aspects of the environment. For instance, use of lower-quality water would require the installation of pipelines and create higher particulate matter emissions from the cooling towers.

The potential environmental effects of design refinements suggested by Staff are presented in Section 4.1, below, and Beacon's proposed refinements are evaluated in Section 4.2. The potential environmental effects associated with the two alternative water options are presented in Section 4.3. The focus of this discussion is where the refinements or alternatives could have a potential impact that is different from what was presented in the BSEP AFC. For instance, site grading of the plant site was already assumed, so air quality impacts are not expected to be different for the re-routed wash design or other changes to the site layout.

4.1 Potential Environmental Effects from Staff Suggested Design Refinements

A summary matrix of the potential environmental impacts from Staff suggested changes are shown in Table 1 and described further below by topic area affected.

Table 1. Matrix of Potential Environmental Effects for Staff Design Refinements

Design Refinement	AQ	BR	C&P	HM	S&W	T&T	VR	WM	Other
Re-Routed Wash	-	X	-	-	X	-	-	-	-
Water Treatment & Discharge	-	X	-	X	X	X	X	X	-
Stormwater Retention	-	-	-	-	X	-	-	-	-
Emergency Access Road	X	X	X	-	-	-	-	-	-
SCE Distribution Line	-	-	-	-	-	-	X	-	-
LTU, Telecommunications and Site Layout	-	-	-	-	-	-	-	-	-
Maintenance Vehicles	X	-	-	-	-	-	-	-	-
X potential impact on topical area - negligible to no effect anticipated that is different from previously analyzed Project									

4.1.1 Air Quality

The design refinements suggested by Staff that could affect air quality that are different from the AFC are discussed below. The only item that would potentially have a new off-site air quality effect is emissions from construction of the emergency access road. In addition, Beacon provided a revised proposal and analysis of emissions from maintenance vehicles in the solar field in its comments on the Staff PSA submitted on May 1, 2009; these changes are summarized herein. The modeling analyses for PM10 and PM2.5 impacts have been provided based on these new projected emissions.

Note that this scenario assumes the use of on-site groundwater, as originally proposed, and thus there will be no increase in cooling tower TDS or associated emissions. Potential air quality impacts resulting from the use of an off-site water supply are discussed in Section 4.3.1.

4.1.1.1 Emergency Access Road

During the construction of the additional access road, there will be emissions similar to those associated with other Project construction activities. The construction of the additional access road will result in the emissions shown in Table 2. As determined in the original AFC submittal, the Project construction-related emissions are transient in nature and will cause some unavoidable but minor localized short-term impacts. The proposed construction of the additional access road will not alter that conclusion. Emission calculations are shown in **Attachment 7a**.

Table 2. Maximum Daily Construction Emissions for Emergency Access Road (lb/day)

Phase of Construction	NOx	VOC	CO	SO_2	PM10	PM2.5
Emergency access road	208.23	22.95	87.52	0.22	23.13	11.16

4.1.1.2 Maintenance Vehicle Emissions

As noted above, in response to Staff comments in the PSA, Beacon has reviewed the types and sizes of vehicles proposed to be used for maintenance activities such as mirror washing in the solar field. These changes were provided previously in Beacon's Comments on the PSA, submitted on May 1, 2009.

Beacon also provided comments on the modeling analyses performed by staff. The revised modeling analyses presented in **Attachment 7d** includes these changes.

4.1.2 Biological Resources

This section describes the potential environmental effects to Biological Resources resulting from refinements suggested by Staff.

4.1.2.1 Rerouted Wash Supplemental Analysis

Modifications have been made to the rerouted wash to facilitate necessary hydrology and hydraulics design changes to adequately manage flows onsite. These design changes are summarized as part of the water and soils analysis; however, it should be noted that these changes also affect the biological function and value of the rerouted wash. The overall approach to mitigation for the wash has not changed, and these design changes will assist in achieving replacement of the biological and hydrological function and value of the wash. A summary of the impacts to Waters of the State, the design modifications, and a summary of the overall mitigation for purposes of achieving mitigation for impacts to Waters of the State are included as **Attachment 1b.**

4.1.2.2 Evaporation Pond Refinements

The evaporation pond design was analyzed in detail in several transmittals submitted to the CEC to date. Although the pond design size has been reduced and the location modified, the anticipated impact on birds remains similar and the avoidance, minimization, and mitigation measures previously recommended are expected to provide appropriate mitigation for potential impacts. The original analysis of evaporation pond biological impacts was based on an equilibrium condition in the ponds for both TDS and selenium. The equilibrium condition assumes that the water has become saturated for the respective constituents and any additional contributions would result in precipitation out of solution. This assumption removes the variability from the biological impact analysis associated with changes in the quality of source water and effluent to the ponds. An increase in concentration of constituents in the water due to use of poorer quality water may result in a shorter time interval until saturated or equilibrium concentrations are obtained; however, it would not affect the final pond concentration used to evaluate biological impacts.

4.1.2.3 Tortoise Removal Plan

Although no tortoises are expected on the Project site and no removal of tortoises is anticipated, a Tortoise Removal Plan was prepared by Dr. Alice Karl and submitted as an attachment to the Response to PSA Comments submitted by Beacon to the CEC on May 1, 2009.

4.1.2.4 Emergency Access Road Supplemental Surveys

Staff has required that an emergency access route to the Project site be incorporated into the BSEP. In response to this request, Beacon identified a potential emergency access route along an existing easement along the northern property line and extending from the northeast corner of the BSEP property, directed east along the north line of Section 3, connecting to Neuralia Road. The emergency access route is approximately 0.5 miles long and 12 feet wide. The proposed route and required buffer zones were surveyed for biological resources. The results of the protocol surveys are summarized below and the survey reports are included as **Attachments 4a** and **4b**.

EDAW, Inc (EDAW) and Southern Nevada Environmental, Inc (SNEI; on behalf of EDAW), conducted protocol level surveys for desert tortoise (*Gopherus agassizii;* DT) and western burrowing owl (*Athene cunicularia;* WBO) in support of the emergency access route.

This route and required Zone of Influence (ZOI) buffers were habitat assessed and surveyed in mid-May 2009 in accordance with appropriate protocol survey guidelines for the DT and WBO (US Fish and Wildlife Service [USFWS] 1992, California Burrowing Owl Consortium [CBOC], Burrowing Owl Survey Protocol and Mitigation Guidelines, 1993).

Across all DT and WBO surveys, no DT or WBO were detected anywhere within the emergency access road, or associated buffers and ZOI. No new WBO signs were detected, and all signs found in and around the emergency access route were very old. Since the burrows observed in and around the emergency access route were small, unstable, and primarily sinkholes, it is unlikely that WBO would use them for breeding. The biological surveys conducted did not result in any new potential impacts to special status species or biological resources that would require new or revised mitigation measures. No significant impacts are expected from the installation of this road. An additional 0.12 acres of developed land would be impacted as a result of the emergency access road. The placement of the road would all be within disturbed habitat and no new impacts beyond those identified to date would occur

4.1.3 Cultural and Paleontological Resources

This section describes the potential environmental effects to the Cultural and Paleontological Resources resulting from refinements suggested by Staff.

4.1.3.1 Emergency Access Road Supplemental Surveys

The emergency access route and required buffer zones were surveyed for cultural and paleontological resources. No new cultural or paleontological resources were identified during the surveys and no additional mitigation is recommended beyond that already identified for the Project. The survey reports are included as **Attachments 4c** and **4d**.

4.1.4 Hazardous Materials Management

Additional hazardous materials will be used and stored onsite during BSEP operations due to the addition of the partial ZLD system. The hazardous material inventory, the general operational safety practices employed during hazardous material storage and use, the material-specific handling practices, and the toxicity of each new/additional hazardous material are discussed below.

4.1.4.1 Hazardous Material Inventory

A list of the new/additional large-quantity hazardous materials stored and used at the BSEP site along with the toxicity and storage practices for each material are provided in Table 3. For the purpose of this discussion, "large quantity" is defined as those chemicals stored or used in excess of 55 gallons for liquids, 500 pounds for solids and 200 cubic feet for compressed gases. These quantities coincide with the thresholds for reporting under California's Hazardous Material Business Plan (HMBP) requirements.

Table 3. Summary of Special Handling Precautions for Large Quantity Hazardous Materials

Hazardous Material	Relative Toxicity[1] and Hazard Class[2]	Permissible Exposure Limit	Storage Description; Capacity	Storage Practices and Special Handling Precautions
Propane	Low toxicity; Flammable gas	PEL: 1,000 ppm	Two 18,000 gallon pressure tanks	Isolated from incompatible chemicals
Calcium Hydroxide (Lime) (water treatment chemical)	Moderate toxicity; Irritant	PEL: 15 mg/m^3 (total dust); PEL: 5 mg/m^3 (respirable fraction) TLV: 5 mg/m^3 (ACGIH)	Bulk Lime Feed System (1 x 100%): 14' D x 56' H Solid	Isolated from incompatible chemicals
Sodium Carbonate (Soda Ash) (water treatment chemical)	Low toxicity; Hazard class – NA.	No specific limits; Only inert dust limits: PEL: 15 mg/m^3 (total dust); PEL: 5 mg/m^3 (respirable fraction)	Bulk Soda Ash Feed System (1 x 100%): 12' D x 40' H solid	Isolated from incompatible chemicals

Hazardous Material	**Relative Toxicity[1] and Hazard Class[2]**	**Permissible Exposure Limit**	**Storage Description; Capacity**	**Storage Practices and Special Handling Precautions**
Polymer (water treatment chemical)	Low toxicity Hazard class – NA	None	FRP tank; 3000 gallons	Inventory management, isolated from incompatible chemicals and secondary containment
Magnesium Chloride (water treatment chemical)	Low toxicity; Hazard class – NA	No specific limits; only inert dust limits: PEL: 15 mg/m^3 (total dust); PEL: 5 mg/m^3 (respirable fraction)	FRP tank; 3000 gallons	Inventory management, isolated from incompatible chemicals and secondary containment
Ferric Chloride (water treatment chemical)	High toxicity; Hazard class – Corrosive	No specific limits. TLV: 1 mg/m^3 iron salts; TLV: 1 mg/m^3 HCl salts;	FRP tank; 3000 gallons	Inventory management, isolated from incompatible chemicals and secondary containment
Sodium Hydroxide, 50% solution (WAC resin regenerant)	High toxicity; Hazard class – Corrosive	PEL: 2 mg/m^3 total dust	Plastic totes, 2 x 400 gallons	Isolated from incompatible chemicals and secondary containment
Hydrochloric Acid, 93% solution (WAC resin regenerant)	High toxicity; Hazard class – Corrosive, water reactive	PEL: 5 ppm TLV: 2 ppm	Plastic totes, 2 x 400 gallons	Isolated from incompatible chemicals and secondary containment

Hazardous Material	Relative Toxicity[1] and Hazard Class[2]	Permissible Exposure Limit	Storage Description; Capacity	Storage Practices and Special Handling Precautions
Sodium Hypochlorite, 12.5% solution	High toxicity; Hazard class – Poison-B, Corrosive	Workplace Environmental Exposure Limit (WEEL) - STEL: 2 mg/m3 PEL: 0.5 ppm (TWA), STEL: 1 ppm as Chlorine TLV: 1 ppm (TWA), STEL: 3 ppm as Chlorine	Plastic tanks; 8,500 gallons total inventory (1 x 8,500 gallons)	Secondary containment
Sulfuric Acid, 93% solution (water treatment chemical)	High toxicity; Hazard class – Corrosive, water reactive	PEL: 1 mg/m^3	Lined, carbon steel tanks; 8,000 gallons total inventory (1 x 8,000 gallons)	Isolated from incompatible chemicals, lined tank, and secondary containment
Therminol VP-1 Diphenyl ether (73.5%) Biphenyl (26.5%	Moderate toxicity, Hazard class – Irritant; Combustible Liquid (Class III-B)	Biphenyl = PEL: 0.2 ml/m^3 (8-hr TWA) TLV: 0.2 ml/m^3 (1 mg/m^3) (8-hr TWA) Diphenyl ether = TLV: 1 ml/m^3(8-hr TWA) TLV: 2 ml/m^3(15-min TWA) PEL: 1 ml/m^3 (7 mg/m^3) (15-min TWA)	2.4 MM gallons in system, no additional onsite storage	Continuous monitoring of pressure in piping network; routine inspections (sight, sound, smell) by operations staff; isolation valves throughout piping network to minimize fluid loss in the event of a leak; prompt clean up and repair.

[1] Low toxicity is used to describe materials with an NFPA Health rating of 0 or 1. Moderate toxicity is used describe materials with an NFPA rating of 2. High toxicity is used to describe materials with an NFPA rating of 3. Extreme toxicity is used to describe materials with an NFPA rating of 4.

[2] NA denotes materials that do not meet the criteria for any hazard class defined in the 1997 Uniform Fire Code.

4.1.4.2 General Operating Practices

The new/additional chemicals will be stored or processed in vessels or tanks specifically designed for their individual characteristics. All hazardous materials storage or process vessels will be designed in conformance with applicable ASME codes. Large quantity (bulk) liquid chemicals will be stored outdoors in aboveground storage tanks (ASTs) manufactured of carbon steel or plastic, or in 400-gallon (nominal) capacity plastic totes. Spill containment structures (e.g., curbing, double walled tanks, or equivalent) to contain the chemicals in the event of a leak or spill will be constructed around each of the large-quantity hazardous chemical storage tanks or totes. Bulk storage tanks or totes will each have secondary containment structures capable of holding the tank or tote volume plus an allowance for precipitation (25-year, 24-hour rain event). Concrete containment structures will be coated with a chemical resistant coating (e.g., epoxy) to ensure long-term integrity of the containment structure.

Small quantity chemicals will be stored in their original delivery containers in order to minimize risk of upset. Personnel working with chemicals will be trained in proper handling technique and in emergency response procedures for chemical spills or accidental releases. Personal protection equipment (PPE) will be provided.

Appropriate safety programs will be developed addressing hazardous materials storage and use, emergency response procedures, employee training requirements, hazard recognition, fire safety, first-aid/emergency medical procedures, hazardous materials release containment/control procedures, hazard communications training, PPE training and release reporting requirements. These programs include Injury and Illness Prevention Program, fire response program, plant safety program and facility standard operating procedures. As required under Federal and California regulations, a HMBP will be prepared and submitted to the Kern County Environmental Health Services Department.

The facility will be subject to the Storm Water Pollution Prevention Plan (SWPPP) requirements administered by the State Water Resources Control Board under the Storm Water General Permit. The SWPPP will describe the management practices in place at the facility (e.g., regular inspections and maintenance of drainage facilities, employee training in proper hazardous material storage and handling procedures, and chemical spill response procedures) to prevent the release or discharge of these new/additional hazardous materials to the Waters of the State.

4.1.5 Soil and Water Resources

Additional analyses have been prepared to present supplemental information related to groundwater, surface water, and geomorphology. The following is a summary of relevant components for further evaluation of potential project impacts and proposed design features that are intended to avoid, minimize, and mitigate for impacts associated with the BSEP.

Attachment 1a: Rerouted Wash Design Modifications (Hydrology, Hydraulics, and Sediment Transport). A Memorandum for Hydrologic and Hydraulic Analysis of Rerouted Channel for Beacon Solar Energy - Mojave, CA has been prepared that summarizes the redesign of the rerouted wash to address on-site and off-site flows, sediment transport including fluvial geomorphology, and wash design features to facilitate biological and hydrological functions and values.

Attachment 1b: Wash Mitigation Plan has also been prepared.

Attachment 3: Storm Water Management. A Conceptual Retention and Grading Study has been prepared that summarizes the revised BSEP approach to storm water management, including the Low Impact Development approach of using on-site retention for treatment of the water quality storm event.

Attachment 5: Groundwater Mitigation. A memorandum has been prepared that summarizes Beacon's approach to mitigation for potential groundwater impacts.

Attachment 6: Amendment to the ROWD. An amendment to the ROWD has been prepared to address the Lahontan RWQCB comments.

4.1.6 Traffic and Transportation

The construction of the emergency access road will require vehicle traffic for workers, on-road and off-road heavy duty trucks, and material delivery trucks. The construction of the emergency access road would require activities that are similar or identical to those required for the paving and road construction evaluated in the original AFC. The construction of emergency access road is estimated to take approximately two months to complete. During the period of peak activities, the roadway construction will require 42 truck trips per day for material delivery during month 1 of construction. Assuming that the material delivery takes place over a four hour period, the material delivery trucks would add approximately 10 trucks per hour to the traffic load on the roadway to and from the Project site. Based on the traffic volumes shown in Table 4 for the roadways servicing the Project area (note: this table appeared as Table 5.13-6 in the AFC), it is reasonable to conclude that the additional vehicle traffic required for the emergency access road construction would not adversely impact the level-of-service (LOS) of any of the roadways. Therefore, construction of the emergency access road would not cause or contribute to a significant adverse impact to Traffic and Transportation resources.

The proposed water treatment options will require approximately 30 additional two-way truck trips per month for water treatment chemical delivery to the Project site. This estimate is based on use of Koehn Lake water; use of on-site groundwater would require slightly less water treatment, and correspondingly fewer truck trips.

Solids removal from the evaporation ponds will require approximately 700 truck trips per event. The frequency of clean-out will depend on which water supply option is selected; clean out will be required once every 4.5 years for the on-site groundwater option (3.5 years for the Koehn Lake water option).

Table 4 shows the peak traffic impacts during construction and operation of the BSEP as it was originally proposed. The water treatment chemical delivery would add one truck trip per hour, one hour per day, on average, to the traffic volume on the roadways servicing the Project. As seen in Table 4, the additional truck trips would not add significantly to the volumes and would not adversely impact LOS on those roadways.

During those periods in which solid waste is removed from the evaporation ponds, it is assumed that two trucks per hour could be loaded, up to ten hours per day. Again, as shown in Table 4, two additional truck trips per hour would not adversely impact the LOS of the roadways servicing the Project.

Consequently, the proposed additional water treatment would not cause or contribute to a significant adverse impact to Traffic and Transportation resources.

Table 4. Peak Hour Roadway Traffic Volumes, Design Capacities, and Levels of Service (With Project Related Traffic)

Roadway / Segment	Year 2011 Conditions with Project Construction Traffic[1]				Year 2011 Conditions with Project Operations Traffic[2]			
	Travel Lanes	Volume	Capacity[3]	LOS	Travel Lanes	Volume	Capacity[3]	LOS
SR-14 North of the Project Site	2	397	2,000	A	2	358	2,000	A
SR-14 At the Project Site	4	1,150	6,800	A	4	402	6,800	A
SR-14 South of the Project Site	2	1,150	2,000	A[4]	2	402	2,000	A
SR-14 South of Mojave	4	2,680	6,800	A	4	2,365	6,800	A
SR-58 West of SR-14	4	2,505	6,800	A	4	2,265	6,800	A
SR-58 East of SR-14	4	2,512	6,800	A	4	2,355	6,800	A

1 Assumes Month 15 peak construction traffic levels with 836 workers

2 Assumes normal future Project operations with total work force of 66 employees.

3 Two-way capacity in vehicles per hour

4 Based on Volume to Capacity Ratio, Project operations are LOS A. Based on the most recent Highway Capacity Manual methodology for rural two-lane highways, which determines LOS based on an estimated percentage of drivers having to follow another vehicle under worst case peak conditions, the two-lane segment of SR-14 at the BSEP site could be described as operating at LOS D.

4.1.7 Visual Resources

Additional water treatment facilities will add additional elements in the power block. However, due to the distance from any of the KOPs, these changes will not be readily discernable to a viewer. Therefore, no changes in the visual resources analysis or requirements would be needed due to these changes.

See Section 2.1.10 above for additional information regarding vegetative screening at Jawbone Visitors' Center and along the KOP 6 trail.

4.1.8 Waste Management

As outlined in Section 2.1.2, accumulated solids are to be removed from the evaporation ponds when they reach a depth of three feet for safety and operational purposes. Based on C1, approximately 75,000 tons of solids are expected to accumulate over 30 years. The clean out rate is estimated to be every 4.5 years, which equates to approximately 11,200 tons per clean out which would require 560 truck trips. Based on C2, approximately 123,000 tons of solids are expected to accumulate over 30 years. The clean out rate is estimated to be every 3.5 years, which equates to approximately 14,300 tons per clean out which would require 700 truck trips.

As outlined in Section 2.1.6, HTF-impacted soils will be classified as hazardous or non–hazardous when initially moved to the staging area. Any material classified as a hazardous waste will be removed from site by a licensed hazardous waste hauler for disposal at a licensed hazardous waste landfill. No HTF-impacted soils characterized as hazardous waste will be disposed or treated on-site.

It is anticipated that the pond solids and other non-hazardous wastes would be classified as Class II non-hazardous industrial waste. Beacon will test the pond solids using appropriate test methods in advance of removal from the evaporation ponds to confirm this determination. For planning purposes, Beacon would dispose of the waste in the McKittrick Waste Treatment Site, a Class II facility. The capacity and closure information for the McKittrick facility and two alternative facilities are shown in Table 5. Based on the available capacity, the waste volume generated from each clean-out event represents less than two percent of the remaining capacity of the McKittrick facility.

Table 5. Solid and Hazardous Waste Disposal Facilities

Waste Disposal Site	Title 23 Class	Maximum Permitted Capacity	Current Operating Capacity [1]	Remaining Capacity	Estimated Closure Date	Enforcement Action Taken?
McKittrick Waste Treatment Site 56533 Highway 58 McKittrick, CA	Class II	2,092,000 cubic yards	1,180 tons/day	841,498 cubic yards	2029	No
Waste Management Kettleman Hills Landfill 36251 Old Skyline Road Kettleman City, CA	Class I	10,700,000 cubic yards	8,000 tons/day	6,000,000 cubic yards	2037-2038	No
Clean Harbors Buttonwillow Landfill 2500 West Lokern Road Buttonwillow, CA	Class I	14,300,000 cubic yards	10,500 tons/day	9,500,000 cubic yards	2040	No

Source: CIWMB/SWIS, December 2007

[1] Maximum Permitted Throughput

4.1.9 Other Environmental Topic Areas

Project refinements are not expected to affect socioeconomic impacts of the Project except for a potential insignificant tax benefit from the purchase of additional water treatment chemicals.

4.2 Potential Environmental Effects from Beacon Design Refinements

A summary matrix of the potential environmental impacts from the Project design refinements proposed by Beacon is shown in Table 6 and described further below by topic area affected.

Table 6. Matrix of Potential Environmental Effects for Beacon Design Refinements

Design Refinement	AQ	BR	C&P	HM	S&W	T&T	VR	WM	Other
Propane Use	X	-	-	X	-	X	X	-	-
HTF Expansion Tanks	-	-	-	-	-	-	-	-	-
Transmission Line Option 1	-	-	-	-	-	-	-	-	-
X potential impact on topical area - negligible to no effect anticipated that is different from previously analyzed Project									

4.2.1 Air Quality and Public Health

The design refinements proposed by Beacon that could affect air quality and public health that are different from the AFC are discussed below.

4.2.1.1 Use of Propane instead of Natural Gas

Pursuant to information provided by the equipment manufacturer, the substitution of propane for natural gs as boiler fuel will not result in an increase in NOx, CO, VOC or PM10 emissions; the manufacturer guarantees the same emission rate for propane combustion as it does for natural gas combustion. A performance specification for the boilers is provided in **Attachment 7d**. The sulfur content of propane is higher than the sulfur content of pipeline natural gas; thus an increase in SO_2 emissions is anticipated.

The Santa Barbra County Air Pollution Control District default emission factor for SOx and heating value for propane were used to calculate the SOx emissions. The hourly emissions were calculated based on one hour of operation at a full load. Daily emissions are based on a maximum of 14 hours per day of operation and the annual emissions are based on 1,000 hours of operation per year. The changes in SOx emissions are shown in Table 7. Although SOx emissions from the use propane are higher than from the use of natural gas, the resulting emissions are small. Emission calculations are provided in **Attachment 7b**.

Table 7. SOx Emission Comparison – One Boiler

Fuel	SOx Emissions		
	lb/hr	**lb/day**	**ton/yr**
Natural Gas	0.08	0.11	0.004
Propane	0.34	4.75	0.17
Net Increase	*0.26*	*4.64*	*0.166*

The EPA AERMOD model was run to examine the impacts of the increased SO_2 emissions from the use of propane. As shown in **Attachment 7d**, while the maximum modeled concentration does increase with propane fuel, the overall SO_2 impact, when added to ambient background values, is still less than 15 percent of any applicable California Ambient Air Quality Standards (CAAQS) / National Ambient Air Quality Standards (NAAQS) standard for SO_2, and the impacts from Project sources alone are less than 1 percent of any applicable ambient air quality standards.

The substitution of propane for natural gas will eliminate the need to construct the originally proposed 17.6-mile long natural gas pipeline. The peak daily construction emissions for the natural gas pipeline are shown in Table 8. Because the pipeline will not be constructed under this scenario, the construction emissions associated with its' construction will not occur. While the construction emissions for the propane tanks have not specifically been quantified, the overall on-site emissions from construction of the power block facilities has been estimated and is not expected to be substantially different from the emissions previously estimated.

Table 8. Avoided Maximum Daily Construction Emissions (lb/day) if Natural Gas Pipeline is Not Constructed

Phase of Construction	NOx	VOC	CO	SO_2	PM10	PM2.5
Natural Gas Pipeline	529.4	85.4	546.3	0.5	102.5	44.5

4.2.1.2 Public Health Analysis for Propane

Toxic air contaminant (TAC) emissions are not expected to be significantly different for propane than they are for natural gas. As a practical matter, TAC emission factors are not readily available for propane; Beacon reviewed the California Air Toxic Emission Factor (CATEF) database, EPA Compilation of Air Pollution Emission Factors (AP-42), South Coast Air Quality Management District (SCAQMD), Ventura County Air Pollution Control District (VCAPCD) and Bay Area Air Quality Management District (BAAQMD) emissions guidance and was unable to identify TAC emission factors for propane. It is Beacon's understanding that the natural gas TAC emission factors are routinely used to predict TAC emissions from propane combustion. Further, the health risks predicted for the Project were dominated by the diesel combustion emissions, and only marginally due to natural gas combustion. The overall BSEP health risk was modeled to be very low. So, while the TAC emissions from propane combustion may differ from natural gas to some (not quantified) extent, the propane TAC emissions are not expected to lead to a significantly higher health risk from Project operations.

4.2.1.3 Operational Delivery Truck Emissions

The proposed Project changes will result in additional truck travel on off-site paved roads, as follows:

- Propane delivery of up to 7 truck trips per month (82 truck trips per year)
- Water treatment chemical delivery of up to 30 truck trips per month (360 trips per year)
- Waste removal (evaporation pond clean out) of up to 700 truck trips once every 3.5 years.

The combustion of fuel in motor vehicle engines results in the generation of CO, VOC, NOx, SOx, PM10 and PM2.5 emissions. Motor vehicle brake and tire wear and entrained paved road dust result in the generation of PM10 and PM2.5 emissions.

CO, VOC, NOx, SOx and PM10 emission factors were compiled by running the ARB's EMFAC2007 (version 2.3) Burden Model (ARB, 2007b) for the KCAPCD jurisdiction during calendar year 2009. Daily emissions by vehicle class (light-duty truck, heavy, heavy-heavy duty diesel vehicle, etc.) from the Burden model were divided by the daily mileage traveled by vehicles within the class from the Burden Model to calculate the emission factors. The emission factors account for the emissions from start, running and idling exhaust. In addition, the VOC emission factors take into account diurnal, hot soak, running and resting emissions, and the PM10 emission factors account for exhaust, brake wear and tire wear emissions separately.

PM2.5 emission factors were calculated by multiplying the PM10 emission factors by the mass fraction of PM2.5 emissions in motor vehicle exhaust, brake wear and tire wear PM10 emissions. The PM2.5 mass fractions in PM10 emissions from gasoline and diesel-fueled engine exhaust were from “Final –Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds”

In addition, vehicle travel on paved roads generates fugitive PM10 and PM2.5 emissions by entrainment of dust on the roads. The emission factor used was calculated from ARB Emission Inventory Methodology 7.9, “Entrained Paved Road Dust” guidance (ARB, 1997). Roadway silt loadings were taken from Table 3 of CARB Emission Inventory Methodology 7.9 (ARB, 1997). Offsite motor vehicles were assumed to travel on paved collector roads. The average weight of vehicles on roads traveled by offsite motor vehicles was assumed to be 2.4 tons, as listed in Table 3 of ARB Emission Inventory Methodology 7.9 (ARB, 1997) for the Kern County portion of the Southeast Desert Air Basin. PM2.5 emission factors were calculated by multiplying the PM10 emission factors by the mass fraction of PM2.5 emissions in PM10 emissions from entrained paved road dust. The PM2.5 mass fractions were from “Final–Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds” (SCAQMD, 2006).

Project offsite transportation emissions are summarized in Table 9. Emission calculations are provided in **Attachment 7b**.

Table 9. Delivery Truck Criteria Pollutant Emissions

Trip Type	2009 Motor Vehicle Emission Factors (lbs/mile)								
	CO	**VOC**	**NOx**	**SOx**	**Exh. PM10**	**Fug PM10**	**Diesel PM**	**Exh. PM2.5**	**Fug PM2.5**
Propane Delivery	0.01214	0.00295	0.03890	0.00004	0.00154	0.00097	0.00154	0.00142	0.00019
Chemical Delivery	0.01214	0.00295	0.03890	0.00004	0.00154	0.00097	0.00154	0.00142	0.00019
Evaporation Pond Cleanout	0.01214	0.00295	0.03890	0.00004	0.00154	0.00097	0.00154	0.00142	0.00019
Trip Type	**Daily Emissions (lbs/day)**								
	CO	**VOC**	**NOx**	**SOx**	**Exh. PM10**	**Fug PM10**	**Diesel PM**	**Exh. PM2.5**	**Fug PM2.5**
Propane Delivery	1.94	0.47	6.22	0.01	0.25	0.16	0.25	0.23	0.03
Chemical Delivery	7.77	1.89	24.89	0.03	0.98	0.62	0.98	0.91	0.12
Evaporation Pond Cleanout	51.48	12.52	164.93	0.18	6.52	4.12	6.52	6.00	0.79
Total	**61.19**	**14.88**	**196.05**	**0.21**	**7.75**	**4.90**	**7.75**	**7.13**	**0.94**
Trip Type	**Monthly Emissions (lbs/month)**								
	CO	**VOC**	**NOx**	**SOx**	**Exh. PM10**	**Fug PM10**	**Diesel PM**	**Exh. PM2.5**	**Fug PM2.5**
Propane Delivery	13.60	3.31	43.57	0.05	1.72	1.09	1.72	1.59	0.21
Chemical Delivery	116.56	28.34	373.42	0.40	14.77	9.32	14.77	13.59	1.80
Evaporation Pond Cleanout	1621.60	394.29	5195.23	5.55	205.48	129.73	205.48	189.04	24.99
Total	**1,751.8**	**425.9**	**5,612.2**	**6.0**	**222.0**	**140.1**	**222.0**	**204.2**	**27.0**
Trip Type	**Annual Emissions (tons/yr)**								
	CO	**VOC**	**NOx**	**SOx**	**Exh. PM10**	**Fug PM10**	**Diesel PM**	**Exh. PM2.5**	**Fug PM2.5**
Propane Delivery	0.080	0.019	0.255	0.000	0.010	0.006	0.010	0.009	0.001
Chemical Delivery	0.699	0.170	2.241	0.002	0.089	0.056	0.089	0.082	0.011
Evaporation Pond Cleanout	0.901	0.219	2.886	0.003	0.114	0.072	0.114	0.105	0.014
Total	1.680	0.408	5.382	0.006	0.213	0.134	0.213	0.196	0.026

Notes:
Assumes a maximum of one propane delivery tuck, two chemical delivery trucks, and 20 evaporation pond cleanout trucks in one day
Assumes a maximum of seven propane deliveries in one month, 82 deliveries per year.
Monthly evaporation pond delivery truck emissions assumes clean out occurs at the maximum daily rate everyday for one month; and there are 31 days in month

4.2.1.4 Greenhouse Gas Emissions

The BSEP boilers and the propane delivery trucks will emit greenhouse gases (GHG). The methodology used to calculate GHG emissions from these sources is explained below. A comparison of GHG emissions for the substitution of propane for natural gas for the Project is summarized in Table 10. Emission calculations are provided in **Attachment 7b**.

GHG emissions from operation of the two 30-MMBtu per hour boilers are based on the permitted maximum usage of the units by the Project (1,000 hours/year each) and the emission factors for propane combustion listed in Tables C.5 and C.6 of the California Climate Action Registry General Reporting Protocol, Version 2.2 (GRP) (March 2007).

GHG emissions from operation of the propane delivery trucks are based on the round-trip distance from the propane supplier (assumed to be located in Bakersfield, California), the estimated fuel use for a heavy duty tank truck, and the emission factors for diesel combustion listed in Tables C.5 and C.6 of the California Climate Action Registry General Reporting Protocol, Version 2.2 (GRP) (March 2007).

CO_2 equivalents are calculated using the global warming potential (GWP) provided in Appendix C of the GRP (March 2007) in the column labeled GWP, as these are the values used by the California Climate Registry. The GWP of methane is 21 times that of CO_2 and the GWP of nitrous oxide is 310 times that of CO_2.

Table 10. Comparison of Project GHG Emissions: Propane verses Natural Gas

Fuel	CO_2e Emissions (metric tons /year)
Natural Gas	3,176
Propane	
Boilers	3,787
Propane Delivery Trucks	24
Total for Propane	3,811
Net Increase	*635*

By comparison, a new 250 MW gas-fired combustion turbine-based power plant would have the potential to emit on the order of one million metric tons of CO_2e per year. Hence, the development of new renewable energy projects will assist the State of California to meet the GHG reduction goals set forth in AB 32 while still providing the power needs of all Californians.

4.2.1.5 SB 1368 GHG Emissions Performance Standard

On January 25, 2007, the California Public Utilities Commission (PUC) and CEC adopted an interim GHG Emissions Performance Standard (EPS). The EPS is a facility-based emissions standard requiring that all new long-term commitments for baseload generation to serve California consumers be with power plants that have emissions no greater than a combined cycle gas turbine plant. That level is established at 1,100 pounds of CO_2 per megawatt-hour. “New long-term commitment” refers to new plant investments (new construction), new or renewal contracts with a term of five years or more, or major investments by the utility in its existing baseload power plants.

As a solar power plant with minimal combustion sources, BSEP will surpass the EPS requirement regardless of which fuel is used, natural gas or propane. Based on natural gas fuel for the boilers, the stationary source GHG emissions (i.e., excluding mobile source emissions) are approximately 10.61 pounds per MW-hr, and based on propane fuel, the stationary source GHG emissions are slightly higher at 12.65 pounds per MW-hour.

4.2.1.6 Air Quality Impacts Assessment

As noted above, the vehicles to be used for solar field maintenance were revised and emissions recalculated. The PM10 and PM2.5 emissions were modeled for the BSEP sources including the maintenance vehicles on unpaved surfaces in the solar field. For this scenario (use of on-site groundwater), the TDS and resulting PM10 and PM2.5 emissions from the cooling tower were assumed to remain the same as evaluated previously, 1,600 ppm TDS, and with a drift eliminator to control to 0.0005 percent. A scenario based on the use of water with 16,600 ppm TDS if Koehn Lake water is provided in Section 4.3.1.

The comparison of Project impacts from this scenario to National and California Ambient Air Quality Standards (NAAQS and CAAQS) is provided in **Attachment 7d**. The Project maximum modeled concentrations for pollutants are summed with ambient background concentrations for comparison to the air quality standards. The short-term ambient background values are the highest values (for comparison to the CAAQS) over the three year period (2005-2007) for all pollutants except 24-hour PM2.5. The 24-hour PM2.5 background value is based on the three-year average of the 98th percentile values consistent with the final revisions of the PM2.5 standards (40 CFR Part 50, December 17, 2006). That is, “[T]o attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 $\mu g/m^3$.” All annual background values are highest over the three-year period.

As shown in **Attachment 7d,** all total concentrations, modeled plus ambient background, are below the NAAQS and CAAQS with the exception of 24-hour and annual PM10 CAAQS. This exceedance occurs because the monitored background concentration by itself is greater than the CAAQS.

4.2.1.7 HTF Expansion Tanks

As with the original Project, the HTF expansion tanks will vent to atmosphere via the Ullage system. The emissions will be controlled using two carbon adsorption beds in series. VOC emissions from the HTF are the result of thermal degradation of the HTF resulting in the formation of low molecular weight compounds that have low boiling points and high vapor pressure. These low molecular weight compounds volatilize in the headspace of the expansion tanks and when the HTF expands during the day, are forced out of the system through the Ullage system and carbon adsorption controls. The number of expansion tanks does not adversely affect the rate at which the HTF degrades into low molecular weight compounds. So, while the revised Project has more HTF expansion tanks and, therefore, a greater vapor volume to be displaced and vented, the daily and annual quantity of low molecular weight compounds in the system (and thus vented through the Ullage system to atmosphere) will not change. The net result is a much larger vapor volume at a much lower concentration, with no net change in emissions expected.

4.2.2 Biological Resources

This section describes the potential environmental effects to Biological Resources resulting from refinements proposed by Beacon.

4.2.2.1 Potential Impacts to Biological Resources from Electrical Transmission Line Route

The AFC evaluated the potential impacts to biological resources from both transmission line route options (Option 1 and Option 2). Option 1 has been selected by Beacon, as mentioned above. It should be noted that Option 1 has a smaller footprint that Option 2, and therefore potential impacts to biological resources are minimized.

4.2.3 Hazardous Materials Management

This section describes the potential environmental effects of changes to hazardous materials as a result of Project refinements proposed by Beacon.

4.2.3.1 Propane Tanks Storage and Handling

The propane storage tanks and handling facilities will be equipped with continuous tank level monitors, temperature and pressure monitors and alarms, and excess flow and emergency island valves. Only trained technicians will conduct system maintenance and repairs.

Propane Delivery

Propane is typically delivered in 5,000-gallon tank trucks. The tank trucks will be unloaded in a tank truck unloading area immediately adjacent to the propane tanks. The unloading area is paved with concrete and surrounded by a curb.

During unloading operations, the driver performing the unloading operation will wear appropriate protective equipment, and will have a cut-off switch to stop the propane transfer in case of an emergency. The offloading operation will also be monitored by a control room operator via camera to be able to provide backup support if there is a leak, hose break, or other accident during unloading.

With respect to the transport of propane to the Project site, Department of Transportation (DOT) regulations require all truck tank trailers to meet strict requirements for collision and accident protection. Hazardous materials shipments will comply with applicable regulations in terms of route selection, operator training and qualifications, etc. The tank trucks are designed to withstand violent accidents without breach of containment. Project truck travel will include approximately 37 hazardous material deliveries per month, of which approximately seven will be propane. It is expected that hazardous materials shipments would utilize SR 14 to access the Project site from the south for propane deliveries. It is anticipated that propane deliveries will originate in Bakersfield.

In a 2001 study, The Battelle Institute performed a study for the Federal Motor Carrier Safety Association to assess the comparative risks of hazardous materials truck shipment accidents (Battelle, 2001). In this report, the accident frequencies for trucking accidents involving various hazardous materials are computed based on 1996 mileage traveled. For hazmat accident involving flammable gases (Hazardous Material Division 2.1), the computed accident frequency was 3.43×10^{-07} accidents per mile (Battelle, 2001, Table 24). Assuming a one-way trip distance to the Project of 80 miles from Bakersfield to deliver propane and an estimated 82 truck deliveries per year, the expected accident frequency for a propane truck traveling from Bakersfield to the BSEP facility is 0.0023 accidents per year ($80 \times 82 \times 3.43 \times 10^{-07}$), or one accident approximately every 444 years. This accident frequency is much longer than the lifetime of the facility. Therefore, a transportation accident involving propane being delivered to the BSEP is an unlikely event during the facility lifetime.

Propane Storage

Storage of propane onsite in two 18,000-gallon tanks creates the potential for leak, spill or rupture of the tank releasing propane to the atmosphere. Propane is a flammable gas. Pressurized metallic storage tanks have a mean time to catastrophic failure of 0.0109 per million hours of service, or on average, one failure every 10,500 years (Center for Chemical Process Safety, 1989). Thus, failure of a pressurized propane tank during the lifetime of the facility is unlikely.

Accident Scenarios Modeled

The worst-case accident scenarios that were considered in the analysis for propane are given in Table 11. The accident scenarios consist of a catastrophic failure of the 18,000-gallon propane tank resulting in either a vapor cloud explosion with resultant overpressure or a boiling liquid expanding vapor explosion (BLEVE) with resultant thermal exposure. A truck loading accident was considered as alternative worst case analyses, but the unloading accidents will involve only 5,000 gallons of propane, and hence will produce less severe impacts than that considered for the larger propane tank.

There are two propane tanks proposed for the Project, each with a capacity of 18,000 gallons. However, there are no credible accident scenarios that will produce the simultaneous rupture of multiple propane tanks at the BSEP site. Following prior CEC precedent in previous licensing decisions, transportation accidents, seismic events, aircraft crashes, and terrorist attacks are not considered applicable and/or credible accident scenarios for the purposes of hazardous material analyses during power plant licensing. Therefore, the worst case accident scenarios chosen assumed the failure of a single tank on the project site, consistent with EPA Risk Management Program (RMP) guidance for the RMP program.

Table 11. Definition of Hazard Scenarios Modeled

Scenario	**Hazard**	**Chemical**	**Discussion**
1	Vapor Cloud Explosion	Propane	Assumes 18,000 gallons of propane is released instantaneously due to catastrophic tank failure. 10 percent of the released propane vaporizes / aerosolizes and is ignited to form a vapor cloud explosion. The risk threshold is an overpressure of 1.0 pound per square inch (psi) at ground level.
2	BLEVE	Propane	Assumes an 18,000 gallon propane tank is subject to external heating without pressure relief, resulting in a catastrophic tank failure that produces a boiling liquid expanding vapor explosion (BLEVE). 100 percent of the contents of a full propane tank participates in the BLEVE. The risk threshold is an equivalent thermal exposure (“dose”) of 5.0 kWatts per square meter (kW/m^2) for 40 seconds.

Hazard Assessment Modeling Methods

Consequence modeling was performed for the scenarios identified below. The purpose of the modeling was to estimate the offsite consequences of accidental release scenarios for an 18,000 gallon propane tank at the BSEP. The modeling was based on equations from the EPA's RMP Off-Site Consequence Analysis Guidance (EPA, 1996) document for estimating impact distances for vapor cloud explosions and BLEVEs.

The EPA equations for these events were programmed into an Excel spreadsheet and used to determine the distance to the impact threshold. The equations are summarized below.

Vapor Cloud Explosions

For vapor cloud explosion, a catastrophic failure of the storage tank releases the liquid propane to the atmosphere where it is vaporized / aerosolized. An ignition source initiates a vapor explosion involving ten percent of the released mass of propane. The impact threshold is defined to be the distance to an overpressure at ground level of one pound per square inch (psi). The distance to threshold level is determined using Equation 1 (EPA, 1996, Equation C-1).

$$D = 17 \times \left(0.1\ W_f\ \frac{Hc_f}{Hc_{TNT}}\right)^{1/3} \qquad \text{(Eq. 1)}$$

Where:

D = distance to overpressure of 1 psi (meters)

W_f = weight of flammable substance (kg)

Hc_f = heat of combustion of flammable substance (joules/kg)

Hc_{TNT} = heat of combustion of trinitrotoluene (TNT) (4.68 E+06 joules/kg)

Boiling Liquid Expanding Vapor Explosion

The equations used by the EPA to estimate impact distances for BLEVEs are shown below:

$$D = \sqrt{\frac{2.2\ t_a\ R\ H_c\ W_f^{\ 0.67}}{4\,\pi \left[\frac{3.42\ \text{x}\ 10^6}{t}\right]^{0.75}}} \qquad \text{(Eq. 2)}$$

Where:

D = distance to the 5 kilowatts per square meter endpoint (m)

R = radiative fraction of the heat of combustion (assumed to be 0.4)

t_A = atmospheric transmissivity (assumed to be 1.0)

H_C = heat of combustion of the flammable liquid (joules/kg)

W_f = entire amount of flammable substance in the tank (kg)

t = duration of the fireball in seconds (estimated from the following equations)

For $W_f < 30{,}000$ kg

$$t = 0.45\, W_f^{\,1/3} \qquad \text{(Eq. 3)}$$

For $W_f > 30{,}000$ kg

$$t = 2.6 W_f^{\,1/6} \qquad \text{(Eq. 4)}$$

The parameters input to the Hazard Analysis and the computed distance to impact thresholds are given in Table 12.

Table 12. Offsite Consequence Analysis Input Parameters

Chemical / Physical Parameters

Input	Chemical	Hc (joules/kg)	Density (lb/gal)	Flash Fraction Factor[a]
1	Propane	4.63E+07	4.24	0.38
a. EPA 550-B-99-009. Risk Management Program Guidance for Offsite Consequence Analysis				

Scenario Definitions						
Scenario	**Container**	**Event Type**	**Chemical**	**Gallons**	**Pounds**	**Kg**
1	Propane Tank	Vapor Cloud Explosion	Propane	18,000	76,320	34,619
2	Propane Tank	BLEVE	Propane	18,000	76,320	34,619

Vapor Explosion: Distance to overpressure of 1 psi. Assumes 10% of total weight is evaporated and explodes							
Scenario	**Description**	**Size (gal)**	**Chemical**	**Qs [Wt (kg)]**	**Flash Fraction Factor**	**Hc (KJoules/kg)**	**X (m)**
1	Propane Tank	76,320	Propane	3.46E+04	0.38	4.63E+04	500
Source of Equation. EPA RMP Off-Site Consequence Analysis Guideline (5/24/96), Equation C-1							

BLEVE: Assumes 100% of total weight of substance is involved in the BLEVE. Distance is to energy flux of 5kW/m^2							
Scenario	**Description**	**Size (gal)**	**Chemical**	**Weight (kg)**	**Hc (joules/kg)**	**Fire Ball Duration (s)**	**X (m)**
2	Propane Tank	76,320	Propane	3.46E+04	4.63E+07	15	580
Source of Equation. EPA RMP Off-Site Consequence Analysis Guideline (5/24/96), Equations D-31, D-32, D-36							

Hazard Assessment Results

The impacts for the two worst-case scenarios do not extend past the property fenceline. It should be noted that the two accident scenarios modeled are not likely to occur and were estimated using the very conservative EPA RMP worst-case assumptions. These worst-case assumptions include the accident occurrence at night during low wind speed and very stable nighttime conditions.

The vapor explosion impact metric is overpressure that can damage structures and injure persons exposed to the blast wave. The BLEVE impact metric is thermal exposure that can cause skin damage or other thermal-related injuries.

The BLEVE significant impact distance extends almost to the property line. Because the BSEP plant site is rural with basically barren land surrounding the plant site, the potential for significance level impacts to persons or property immediately outside the BSEP property line due to the worst-case BLEVE is negligible. The results of the model runs are summarized in Table 13.

Table 13. Distance (meters) to Endpoint from Center to Upset*

Scenario	Event	Distance to Threshold (m)	Distance to Property Fence Line (m)	Off-Property Impact? (yes/no)
1	Vapor Cloud Explosion	500	610	No
2	BLEVE	580	610	No

Endpoint:
EPA 550-B-99-009, Risk Management Program Guidance for Offsite Consequence Analysis
Vapor Explosion Endpoint – 1.0 psi

Fireball/BLEVE Endpoint – 5.0 kW/m^2 for 40 seconds, or equivalent exposure

All distances are rounded to the nearest 10 meters

4.2.3.2 HTF Expansion Tanks

The addition of 16 HTF expansion tanks will not result in any change to the impacts the Project has with respect to hazardous materials. The additional HTF expansion tanks do not introduce any new hazards that did not previously exist and do not increase the amount of HTF onsite in the heat collection system. There is a slight increase in the risk of HTF leakage, as the number of piping components and number of tanks is greater than the original Project. Pressurized metallic storage tanks have a mean time to catastrophic failure of 0.0109 per million hours of service, or on average, one failure every 10,500 years (Center for Chemical Process Safety, 1989). Thus, failure of a pressurized HTF expansion tank during the lifetime of the facility is unlikely. Leaks are far more common in piping components such as valves, flanges and connectors. The number of additional components required to add the 16 additional HTF expansion tanks is less than five percent of the total components in the heat collection system piping. The additional HTF expansion tanks do not introduce or significantly increase the risk of fire or explosion, nor do they increase the risk of failure due to an earthquake.

4.2.4 Traffic and Transportation

The proposed substitution of propane for natural gas as boiler fuel will require approximately seven additional two-way truck trips per month (82 round trips per year) for propane delivery to the project site.

Table 4 above shows the peak traffic impacts during construction and operation of the BSEP as it was originally proposed (note this table appeared as Table 5.13-6 in the AFC). The propane delivery would add one truck trip per hour, one hour per day, seven days per month on average to the traffic volume on the roadways servicing the Project. As seen in Table 4, the additional truck trips would not add significantly to the volumes and would not adversely impact LOS on those roadways. Consequently, the proposed additional propane deliveries would not cause or contribute to a significant adverse impact to Traffic and Transportation resources.

The use of propane would eliminate the need to construct the natural gas pipeline. Accordingly, the vehicle traffic associated with pipeline construction would not occur, thus reducing the impacts on the roadways serving the Project site. The BSEP as originally proposed had a less-than-significant impact on traffic and transportation.

4.2.5 Visual Resources

The section below addresses potential impacts to visual resources from Project refinements in this category

4.2.5.1 Propane and Additional HTF Tanks

Additional propane and HTF expansion tanks will add additional elements in the power block. However, due to the distance from any of the KOPs, these changes will not be readily discernable to a viewer. Propane tanks are approximately 11 to 13 feet in height and will be below the level of the solar arrays. The HTF tanks are approximately 20 feet in height, about the same height as the solar arrays. Therefore, no changes in the visual resources analysis or requirements would be needed due to these changes.

4.2.6 Waste Management

The section below addresses potential impacts to waste management from Project proposed by Beacon.

4.2.6.1 Waste from Additional HTF Expansion Tanks

As with the original Project, waste from the HTF expansion tanks will be processed by the Ullage system. Waste is generated from HTF as the result of thermal degradation of the HTF resulting in the formation of both high and low molecular weight compounds. As discussed elsewhere, the low molecular weight compounds are vented to atmosphere through carbon controls. The high molecular weight degradation byproducts are collected in the Ullage system and removed via pump truck for offsite disposal. The number of expansion tanks does not affect the rate at which the HTF degrades into high molecular weight compounds. So, while the revised Project has more HTF expansion tanks, the daily and annual quantity of high molecular weight compounds (i.e., waste) in the system will not change. The quantity of waste from the heat collection system is not expected to change as a result of the additional HTF expansion tanks.

4.2.6.2 Electrical Transmission Line Route

As discussed in Section 2.2, Beacon has purchased a parcel that will allow the construction of the transmission line route Option 1 route. A Phase I Environmental Site Assessment for this property has been completed and is provided as **Attachment 8**. No recognized environmental concerns (RECs) were found for this property. Accordingly, Beacon will construct the Option 1 transmission route and has dropped Option 2 from consideration. The initial portion of this route is shown on the site layout in **Figure 3**.

4.2.7 Other Environmental Topic Areas

It is accepted that prior to construction, worker safety plans will have to be amended to account for the usage of propane as well as any necessary additional chemicals associated with water treatment.

No changes are necessary to Transmission Line Safety and Nuisance, as the selected transmission line route (Option 1) was analyzed in the AFC.

4.3 Potential Environmental Effects from Water Supply Alternatives

A summary matrix of the potential environmental impacts from changes associated with water supply alternatives are shown in Table 14 and described further below by topic area affected.

Table 14. Matrix of Potential Environmental Effects for BSEP Water Supply Alternatives

Water Supply Alternative	AQ	BR	C&P	HM	S&W	T&T	VR	WM	Other
Koehn Lake Area	X	X	X	X	X	X	-	X	X
Rosamond Reclaimed Water	X	X	X	X	X	X	-	X	X
X potential impact on topical area									
- negligible to no effect anticipated that is different from previously analyzed Project									

4.3.1 Air Quality

This section describes the potential environmental effects to air quality resultant from the water supply alternatives.

4.3.1.1 Partial ZLD System with Poor Quality Water

The partial ZLD system will entail additional cycling in the cooling tower, which will increase the TDS levels in the cooling tower. In addition, if either of the water supply alternatives or a blend of water supplies is used, the inlet water would be higher in TDS as well.

Using a partial ZLD system with on-site ground water will necessitate the use of a pre-treatment ion-exchange system to reduce the TDS of the water entering the cooling tower. This make-up water will be cycled up to 15 times in the cooling tower for a maximum TDS of 1,600 ppm. If off-site ground water is used with substantially higher TDS, a system similar to the pre- and post- treatment clarifier may be used which could cycle water in the cooling tower up to approximately 16,600 ppm. A comparison of emissions using on-site groundwater and an estimated high TDS level for Koehn Lake area water is shown in Table 15.

Table 15. PM10/PM2.5 Emission Comparison

TDS Loading ppm	Emissions		
	lb/hr	lb/day	ton/yr
1,600	0.60	9.55	1.74

16,600	6.19	99.08	10.22
Net Increase	*5.59*	*89.53*	*8.48*

An air quality impact analysis which incorporates these changes is provided in **Attachment 7d**. The modeling analysis provided in the attachment shows that even with the increased PM10/PM2.5 emissions in the 16,600 TDS scenario, the overall modeled impacts do not change significantly.

4.3.1.2 Water Supply Construction Emissions

During the construction of the water supply pipeline, there will be emissions similar to those associated with other Project construction activities. The construction of the water supply pipeline will result in the peak daily emissions shown in Table 16. As determined in the original AFC submittal, the Project construction-related emissions are transient in nature and will cause some unavoidable but minor localized short-term impacts. The proposed construction of the additional water supply pipeline will not alter that conclusion.

Peak daily emission are independent of which supply option is selected, as the daily pipeline construction activities do not depend on the length or route; however, duration of construction would vary, depending on pipeline length. If the Koehn Lake supply is selected, the approximately eight-mile pipeline construction would take approximately 2.7 months to construct. If the Rosamond Waste Water Treatment Plant (WWTP) option is selected, the approximately 40 mile pipeline would take approximately 12 months to construct.

Table 16. Maximum Daily Offsite Construction Emissions (lb/day)

Phase of Construction	NOx	VOC	CO	SO_2	PM10	PM2.5
Water Supply Pipeline	529.4	85.4	546.3	0.5	102.5	44.5

4.3.2 Biological Resources

If constructed, a pipeline to draw water from the Koehn Lake area would be approximately seven to nine miles in length from the BSEP site. A pipeline to bring water from Rosamond would be approximately 40 miles in length from the BSEP site. The potential routes of these pipelines have not been determined, and therefore analyses as to the potential impacts to biological resources stemming from the construction of the pipeline have not been conducted. The lines would likely be placed in previously-disturbed rights of way (ROW) of existing roads; however, the impacts remain unknown at this time. It is also unknown what streambeds or jurisdictional waters might be impacted by this construction.

4.3.3 Cultural and Paleontological Resources

Similar to biological resources, water supply alternatives would require the construction of new pipelines. The potential routes of these pipelines have not been determined, and therefore analyses as to the potential impacts to cultural and paleontological resources stemming from the construction of the pipeline have not been conducted. The pipelines would likely be placed in a previously-disturbed ROW of existing streets; however, the impacts to cultural and paleontological resources are unknown at this time.

4.3.4 Hazardous Materials Management

Use of poor quality water with high TDS will require the use of additional water treatment chemicals. See Section 4.1.4 for a discussion of the types and amounts of chemicals that would be used if poor quality water is used.

4.3.5 Soil and Water Resources

There is currently insufficient data to understand if degraded water in the area of Koehn Lake can be provided at a rate necessary to support project water supply requirements. In addition, though groundwater sampling is proposed, the impacts from the use of water from this area have not been evaluated. Groundwater pumping in the areas of T30S/38E, Sections 7, 8, 17 and 18 would likely be influenced by both the low permeability sediments of Koehn Lake and the strand of the Garlock Fault. Both of these features would serve as barriers to groundwater flow and would influence pumping depending on the location of the pumping well. Historic water quality data shows that TDS concentrations are significantly higher in water samples from the north side of the lake and north of the Garlock Fault west of Koehn Lake. This supports the interpretation that groundwater north of the fault does not readily mix with groundwater to the south, and that the fault may be a barrier to groundwater flow. The groundwater sampling proposed by the CEC should help understand this contrast and aid in the identification of degraded groundwater. If such groundwater were identified, pumping tests would need to be performed to evaluate well yield and influence, and understand the influence on pumping from the fault and/or Koehn Lake.

Use of water from the Koehn Lake area has not been extensively modeled as has the use of on-site groundwater. Given the apparent complexity of the subfeatures around Koehn Lake, and the barriers to groundwater, pumping influence would tend to extend in the direction of higher conductivity materials in a direction away from the barrier. Pumping in an area south of the Garlock Fault and west of Koehn Lake, in the southern portions of Sections 8, 17 and 18 would produce an exaggerated cone of depression toward the south and southwest of the barriers. Pumping in these areas would have more impact on surrounding single family wells as the density of water wells is higher in this portion of the Koehn sub-basin (**Figure 7**).

In addition, the amount of degraded groundwater that would be available for pumping is also in question. There is no data to understand the amount of storage of degraded water and to show that pumping for 30 years, the life of the project, is going to produce a sustainable yield of high TDS groundwater. As noted above, it would be anticipated that pumping south of the Garlock Fault and west of Koehn Lake would induce flow of much lower TDS water. Over time, it is very possible that the degraded groundwater would be replaced by lower TDS groundwater as pumping influence would tend to extend south and southwestward away from Koehn Lake and the Garlock Fault. Further, pumping north of the Garlock Fault and north of Koehn Lake may very well be affected by limitations in storage of high TDS water, as the aquifer in this area is limited in extent as it is sandwiched between the fault and bedrock of the El Paso Mountains. Historic pumping records and water quality data from this area are needed to better understand the sustainability of the theorized degraded water source in this area.

Similarly, specific studies have not been conducted on the feasibility of using reclaimed water from the Rosamond area located within the Antelope Valley Groundwater Basin, which is south of the Koehn Sub-basin and the Fremont Valley Groundwater Basin. An analysis of transferring water from the Rosamond area, and thus removing it as a potential source of recharge or water offset to another groundwater basin, one that is in recovery, will be needed to better understand the environmental impacts of this alternative. It is important to note that portions of the Antelope Valley Groundwater Basin along the SR 14 corridor from Palmdale through Lancaster to Rosamond and surrounding Rogers Lake on Edwards Air Force Base have historically shown declining groundwater levels.

4.3.6 Traffic and Transportation

The construction of a water supply pipeline will require vehicle traffic for workers, on-road and off-road heavy duty trucks, and material delivery trucks. The construction of a water supply pipeline would require activities that are similar or identical to those required for the natural gas pipeline that was evaluated with the original AFC submittal, thus peak hourly and daily vehicle traffic volumes would be similar. The duration of pipeline construction would vary according to which water supply is selected. Approximately 2.7 months would be required to construct the approximately eight mile pipeline from Koehn Lake to the Project site. Approximately 12 months would be required to construct the 40 mile pipeline from the Rosamond WWTP to the Project site. By comparison, the 17.6 mile natural gas pipeline was projected to require five months for construction. As determined in the original AFC, construction of the natural gas pipeline did not cause or contribute to a significant adverse impact to Traffic and Transportation resources. Based on the traffic volumes shown in Table 6 in Section 4.1.6 and the determination that construction of the natural gas pipeline would not cause an adverse impact, it is reasonable to conclude that construction of either water supply pipeline would not cause or contribute to a significant adverse impact.

As discussed in Section 4.1.6, the proposed water treatment options will require approximately 30 additional two-way truck trips per month for water treatment chemical delivery to the project site. This estimate is based on use of Koehn Lake water; use of on-site groundwater would require slightly less water treatment, and correspondingly fewer truck trips. As discussed in Section 4.1.6, the proposed additional water treatment would not cause or contribute to a significant adverse impact to Traffic and Transportation resources, regardless of which water supply were selected for the Project.

4.3.7 Waste Management

For safety and operational purposes, the evaporation ponds will be cleaned when three feet of precipitated solids are accumulated in the base of the ponds, which is estimated to be every 4.5 years when using on-site groundwater with partial ZLD, or 3.5 years when using off-site Koehn Lake groundwater with partial ZLD. Ponds would require more frequent cleaning and additional waste would be generated if high TDS water is used.

As discussed in Section 4.1.8 above, it is anticipated that the pond solids and other non-hazardous wastes would be classified as Class II non-hazardous industrial waste. Beacon will test the pond solids using appropriate test methods in advance of removal from the evaporation ponds to confirm this determination. For planning purposes, Beacon would dispose of the waste in the McKittrick Waste Treatment Site, a Class II facility. The capacity and closure information for the McKittrick facility and two alternative facilities are shown in Table 5 above, Section 4.1.8. Based on the available capacity, the waste volume generated from each clean-out event represents less than two percent of the remaining capacity of the McKittrick facility.

4.3.8 Other Environmental Topic Areas

Potentially, socioeconomics may be positively affected if more employees are required to construct a water-supply pipeline, or if more money is spent due to additional water treatment needs.

Potential impacts from the water supply pipeline to land use or agricultural resources have not been analyzed, nor has a Phase I Environmental Site Assessment been conducted to determine the potential for contaminated soils along the pipeline route. Therefore, it is not possible to conclude whether any significant impacts to these resources would occur as a result of pipeline construction or operation.

4.4 References

Batelle, 2001. Comparative Risks of Hazardous Materials and Non-Hazardous Materials Truck Shipment Accidents/Incidents, prepared for the Federal Motor Carrier Safety Administration, March.

Center for Chemical Process Safety, 1989. Guidelines for Process Equipment Reliability Data with Data Tables, American Institute of Chemical Engineers, ISBN 0-8169-0422-7.

EPA, 2008. U.S. Environmental Protection Agency Compilation of Air Pollutant Emission Factors (AP-42), Section 1.5, Liquefied Petroleum Gas Combustion, July 2008.

EPA, 1999. Risk Management Program Guidance for Offsite Consequence Analysis, EPA 550-B-99-009

GRP, 2008a. California Climate Action Registry General Reporting Protocol, Version 3.0, Tables C.6 and C.7, April 2008.

GRP, 2008b. California Climate Action Registry General Reporting Protocol, Version 3.0, Appendix C, April 2008.

Santa Barbra County Air Pollution Control District, 1997. Technical Information and Reference: Gaseous Fuel SOx Emission Factor, Version 1.0. http://www.sbcapcd.org/eng/tech/sulfur01.htm

5.0 Conclusion

In response to Staff's requests, comments in the PSA, and at the subsequent public workshop, Beacon submits the enclosed project design refinements and analyses. The information that has been prepared is intended to be responsive to the list of information that Staff indicated in its most recent Status Report is necessary to prepare the Final Staff Assessment by the end of July 2009.

The project design refinements discussed in this submission were initiated largely at the behest of Staff, with three additional refinements proposed by Beacon. The Staff-requested refinements consist of revisions and supplemental information relative to the rerouted wash and attendant mitigation; incorporation of a partial ZLD system to reduce evaporation pond size; addition of storm water detention facilities; a secondary, emergency access road to the site; further details regarding the SCE distribution line across the property; confirmation of the LTU design; and revisions to the proposed site layout to accommodate each of the refinements. In addition, Staff requested that Beacon confirm the accessibility of adequate telecommunications facilities, consider different vehicles for solar field maintenance activities, and provide additional mitigation for potential visual impacts. The three design refinements proposed by Beacon consist of a proposal to utilize propane in lieu of natural gas, an increase in the number of HTF expansion tanks, and definitive selection of one of the two electrical transmission line routes discussed in the AFC. Based on the discussion and analyses provided above, it is expected that each of these project design refinements would have a similar or reduced impact on the environment than the previously-proposed component.

Staff has also requested that Beacon continue to assist in the exploration of alternative water supplies for the project. The alternative supplies currently under consideration are low quality groundwater from the vicinity of Koehn Lake, and tertiary treated reclaimed water that would be acquired from the community of Rosamond. As discussed herein, neither water supply has been fully analyzed, and thus are uncertain resources. In addition, each of these alternatives has the potential for ancillary environmental impacts that are also uncertain at this time. While limited historical data shows that lower-quality groundwater may be found around Koehn Lake, well sampling has not yet been conducted, and groundwater barriers in the area indicate that the source, if available, may be limited in nature. This alternative would also require construction of a seven to nine mile pipeline, whose route has not yet been determined. The reclaimed water from the community of Rosamond is a more known source, but would involve an inter-basin transfer and construction of an approximately 40 mile pipeline. Accordingly, while Beacon will continue to work diligently with Staff to explore these alternatives, Beacon continues to consider the use of on-site groundwater to be the environmentally-preferred scenario at this time.

Figure 1 Water Balance with On-Site Groundwater (C1)

Figure 2 Water Balance with High TDS Water (C2)

Figure 3 Revised Site Layout

Figure 4 Revised Equipment Layout with Propane Facilities

Figure 5 Revised Equipment Layout without Propane Facilities

Figure 6 Revised One Line Diagram

Figure 7 Water Wells Identified in Koehn Sub-basin

Attachment 1a
Rerouted Wash Design Modifications (Hydrology, Hydraulics, and Sediment Transport)

Attachment 1b
Rerouted Wash Mitigation Plan

Attachment 2
Evaporation Ponds Calculations

Attachment 3
Storm Water Management – Conceptual Retention and Grading Study

Attachment 4a
Burrowing Owl Survey Report for Emergency Access Road

Attachment 4b
Desert Tortoise Survey Report for Emergency Access Road

Attachment 4c
Cultural Resources Survey Report for Emergency Access Road

Attachment 4d
Paleontological Resources Survey Report for Emergency Access Road

Attachment 5
Groundwater Mitigation Plan

Attachment 6
Amendment to the Report of Waste Discharge

Attachment 7a
Construction Emissions Related to Emergency Access Road

Attachment 7b
Operational Emissions Related to Propane Deliveries and Use

Attachment 7c
Boiler Manufacturer Specifications

Attachment 7d
Additional Air Quality Impact Analyses

Attachment 8
Phase I Environmental Site Assessment for Additional Transmission Line Parcel