SECTION 2.0

Project Description

2.1 Introduction

Section 2.0 describes the design and operation of the proposed project, associated electric transmission lines, natural gas supply line, and water lines. Site selection and alternative sites considered are presented in Section 9.0, Alternatives.

The City of Vernon (City) is in the process of implementing policies that will reposition its power generation asset portfolio to 100 percent local generation. The City is therefore proposing to develop the Vernon Power Plant (VPP). This power plant will meet the needs of City's native load and will also contribute to the electricity reserves that will ensure a reliable energy supply in southern California.

VPP will be a 914-megawatt (MW) net (at 65 degrees Fahrenheit [°F] with duct burners and evaporative cooling)/943-MW (gross) combined-cycle generating facility configured using three natural-gas-fired combustion turbines and one steam turbine. The VPP will connect to the electrical transmission system via new double-circuit 230-kilovolt (kV) line that will connect to Southern California Edison's (SCE) Laguna Bell Substation. Natural gas for the facility will be delivered via approximately 2,300 feet of new 24-inch pipeline that will connect to Southern California Gas Company's (SoCalGas) existing gas transmission line (Line 765). The project will include an onsite fuel gas compressor station.

For cooling tower make-up and other uses, the VPP will use up to 6,266 acre feet per year (afy) of recycled water provided by the Central Basin Municipal Water District (CBMWD). Cooling water will be cycled in the cooling tower five times. The blowdown will be sent to Sanitation Districts of Los Angeles County (LACSD) via a new 2,400-foot section of City sanitary sewer line. The recycled water will be delivered to VPP through a recycled water pipeline in Boyle Avenue, adjacent to the site.

Potable water for drinking, safety showers, fire protection, service water, and sanitary uses will be served from the City's potable water system. Sanitary wastewater disposal will be to LACSD via the City's sanitary sewer system. A new sewer line connection will be added to connect to the County's system. An 18-inch sanitary sewer line would exit the plant site from the southeast corner, follow along the east property line and railroad right-of-way to Alcoa Avenue, turning south on Alcoa Avenue, the line would be 21 inches in diameter to the point where it will connect to the LACSD's 24-inch line at Alcoa and Slauson avenues. The total distance of the new line would be 2,400 feet.

The VPP will be located on land at the southeast corner of Fruitland and Boyle avenues. The City has executed a purchase agreement for the 27-acre parcel. The seller conducted a public bid process for the sale of the site and the city was the successful bidder. As part of the sales package, the seller committed to: (1) obtaining permits and demolishing all structures on the site; (2) complying with all environmental laws regarding site cleanup; and (3) obtaining all necessary site closure certificates. In 2006, the existing facility will be demolished and the title transferred. The project site will consist of approximately 13.7 acres of the subdivided 27-acre parcel. The remaining 13.3 acres will be available during construction for parking and equipment laydown. Once construction is completed, the 13.3-acre property will be available for the city's future use.

The site is located in an industrial area in the City of Vernon, in Los Angeles County. Figure 2.1-1 (all figures are located at the end of this section) shows the location of the generating facility, electric transmission lines, natural gas supply pipeline, recycled water supply pipeline, and potable water supply line.

2.2 Generating Facility Description, Design, and Operation

This subsection describes the facility's conceptual design and proposed operation.

2.2.1 Site Arrangement and Layout

The site plan on Figure 2.2-1 and typical elevation views on Figure 2.2-2 illustrate the location and size of the proposed generating facility. Settled areas, parks, and recreational and scenic areas near the site, the proposed transmission line, and alternate transmission line are shown in Figure 2.2-3.

The site is located southeast of the intersection of Fruitland and Boyle avenues. The main access to the site will be from Fruitland Avenue, with secondary access from Boyle Avenue (see Figure 2.1-1). Part of the power block will be paved to provide internal access to all project facilities and onsite buildings. The areas around equipment, where not paved, will have gravel surfacing. The 230-kV transmission lines will run from the project site to the existing SCE Laguna Bell Substation via one of two optional routes. Both of these routes will be of less than 5 miles in length. The route for the 230-kV transmission line is shown in Figure 2.1-1. The single-line representation of the interconnection scheme is depicted in Figure 2.2-4.

2.2.2 Process Description

The generating facility will consist of three combustion turbine generators (CTGs) equipped with Ultra Low Nitrogen oxide (ULN) combustors; three heat recovery steam generators (HRSGs) with duct burners; one condensing steam turbine generator (STG); a deaerating surface condenser; a 14-cell mechanical-draft cooling tower; and associated support equipment providing a total nominal generating capacity of 914 MW net (at average annual ambient conditions of 65°F with duct burners and evaporative cooling), and 60 percent relative humidity). The combustion turbines will be Siemens SGT6-5000F (formerly Siemens Westinghouse 501F) units. The project will include an electric auxiliary boiler, but will not include a standby generator or black start capability.

Each CTG will generate approximately 193 MW (gross) at base load under average ambient conditions. The CTG exhaust gases will be used to generate steam in the HRSGs. The HRSGs will be a triple-pressure reheat design with duct firing. Steam from the HRSGs will be admitted to a condensing STG. Approximately 365 MW (gross) will be produced by the steam turbine when the CTGs will be operating at base load at average annual ambient conditions of 65°F with duct burners and evaporative cooling. The project is expected to have an overall annual availability of 92 to 98 percent.

The generating facility base load operation heat balance is shown on Figures 2.2-5a and 2.2-5b. This balance is based on an ambient dry bulb temperature of 65°F (annual average), an ambient wet bulb temperature of 57°F (annual average), with duct burners and evaporative cooling on.

Associated equipment will include emission control systems necessary to meet the proposed emission limits. One-hour nitrogen oxide (NO_x) emissions will be controlled at the stack to 2.0 parts per million by volume (ppmv), dry basis, corrected to 15 percent oxygen by a combination of ULN combustors in the CTGs and selective catalytic reduction (SCR) systems in the HRSGs. An oxidation catalyst will be installed in the HRSGs to limit 3-hour stack carbon monoxide (CO) emissions to 2.0 ppmv. VOC emissions will also be limited to 2 ppmv for VOC, during a 1-hour period.

2.2.3 Generating Facility Cycle

In the CTGs, combustion air flows through the inlet air filter, evaporative cooler, and associated air inlet ductwork, is compressed in the gas turbine compressor section, and then flows to the CTG combustor. Natural gas fuel is injected into the compressed air in the combustor and ignited. The hot combustion gases expand through the power turbine section of the CTG, causing the shaft to rotate and drive the electric generator and CTG compressor. The hot combustion gases exit the turbine at approximately 1,088°F and enter the HRSG. In the HRSGs, boiler feedwater is converted to superheated steam and delivered to the steam turbine at three pressures: high pressure (HP), intermediate pressure (IP) and low pressure (LP). The use of multiple steam delivery pressures increases cycle efficiency and flexibility. High-pressure steam expands through the HP section of the steam turbine. This HP exhaust expanded steam, referred to as cold reheat steam, is combined with the IP steam from the HRSGs and returned to the reheater section of the HRSGs. This mixed, reheated steam (called “hot reheat”) is then expanded in the IP section of the steam turbine. Steam exiting the IP section is mixed with LP steam from the HRSGs and expanded in the LP section of the steam turbine. Steam leaving the LP section enters the surface condenser where it is condensed. The heat energy of the condensing steam transfers to a circulating water loop, which, in turn, exhausts heat to the atmosphere by means of a mechanical-draft cooling tower.

2.2.4 Combustion Turbine Generators, Heat Recovery Steam Generators, Steam Turbine Generator, and Condenser

Electricity is produced by the three CTGs and the STG. The following subsections describe the major components of the generating facility.

2.2.4.1 Combustion Turbine Generators

Thermal energy is produced in the CTGs through the combustion of natural gas, which is converted into mechanical energy required to drive the combustion turbine compressors and electric generators. Three Siemens SGT6-5000F CTGs have been selected for the VPP.

Each CTG system consists of a stationary combustion turbine generator, supporting systems, and associated auxiliary equipment. The CTGs will be equipped with the following required accessories to provide safe and reliable operation:

- Inlet air filters
- Inlet air evaporative coolers
- Metal acoustical enclosure
- Redundant lube oil cooler
- ULN combustion system
- Compressor wash system
- Fire detection and protection system

The metal acoustical enclosure, which contains the CTGs and accessory equipment, will be located outdoors.

2.2.4.2 Heat Recovery Steam Generators

The HRSGs provide for the transfer of heat from the exhaust gases of the CTGs to the feedwater, which is turned into steam. Major components of each HRSG include a feedwater preheater, LP evaporator, LP drum, IP economizer, IP evaporator, IP drum and reheaters, HP economizers, HP evaporator, and HP superheaters. The feedwater preheater receives condensate from the condenser hot well via the condensate pumps. The feedwater preheater is the final heat transfer section to receive heat from the combustion gases prior to exhausting them to the atmosphere.

From the feedwater preheater, the condensate is directed to the LP drum where it is available to generate LP steam and supply condensate to the boiler feed pumps. The boiler feed pumps draw suction from the LP drum and provide additional pressure to serve the separate IP and HP sections of the HRSG. The boiler feed water pumps will be enclosed in a building.

Feedwater from the boiler feed pumps is sent to the HP section of the HRSG. High-pressure feedwater flows through the HP economizers to the HP evaporator, to the HP superheater prior to entering the STG. Saturated steam forms in the tubes as energy from the combustion turbine exhaust gas is absorbed. The saturated water is returned to the HP evaporator, while the steam continues on to the HP superheaters. Within the HP superheaters, the temperature of the HP steam is increased above its saturation temperature, or "superheated," prior to being admitted to the HP section of the steam turbine.

Feedwater is also sent to the IP section of the HRSG by an interstage bleed from the boiler feed pumps. IP feedwater is preheated in the IP economizer and steam is generated in the IP evaporator. The saturated IP steam is passed through the IP superheaters and then mixed with "cold reheat" steam from the discharge of the steam turbine HP section. The blended steam then passes through the two reheaters before entering the IP turbine.

Condensate is preheated by the feedwater preheater prior to entering the LP steam drum. Steam is generated in the LP evaporator and superheated in the LP superheaters. The superheated LP steam is then admitted to the LP section of the steam turbine along with the steam exhausting from the steam turbine IP section.

For this project, duct burners will be installed in the HRSGs. Each HRSG will be equipped with an SCR emission control system that uses aqueous ammonia in the presence of a catalyst to reduce NO_x in the exhaust gases. The catalyst module will be located within the HRSG casing. Ammonia from the aqueous ammonia storage tank will be injected into the CTG exhaust gas stream via a grid of nozzles located upstream of the catalyst module. The subsequent chemical reaction will reduce NO_x to nitrogen and water, resulting in an exhaust gas NO_x concentration leaving the HRSG stack no greater than 2.0 ppmv.

An oxidation catalyst will also be installed within the HRSG casing to control the concentration of CO in the exhaust gas leaving the HRSG stack to no greater than 2.0 ppmv. The oxidation catalyst will also control VOC emissions in the exhaust gas leaving the HRSG stack to no greater than 2.0 ppmv. Exhaust from each HRSG will be discharged from individual 180-foot-tall, 20-foot-diameter exhaust stacks.

2.2.4.3 Steam Turbine Generator

The steam turbine system consists of a condensing STG with reheat, gland steam system, lubricating oil system, hydraulic control system, and steam admission/induction valving.

Steam from the HP, IP, and LP sections of the HRSG enters the associated steam turbine sections through the inlet steam system. The steam expands through multiple stages of the turbine, driving the generator. On exiting the LP turbine, the steam is directed into the surface condenser.

2.2.5 Major Electrical Equipment and Systems

The bulk of the electric power produced by the facility will be transmitted to the grid. A small amount of electric power will be used onsite to power auxiliaries such as pumps and fans, control systems, and general facility loads including lighting, heating, and air conditioning. Some power will also be converted from alternating current (AC) to direct current (DC), which will be used as backup power for control systems and other uses. Transmission and auxiliary uses are discussed in the following subsections.

2.2.5.1 AC Power—Transmission

Power will be generated by the three CTGs at 16.5 kV (for the aeropac design generator) and the STG at 19 kV (hydrogen cooled) and then stepped up by 4 transformers to 230 kV for transmission to the grid. An overall single-line diagram of the facility's electrical system is shown on Figure 2.2-4. The generators will be connected by iso-phase bus duct to oil-filled step-up transformers that increase the voltage to 230 kV as indicated on the single-line diagram. Surge arresters will be provided at the high-voltage bushings to protect the transformers from surges on the 230-kV system caused by lightning strikes or other system disturbances. The transformers will be set on concrete pads within containments designed to contain the transformer oil in the event of a leak or spill. Fire protection systems will be provided for the transformers. The high-voltage side of the step-up transformers will be connected to the plant's 230-kV switchyard. From the switchyard, power will be transmitted via a 230-kV transmission line to the grid.

A detailed discussion of the transmission system is provided in Section 5. Figure 2.2-3 illustrates the settled areas, scenic areas, and existing transmission lines within 1 mile of the proposed transmission line routes.

2.2.5.2 AC Power—Distribution to Auxiliaries

Auxiliary power to the combustion turbine and steam turbine power block will be supplied at 4,160 volts AC by a double-ended 4,160-volt switchgear lineup. Three oil-filled, 16.5-to-4.16-kV unit auxiliary stepdown transformers will supply primary power to the switchgear. The high-voltage side (16.5 kV) of the unit auxiliary transformers will be connected to the outputs of one of the three CTGs. This connection will allow the switchgear to be powered from any of the three generators or by back-feeding power from the 230-kV switchyard through the Station Auxiliary Transformer. Low-voltage side (16.5-kV) generator circuit breakers will be provided for the CTGs. These circuit breakers are used to isolate and synchronize the generators, and will be located between the generators and the connections to the transformers. The 4,160-volt switchgear lineup supplies power to the various 4,160-volt motors, to the combustion turbine starting system, and to the load center (LC) transformers, rated 4,160 to 480 volts, for 480-volt power distribution. The switchgear will have vacuum interrupter circuit breakers for the main incoming feeds and for power distribution.

The LC transformers will be oil-filled, each supplying 480-volt, 3-phase power to the double-ended load centers.

The load centers will provide power through feeder breakers to the various 480-volt motor control centers (MCCs). The MCCs will distribute power to 480-volt motors, to 480-volt power distribution panels, and lower voltage lighting and distribution panel transformers. Power for the AC power supply (120-volt/208-volt) system will be provided by the 480-volt MCCs and 480-volt power panels. 480-120/208-volt dry-type transformers will provide transformation of 480-volt power to 120/208-volt power.

2.2.5.3 125-Volt DC Power Supply System

One common 125-volt DC power supply system consisting of one 100 percent capacity battery bank, two 100 percent static battery chargers, a switchboard, and two or more distribution panels will be supplied for balance-of-plant and STG equipment. Each CTG will be provided with their own separate battery systems and redundant chargers.

Under normal operating conditions, the battery chargers supply DC power to the DC loads. The battery chargers receive 480-volt, three-phase AC power from the AC power supply (480-volt) system and continuously charge the battery banks while supplying power to the DC loads.

Under abnormal or emergency conditions, when power from the AC power supply (480-volt) system is unavailable, the batteries supply DC power to the DC system loads. Recharging of a discharged battery occurs whenever 480-volt power becomes available from the AC power supply (480-volt) system. The rate of charge depends on the characteristics of the battery, battery charger, and the connected DC load during charging. The anticipated maximum recharge time will be 12 hours.

The 125-volt DC system will also be used to provide control power to the 230-kV generator breakers, 4,160-volt switchgear, to the 480-volt LCs, to critical control circuits, and to the emergency DC motors.

2.2.5.4 Uninterruptible Power Supply System

The combustion turbines and steam turbine power block will also have an essential service 120-volt AC, single-phase, 60-hertz (Hz) uninterruptible power supply (UPS) to supply AC power to essential instrumentation to critical equipment loads and to unit protection and safety systems that require uninterruptible AC power.

Redundant UPS inverters will supply 120-volt AC single-phase power to the UPS panel boards that supply critical AC loads. The UPS inverters will be fed from the station 125-volt DC power supply system. Each UPS system will consist of one full-capacity inverter, a static transfer switch, a manual bypass switch, an alternate source transformer, and two or more panelboards.

The normal source of power to the system will be from the 125-volt DC power supply system through the inverter to the panelboard. A solid-state static transfer switch will continuously monitor both the inverter output and the alternate AC source. The transfer switch will automatically transfer essential AC loads without interruption from the inverter output to the alternate source upon loss of the inverter output.

A manual bypass switch will also be included to enable isolation of the inverter for testing and maintenance without interruption to the essential service AC loads.

The distributed control system (DCS) operator stations will be supplied from the UPS. The continuous emission monitoring (CEM) equipment, DCS controllers, and input/output (I/O) modules will be fed using either UPS or 125-volt DC power directly.

2.2.6 Fuel System

The CTGs will be designed to burn natural gas only. The natural gas requirement during base load operation at annual average ambient temperature is approximately 5,295 million British thermal units per hour (MMBtu/hr) (lower heat value [LHV] basis, total for three CTG units). The maximum natural gas requirement, experienced during low ambient temperature operation, is approximately 5,571 MMBtu/hr (LHV basis).

Natural gas will be delivered to the site via a 24-inch-diameter pipeline (see Section 6.0). This 2,300-foot-long pipeline will extend from where it ties into SoCalGas transmission pipeline (Line 765) on Downey Road, to the plant site by heading west along East 50th Street, south on Alcoa Avenue and west on Fruitland Avenue. At the plant site, the natural gas will flow through a flow-metering station, gas scrubber/filtering equipment, a gas pressure control station, electric-driven booster compressors (when required), and a fuel gas heater prior to entering the combustion turbines.

Historical data indicate that the pressure on the SoCalGas Line 765 generally varies between 250 and 525 psig. Four 33-percent capacity electric-driven fuel gas compressors will be provided to boost the pressure to that required by the combustion turbines. The gas compressors will be located outdoors.

2.2.7 Water Supply and Use

This subsection describes the quantity of water required, the sources of the water supply, and water treatment requirements. Two water balance diagrams are included, representing two operating conditions. Figures 2.2-6a and 2.2-6b represent: (1) annual average operation at 65°F with 3 CTGs operating at 100 percent load and CTG inlet evaporative cooling, and (2) peak operation at 105°F with 3 CTGs operating at 100 percent load and CTG inlet evaporative cooling.

The VPP project will use up to 3,375 gallons per minute (gpm), at the 65ºF case, of recycled water for cooling tower make-up. Total recycled water use would be 3,885 gpm (average daily use), or 6,266 acre-feet per year. The recycled water will be delivered to VPP by the CBMWD through a recycled water pipeline in Boyle Avenue, adjacent to the site. Steam cycle makeup water for VPP will be provided by treating recycled water using electrodeionization with reverse osmosis pretreatment (RO/EDI).

Potable water will be provided to the plant from existing water lines in Boyle and Fruitland avenues. It will be used for drinking, safety showers, fire protection, service water, and sanitary uses. It will also serve as an emergency water supply, should the recycled water be unavailable for an extended period of time. Sanitary wastewater disposal will be through the City's sanitary sewer system, which flows into the LACSD's sewer system.

A more detailed description of the water supply system, treatment, and permits is provided in Section 7.0, Water Supply, and Subsection 8.14, Water Resources.

2.2.7.1 Water Requirements

A breakdown of the estimated average daily quantity of water, required for operation of VPP, is presented in Table 2.2-1. The daily water requirements shown are estimated quantities based on the combined-cycle plant operating at full load, with evaporative cooling of the CTG inlet air, at an ambient temperature of 65°F (annual average dry bulb temperature). Peak water requirements shown in Table 2.2-1 are based on the plant operating at full load, with evaporative cooling of the CTG inlet air, at an ambient temperature of 105°F (1 percent exceedence dry bulb temperature based upon the American Society of Heating, Refrigerating and Air Conditioning Engineers [ASHRAE]).

TABLE 2.2-1
Daily and Annual Water Use for VPP Operations

Water Use	Average Daily Use (gpm)	Maximum Daily Use (gpm)	Maximum Annual Use (afy)
Process and cooling (i.e., recycled) water	3,885[a]	5,000	6,266[b]
Potable water service	0.21	30	0.34

[a] gpm = gallons per minute
[b] afy = acre-feet per year (based on an annual operation of 8,760 hours/year at full plant output)

2.2.7.2 Water Supply

During normal operation, approximately 87 percent of the total VPP water demand is for cooling tower makeup water to replace water lost to evaporation, drift and blowdown. The remaining water demands include process makeup water for the HRSGs, CTG evaporative cooling makeup, plant service water, and potable water for domestic uses. A detailed description of the water supply is presented in Subsection 8.14.

2.2.7.3 Water Quality

Subsection 8.14 includes a projection of the recycled water quality based on data from the CBMWD.

2.2.7.4 Water Treatment

Figures 2.2-6a and 2.2-6b illustrate the water treatment and distribution system. Water use can be divided into the following four levels based on the quality required: (1) water for the circulating (or cooling) water system; (2) service water for the plant, which includes all other miscellaneous uses; (3) demineralized water for makeup to the steam cycle; and (4) potable water. Water treatment required to obtain these four levels of quality is described in the following paragraphs.

2.2.7.4.1 Water for the Circulating Water System

Recycled water will be fed from the recycled water pipeline into the recycled water storage tank, located near the cooling tower. The recycled water storage tank will provide approximately 8 hours of operational storage (about 2 million gallons) in the event there is a disruption in the flow of recycled water from the CBMWD. If a disruption in the recycled water flow lasts longer than 8 hours, potable water will be used as an emergency supply. Makeup water will be fed by gravity from the recycled water storage tank to the cooling tower basin as required to replace water lost to evaporation, drift, and blowdown.

To minimize corrosion and control the formation of mineral scale and biofouling, a chemical feed system will supply water conditioning chemicals to the circulating water. Sulfuric acid will be fed into the circulating water system in proportion to circulating water pH for alkalinity reduction to control the scaling tendency of the circulating water. The acid feed equipment will consist of a bulk sulfuric acid storage tank and two sulfuric acid metering pumps.

To further inhibit scale formation, a polyacrylate solution will be fed into the circulating water system as a sequestering agent in an amount proportional to the circulating water blowdown flow. The scale inhibitor feed equipment will consist of a chemical solution bulk storage tank and two scale inhibitor metering pumps.

To prevent biofouling in the circulating water system, sodium hypochlorite will be fed into the system. The hypochlorite feed equipment will consist of a bulk storage tank and two sodium hypochlorite metering pumps. Additional chemical storage and feed systems will be provided for feeding alternate oxidizing and non-oxidizing biocides.

A cooling tower Biocide Use, Bio-film Prevention, and Legionella Control Program will be developed and implemented to ensure that cooling tower bacterial growth is controlled. The Program shall be consistent with the CEC Staff's guidelines or the Cooling Technology Institute's "Best Practices for Control of Legionella" guidelines.

2.2.7.4.2 Service Water

Service water includes all water uses at the plant except for the circulating water previously discussed and demineralized water used for makeup to the steam cycle. City (potable) water protected by a reduced pressure backflow prevention device or air gap will be used for service water and for fire protection. No additional treatment of the City water is required for use as service water.

2.2.7.4.3 Makeup Water for the Steam Cycle

Demineralized water will be used for makeup water for the steam cycle and CTG wash water. Demineralized water will be produced from the recycled water and stored in a 250,000-gallon demineralized water storage tank.

To minimize steam cycle corrosion and scale formation, chemical feed systems will feed a neutralizing amine to the condensate for corrosion control and a phosphate solution to the HRSG steam drums for pH control. The design will provide for automatic feed of the amine in proportion to condensate flow with a pH bias. The system will include an amine solution feed tank and two amine feed pumps. The amine system will include a relatively high-volume metering pump to provide sufficient quantities of chemicals to support wet lay-up of the HRSGs during short down-periods.

The phosphate feed system will be designed for operation using the low solids, coordinated phosphate or other standard method of boiler water treatment. The phosphate feed will be manually initiated based on boiler water phosphate residual and manually biased for pH. One solution tank and one phosphate feed pump will be provided for each LP and IP steam drum with one common spare pump serving each HRSG.

2.2.7.4.4 Steam Cycle Sampling and Analysis System

The Steam Cycle Sampling and Analysis System will monitor the water quality at various points in the steam cycle and provide sufficient data to operating personnel for detection of deviations from control limits so that corrective action can be taken. The samples will be routed to a sample panel, located in the Cycle Chemical Feed Building, where pressure and temperature will be reduced as required. At the sample panel, samples will be directed to automatic analyzers for continuous monitoring, and grab samples will be provided for wet chemical analyses. All monitored values will be sent to the DCS.

2.2.8 Plant Cooling Systems

The cycle heat rejection system will consist of a deaerating steam surface condenser, cooling tower, and circulating water system. The heat rejection system will receive exhaust steam from the low-pressure section of the steam turbine and condense it back to water for reuse. The surface condenser will be a shell-and-tube heat exchanger with the steam condensing on the shell side and the circulating water flowing in one or more passes inside the tubes. The condenser will be designed to normally operate at a pressure of about 2.5 inches of mercury. The condenser will remove heat from the condensing steam up to a maximum of 2,007 MMBtu/hr, depending on ambient temperature and plant load. Approximately 157,000 gpm of circulating cooling water will be used to condense the steam at maximum plant load.

The circulating water will pass through a counter-flow mechanical draft-cooling tower, which uses electric-motor-driven fans to move the air in a direction opposite the flow of the water. The heat removed in the condenser will be discharged to the atmosphere by heating the air and through evaporation of a portion of the circulating water. Drift, the fine mist of water droplets entrained in the warm air leaving the cooling tower, will be limited to 0.0005 percent of the circulating water flow.

A closed-loop auxiliary cooling system will be provided for cooling plant equipment other than the steam condenser and vacuum pumps. Equipment served by the auxiliary cooling water system includes the CTG and STG lube oil coolers, CTG and STG generator coolers, STG hydraulic control system cooler (if required by STG manufacturer), boiler feed pump lube oil and seal water coolers, fuel gas compressor coolers, and sample coolers. Closed-loop cooling water pumps will pump condensate quality water from the plate heat exchangers through the individual equipment coolers to remove heat. Auxiliary cooling water pumps will pump water from the cooling tower basin through the heat exchangers to remove heat from the closed cooling water system.

2.2.9 Waste Management

Waste management is the process whereby all wastes produced at VPP are properly collected, treated if necessary, and disposed of. Wastes include process and sanitary wastewater, nonhazardous waste and hazardous waste, both liquid and solid. Waste management is discussed in more detail in Subsection 8.13.

2.2.9.1 Wastewater Collection, Treatment, and Disposal

The primary wastewater collection system will collect process wastewater from all of the plant equipment, including the HRSGs, cooling tower, and water treatment equipment. To the extent practical, process wastewater will be recycled and reused. The water balance diagrams, Figures 2.2-6a and 2.2-6b, show the expected wastewater streams and flow rates for VPP. The second wastewater collection system will collect sanitary wastewater from sinks, toilets, showers, and other sanitary facilities, and discharge it to LACSD via the City’s sanitary sewer system.

2.2.9.1.1 Circulating Water System Blowdown

Circulating water system blowdown will consist of recycled water from the CBMWD along with various process waste streams that have been concentrated approximately five times along with residues of the chemicals added to treat the circulating water. These chemicals control scaling and biofouling of the cooling tower and control corrosion of the circulating water piping and condenser. Cooling tower blowdown will be discharged to LACSD via the City’s sanitary sewer system.

2.2.9.1.2 Plant Drains and Oil/Water Separator

General plant drains will collect containment area washdown, sample drains, and drainage from facility equipment drains. Water from these areas will be collected in a system of floor drains, hub drains, sumps, and piping and routed to the wastewater collection system. Drains that potentially could contain oil or grease will first be routed through one of two oil/water separators. Water from the plant wastewater collection system will be discharged to the sanitary sewer. Wastewater from combustion turbine water washes will be collected in holding tanks or sumps and will be trucked offsite for disposal at an approved wastewater disposal facility or pumped to the cooling tower basin, depending on the quality of the wastewater.

2.2.9.1.3 Power Cycle Makeup Water Treatment Wastes

Distillate from the RO/EDI system will be used as the feed water for the power cycle makeup treatment system. Since this distillate is already very low in TDS, the power cycle makeup treatment system will consist only of an onsite water treatment system consisting of multimedia filters, ultrafiltration, a reverse osmosis unit and an e-cell exchanger. The unit will be a self-contained skid mounted unit. Drains from the water treatment equipment will be either re-routed to the cooling tower or routed to the plant wastewater sump for controlled discharge to LACSD via City's sanitary sewer system.

2.2.9.1.4 HRSG Blowdown

HRSG blowdown will consist of boiler water discharged from the HRSG LP and IP steam drums to control the concentration of dissolved solids and silica within acceptable ranges. HRSG blowdown will ultimately be discharged to atmospheric flash tanks where the steam is vented to atmosphere and the condensate is cooled by mixing it with a small amount of recycled water. The quenched condensate will then be discharged to the cooling tower basin, thus recycling most of the HRSG blowdown.

2.2.9.1.5 Solid Wastes

VPP will produce maintenance and plant wastes typical of power generation operations. Generation plant wastes include oily rags, broken and rusted metal and machine parts, defective or broken electrical materials, empty containers, and other solid wastes, including the typical refuse generated by workers. Solid wastes will be trucked off-site for recycling or disposal (see Subsection 8.13).

2.2.9.1.6 Hazardous Wastes

Several methods will be used to properly manage and dispose of hazardous wastes generated by VPP. Waste lubricating oil will be recovered and recycled by a waste oil recycling contractor. Spent lubrication oil filters will be disposed of in a Class I landfill. Spent SCR and oxidation catalysts will be recycled by the supplier or disposed of in accordance with regulatory requirements. Workers will be trained to handle hazardous wastes generated at the site.

Chemical cleaning wastes will consist of alkaline and acid cleaning solutions used during pre-operational chemical cleaning of the HRSGs, acid cleaning solutions used for chemical cleaning of the HRSGs after the units are put into service, and turbine wash and HRSG fireside washwaters. These wastes, which are subject to high metal concentrations, will be temporarily stored onsite in portable tanks or sumps, and disposed of offsite by the chemical cleaning contractor in accordance with applicable regulatory requirements.

2.2.10 Management of Hazardous Materials

There will be a variety of chemicals stored and used during construction and operation of VPP. The storage, handling, and use of all chemicals will be conducted in accordance with applicable LORS. Chemicals will be stored in appropriate chemical storage facilities. Bulk chemicals will be stored in storage tanks, and most other chemicals will be stored in returnable delivery containers. Chemical storage and chemical feed areas will be designed to contain leaks and spills. Concrete containment pits and drain piping design will allow a full-tank capacity spill without overflowing the containment. For multiple tanks located within the same containment area, the capacity of the largest single tank will determine the volume of the containment area and drain piping. Drain piping for reactive chemicals will be trapped and isolated from other drains to eliminate noxious or toxic vapors.

The aqueous ammonia storage and delivery area will have spill containment and ammonia vapor detection equipment.

Safety showers and eyewashes will be provided adjacent to, or in the vicinity of, chemical storage and use areas. Plant personnel will use approved personal protective equipment during chemical spill containment and cleanup activities. Personnel will be properly trained in the handling of these chemicals and instructed in the procedures to follow in case of a chemical spill or accidental release. Adequate supplies of absorbent material will be stored onsite for spill cleanup.

A list of the chemicals anticipated to be used at VPP and their storage locations is provided in Subsection 8.12, Hazardous Materials Handling. This list identifies each chemical by type, intended use, and estimated quantity to be stored onsite. Subsection 8.12 includes additional information on hazardous materials handling.

2.2.11 Emission Control and Monitoring

Air emissions from the combustion of natural gas in the CTGs will be controlled using state of-the-art systems. To ensure that the systems perform correctly, continuous emissions monitoring for NO_x and CO will be performed. Subsection 8.1, Air Quality, includes additional information on emission control and monitoring.

2.2.11.1 NO_x Emission Control

The CTGs selected for the project include state-of-the-art ULN combustors designed to control emissions of NO_X. In addition, the HRSG's will include SCR systems to further control NO_x concentrations in the exhaust stacks to 2.0 ppmv, 1-hour average. The SCR process will use 19 percent aqueous ammonia. Ammonia slip, or the concentration of unreacted ammonia in the HRSG stack exhaust, will be limited to 5 ppmv, averaged over 1 hour. The SCR equipment will include a reactor chamber, catalyst modules, ammonia storage system, ammonia vaporization and injection system, and monitoring equipment and sensors.

2.2.11.2 Carbon Monoxide and Volatile Organic Compound Emission Control

The combustion turbine combustors incorporate staged combustion of a pre-mixed fuel/air charge, resulting in high thermal efficiencies with reduced CO and VOC emissions. CO and VOC emissions will be further controlled by means of a CO oxidation catalyst. CO and VOC emission rates in HRSG stack exhaust will be limited to 2 ppmv, averaged over 3 hour and 1 hour, respectively.

2.2.11.3 Particulate Emission Control

Particulate emissions will be controlled by the use of best combustion practices, the use of natural gas, which is low in sulfur, as the sole fuel for the CTGs, and high efficiency air inlet filtration. PM_{10} emissions from the cooling tower will be controlled through the use of high-efficiency drift rate of 0.0005 percent.

2.2.11.4 Continuous Emission Monitoring

For each CTG, a separate continuous emission monitoring systems (CEMS) will sample, analyze, and record fuel gas flow rate, NO_x and CO concentration levels, and percentage of O_2 in the exhaust gas from the HRSG stacks. The CEMS's will transmit data to a data acquisition system (DAS) that will store the data and generate emission reports in accordance with permit requirements. The DAS will also include alarm features that will send signals to the plant DCS when the emissions approach or exceed pre-selected limits.

2.2.12 Fire Protection

The fire protection system will be designed to protect personnel and limit property loss and plant downtime in the event of a fire. The primary source of fire protection water will be the City of Vernon's potable water system.

An electric jockey pump and electric-motor-driven main fire pump will be provided to increase the water pressure in the plant fire main to the level required to serve all fire fighting systems. In addition, a diesel engine-driven fire pump will be provided to pressurize the fire loop if the power supply to the electric-motor-driven main fire pump fails. A fire pump controller will be provided for each fire pump.

The fire pump will discharge to a dedicated underground firewater loop piping system. Normally, the jockey pump will maintain pressure in the firewater loop. Both the fire hydrants and the fixed suppression systems will be supplied from the firewater loop. Fixed fire suppression systems will be installed at determined fire risk areas such as the transformers and turbine lube oil equipment. Sprinkler systems will also be installed in the Administration/Control/Warehouse/Maintenance Building and Fire Pump enclosure as required by NFPA and local code requirements. The CTG units will be protected by a FM 200 fire protection system. Handheld fire extinguishers of the appropriate size and rating will be located in accordance with NFPA 10 throughout the facility. The cooling tower will be constructed of fiberglass and will, therefore, not have a sprinkler system.

Subsection 8.12, Hazardous Materials Handling, includes additional information for fire and explosion risk, and Subsection 8.8, Socioeconomics, provides information on local fire protection capability.

2.2.13 Plant Auxiliaries

The following systems will support, protect, and control the generating facility.

2.2.13.1 Lighting

The lighting system provides personnel with illumination for operation under normal conditions and for egress under emergency conditions, and includes emergency lighting to perform manual operations during an outage of the normal power source. The system also provides 120-volt convenience outlets for portable lamps and tools.

2.2.13.2 Grounding

The electrical system is susceptible to ground faults, lightning, and switching surges that result in high voltage that constitute a hazard to site personnel and electrical equipment. The station grounding system provides an adequate path to permit the dissipation of current created by these events.

The station grounding grid will be designed for adequate capacity to dissipate the ground fault current from the ground grid under the most severe conditions in areas of high ground fault current concentration. The grid spacing will maintain safe voltage gradients.

Bare conductors will be installed below-grade in a grid pattern. Each junction of the grid will be bonded together by an exothermic weld.

Ground resistivity readings will be used to determine the necessary numbers of ground rods and grid spacing to ensure safe step and touch potentials under severe fault conditions.

Grounding conductors will be brought from the ground grid to connect to building steel and non-energized metallic parts of electrical equipment.

2.2.13.3 Distributed Control System

The DCS provides modulating control, digital control, monitoring, and indicating functions for the plant power block systems.

The following functions will be provided:

- Controlling the STG, CTGs, HRSGs, and other systems in a coordinated manner
- Controlling the balance-of-plant systems in response to plant demands
- Monitoring controlled plant equipment and process parameters and delivery of this information to plant operators
- Providing control displays (printed logs, LCD video monitors) for signals generated within the system or received from input/output (I/O)
- Providing consolidated plant process status information through displays presented in a timely and meaningful manner
- Providing alarms for out-of-limit parameters or parameter trends, displaying on alarm video monitors(s), and recording on an alarm log printer
- Providing storage and retrieval of historical data

The DCS will be a redundant microprocessor-based system and will consist of the following major components:

- PC-based operator consoles with LCD video monitors
- Engineer work station
- Distributed processing units

- I/O cabinets
- Historical data unit
- Printers
- Data links to the combustion turbine and steam turbine control systems

The DCS will have a functionally distributed architecture comprising a group of similar redundant processing units linked to a group of operator consoles and the engineer workstation by redundant data highways. Each processor will be programmed to perform specific dedicated tasks for control information, data acquisition, annunciation, and historical purposes. By being redundant, no single processor failure can cause or prevent a unit trip.

The DCS will interface with the control systems furnished by the CTG and STG suppliers to provide remote control capabilities, as well as data acquisition, annunciation, and historical storage of turbine and generator operating information.

The system will be designed with sufficient redundancy to preclude a single device failure from significantly affecting overall plant control and operation. This also will allow critical control and safety systems to have redundancy of controls, as well as an uninterruptible power source.

As part of the quality control program, daily operator logs will be available for review to determine the status of the operating equipment.

2.2.13.4 Cathodic Protection

The cathodic protection system will be designed to control the electrochemical corrosion of designated metal piping buried in the soil. Depending upon the corrosion potential and the site soils, either passive or impressed current cathodic protection will be provided.

2.2.13.5 Service Air

The service air system will supply compressed air to hose connections for general plant use. Service air headers will be routed to hose connections located at various points throughout the facility.

2.2.13.6 Instrument Air

The instrument air system will provide dry air to pneumatic operators and devices. An instrument air header will be routed to locations within the facility equipment areas and within the water treatment facility where pneumatic operators and devices will be located.

2.2.14 Interconnect to Electrical Grid

The three CTGs and the STG will be interconnected to the regional electrical grid through a new double-circuit 230-kV transmission line on one set of poles that will exit the site to the east and will follow one of two optional routes to SCE’s Laguna Bell Substation (see Section 5, Electric Transmission).

2.2.15 Project Construction

Construction of the generating facility, from site preparation and grading to commercial operation, is expected to take place from the Third Quarter of 2007 to the Third Quarter of 2009 (24 months total). Major milestones are listed in Table 2.2-2.

TABLE 2.2-2
Project Schedule Major Milestones

Activity	Date
Begin Construction	Third Quarter 2007
Startup and Test	Second Quarter 2009
Commercial Operation	Third Quarter 2009

There will be an average and peak workforce of approximately 266 and 499, respectively, of construction craft people, supervisory, support, and construction management personnel onsite during construction (see Table 8.8-11).

Typically, noisy construction will be scheduled to occur between 6 a.m. and 7 p.m. on weekdays and Saturdays. Additional hours may be necessary to make up schedule deficiencies, or to complete critical construction activities (e.g., pouring concrete at night during hot weather, working around time-critical shutdowns and constraints). During some construction periods and during the startup phase of the project, some activities will continue 24 hours per day, 7 days per week.

The peak construction site workforce level is expected to last from Month 11 through Month 17 of the construction period, with the peak being Month 16.

Table 2.2-3 provides an estimate of the average and peak construction traffic during the 24-month construction period for the plant and associated linear facilities.

TABLE 2.2-3
Average and Peak Construction Traffic

Vehicle Type	Average Daily Trips	Peak Daily Trips
Construction Workers	231	434
Deliveries	10	20
Total	**241**	**454**

The construction laydown and parking area will occupy about 13.3 acres immediately south of the plant area (see Figure 2.2-7). Construction access will generally be from Fruitland Avenue to the plant entrance road, with secondary access from Boyle Avenue, as shown on Figure 2.2-1. Materials and equipment will be delivered by truck and rail. An existing railroad spur is located on the south and west sides of the project site and may be available for delivery of large or heavy equipment.

2.2.16 Generating Facility Operation

VPP will be operated by 3 operators per 12-hour rotating shift, plus 3 relief operators, 5 maintenance technicians, and 5 administrative personnel during the standard 8-hour work day. The facility will be operated 7 days a week, 24 hours per day. Total operations would include 21 personnel.

VPP is expected to have an annual plant availability of 92 to 98 percent. It will be possible for plant availability to exceed 98 percent for a given 12-month period. City of Vernon expects to operate the VPP primarily as a base load unit, with some amount of load following and cycling. The exact operational profile of the plant, however, cannot be defined in detail since operation of the facility depends on the variable demand in the VPP service area.

The facility may be operated in one or all of the following modes:

- **Base Load**. The facility would be operated at its maximum continuous output for as many hours per year as demand requires. It is anticipated that the facility will operate as a base load unit throughout the summer months.
- **Load Following**. During non-peak seasons (primarily Spring and Fall), the facility would be operated at loads that may vary between maximum continuous output (all the three CTGs operating at base load) and minimum load (one CTG operating as low as 60 percent load) to meet electrical demand at all times of the day.
- **Daily Cycling**. During low demand periods, the facility may be operated in daily cycling mode, where the plant is operated at loads up to maximum continuous output during the day and totally shut down at night or weekends. This mode of operation may occur either with daily nighttime shutdowns or with weekend shutdowns depending on electrical demand, hydroelectric power availability, and other issues.
- **Full Shutdown**. This would occur if forced by equipment malfunction, fuel supply interruption, transmission line disconnect, or scheduled maintenance.

In the unlikely event of a situation that causes a longer-term cessation of operations, security of the facilities will be maintained on a 24-hour basis, and the California Energy Commission (CEC) will be notified. Depending on the length of shutdown, a contingency plan for the temporary cessation of operations may be implemented. Such contingency plan will be in conformance with all applicable LORS and protection of public health, safety, and the environment. The plan, depending on the expected duration of the shutdown, could include the draining of all chemicals from storage tanks and other equipment and the safe shutdown of all equipment. All wastes will be disposed of according to applicable LORS. If the cessation of operations becomes permanent, the plant will be decommissioned (see Section 4.0, Facility Closure).

2.3 Facility Safety Design

VPP will be designed to maximize safe operation. Potential hazards that could affect the facility include earthquake, flood, and fire. Facility operators will be trained in safe operation, maintenance, and emergency response procedures to minimize the risk of personal injury and damage to the plant.

2.3.1 Natural Hazards

The principal natural hazard associated with the VPP site is earthquakes. The site is located in Seismic Risk Zone 4. Structures will be designed to meet the seismic requirements of CCR Title 24 and the 2001 California Building Code (CBC). (See Subsection 8.15, Geologic Hazards and Resources.) This subsection includes a review of potential geologic hazards, seismic ground motion, and potential for soil liquefaction due to ground-shaking. Potential seismic hazards will be mitigated by implementing the 2001 CBC construction guidelines. Appendix 10B, Structural Engineering, includes the structural seismic design criteria for the buildings and equipment.

Flooding is not a hazard of concern. According to the Federal Emergency Management Agency (FEMA), the site is not within either the 100- or 500-year flood plain. Subsection 8.14, Water Resources, includes additional information on the potential for flooding.

2.3.2 Emergency Systems and Safety Precautions

This subsection discusses the fire protection systems, emergency medical services, and safety precautions to be used by project personnel. Subsection 8.8, Socioeconomics, includes additional information on area medical services, and Subsection 8.7, Worker Safety, includes additional information on safety for workers. Appendices 10A through 10G contain the design practices and codes applicable to safety design for the project. Compliance with these requirements will minimize project effects on public and employee safety.

2.3.2.1 Fire Protection Systems

The project will rely on both onsite fire protection systems and local fire protection services.

2.3.2.1.1 Onsite Fire Protection Systems

The fire protection systems are designed to protect personnel and limit property loss and plant downtime from fire or explosion. The project will have the following fire protection systems.

FM 200 and Dry Chemical Fire Protection Systems

These systems protect the combustion turbines and certain accessory equipment compartments from fire. The system will have fire detection sensors in all protected compartments. Actuating one sensor will provide a high-temperature alarm on the combustion turbine control panel. Actuating a second sensor will trip the combustion turbine, turn off ventilation, close ventilation openings, and automatically release the gas and chemical agents. The gas and chemical agents will be discharged at a design concentration adequate to extinguish the fire.

Steam Turbine Lube Oil Areas Water Spray System

This system provides suppression for the steam turbine area lube oil piping and lube oil storage.

Fire Hydrants/Hose Stations

This system will supplement the plant’s fixed fire suppression systems. Water will be supplied from the plant fire water system.

Fire Extinguisher

The plant administrative/control/warehouse/maintenance building, water treatment building, and other structures will be equipped with fixed fire suppression systems and portable fire extinguishers as required by the local fire department.

2.3.2.1.2 Local Fire Protection Services

In the event of a major fire, the plant personnel will be able to call upon Vernon Fire Services for assistance. The Hazardous Materials Risk Management Plan (see Subsection 8.12, Hazardous Materials Handling) for the plant will include all information necessary to allow fire-fighting and other emergency response agencies to plan and implement safe responses to fires, spills, and other emergencies.

2.3.2.2 Personnel Safety Program

The VPP project will operate in compliance with federal and state occupational safety and health program requirements. Compliance with these programs will minimize project effects on employee safety. These programs are described in Subsection 8.7, Worker Safety.

2.4 Facility Reliability

This subsection discusses the expected facility availability, equipment redundancy, fuel availability, water availability, and project quality control measures.

2.4.1 Facility Availability

Because of the VPP system needs, it is anticipated that the facility will normally be called upon to operate at high average annual capacity factors. The facility will be designed to operate between about 25 and 100 percent of base load to support dispatch service in response to customer demands for electricity.

VPP will be designed for an operating life of 30 years. Reliability and availability projections are based on this operating life. Operation and maintenance procedures will be consistent with industry standard practices to maintain the useful life status of plant components.

The percent of time that the combined-cycle power plant is projected to be operated is defined as the “service factor.” The service factor considers the amount of time that a unit is operating and generating power, whether at full or partial load. The projected service factor for the combined-cycle power block, which considers projected percent of time of operation, differs from the equivalent availability factor (EAF), which considers the projected percent of energy production capacity achievable.

The EAF may be defined as a weighted average of the percent of full energy production capacity achievable. The projected equivalent availability factor for the VPP is estimated to be approximately 92 to 98 percent.

The EAF, which is a weighted average of the percent of energy production capacity achievable, differs from the “availability of a unit,” which is the percent of time that a unit is available for operation, whether at full load, partial load, or standby.

2.4.2 Redundancy of Critical Components

The following subsections identify equipment redundancy as it applies to project availability. A summary of equipment redundancy is shown in Table 2.4-1. Final design could differ.

TABLE 2.4-1
Major Equipment Redundancy

Description	Number	Note
Combined-cycle CTGs and HRSGs	Three trains	Steam turbine bypass system allows all three CTG/HRSG trains to operate at base load with the steam turbine out of service.
STG	One	See note above pertaining to CTGs and HRSGs.
HRSG feedwater pumps	One—100 percent per HRSG	One spare for all three HRSGs.
Condensate pumps	Three—50 percent capacity	-
Condenser	One	Condenser must be in operation for combined-cycle operation or operation of CTG in steam turbine bypass mode. The condenser will be provided with split water boxes to allow online tube cleaning and repair.
Circulating water pumps	Two—60 percent capacity	The facility may operate at reduced load with one of the two circulating water pumps in service.
Cooling tower	One	Cooling tower is multi-cell mechanical draft design.
Fuel gas booster compressors	Four—33 percent capacity	
Demineralizer system	Three—50 percent capacity	

2.4.2.1 Combined-cycle Power Block

Three separate CTG/HRSG power generation trains will operate in parallel within the combined-cycle power block. Each CTG will provide approximately 22 percent of the total combined-cycle power block output. The exhaust gas from each CTG will be used to produce steam in the steam generation system. Thermal energy from the steam generation system will be converted to mechanical energy, and then electrical energy in the STG. The expanded steam from the STG will be condensed and recycled to the feedwater system. Power from the STG will contribute approximately 39 percent of total combined-cycle power block output.

The major components of the combined-cycle power block consist of the following subsystems.

2.4.2.1.1 Combustion Turbine Generator Subsystems

The combustion turbine subsystems include the combustion turbine, inlet air filtration and evaporative coolers, generator and excitation systems, turbine lube oil system, hydraulic system, and turbine control and instrumentation. The combustion turbine will produce thermal energy through the combustion of natural gas and the conversion of the thermal energy into mechanical energy through rotation of the combustion turbine that drives the compressor and generator. Exhaust gas from the combustion turbine will be used to produce steam in the associated HRSG. The generator will be cooled by totally enclosed water-to-air coolers.

The generator excitation system will be a solid-state static system. Combustion turbine control and instrumentation (interfaced with the DCS) will cover the turbine governing system, and the protective system.

2.4.2.1.2 Steam Generation Subsystems

The steam generation subsystems consist of the HRSG with duct burners and blowdown systems. The HRSG transfers heat from the CTG exhaust gas to feedwater for steam production. This heat transfer produces steam at the pressures and temperatures required by the steam turbine. Each HRSG system consists of ductwork, heat transfer sections, an SCR system, an oxidation catalyst, and exhaust stack. The blowdown system provides vents and drains for each HRSG. The system includes safety and auto relief valves and processing of continuous and intermittent blowdown streams.

2.4.2.1.3 Steam Turbine Generator Subsystems

The steam turbine converts the thermal energy in the steam to mechanical energy to drive the STG. The basic subsystems include the steam turbine and auxiliary systems, turbine lube oil system, and generator/exciter system. The generator will be hydrogen cooled.

The combined-cycle power block is served by the following balance-of-plant systems.

2.4.2.2 Distributed Control System

The DCS will be a redundant microprocessor-based system that will provide the following functions:

- Control the HRSGs, STG, CTG, and other systems in response to unit load demands (coordinated control)
- Provide control room operator interface
- Monitor plant equipment and process parameters and provide this information to the plant operators in a meaningful format
- Provide visual and audible alarms for abnormal events based on field signals or software-generated signals from plant systems, processes, or equipment

The DCS will have functionally distributed architecture comprising a group of similar redundant processing units linked to a group of operator consoles and an engineer workstation by redundant data highways. Each processor will be programmed to perform specific dedicated tasks for control information, data acquisition, annunciation, and historical purposes.

Plant operation will be controlled from the operator panel located in the control room. The operator panel will consist of two individual video/keyboard consoles and one engineering workstation. Each video/keyboard console will be an independent electronic package so that failure of a single package does not disable more than one video/keyboard. The engineering workstation will allow the control system operator interface to be revised by authorized personnel.

2.4.2.3 Boiler Feedwater System

The boiler feedwater system transfers feedwater from the LP drum to the HP and IP sections of the HRSGs. The system will consist of one pump per HRSG, each pump sized for 100 percent capacity for supplying one HRSG. The pump will be multistage, horizontal, motor-driven with intermediate bleed-off, and will include regulating control valves, minimum flow recirculation control, and other associated piping and valves. One 100 percent capacity spare pump will be available for all three HRSGs.

2.4.2.4 Condensate System

The condensate system will provide a flow path from the condenser hotwell to the HRSG LP drum and boiler feed pumps. The condensate system will include three 50-percent capacity multistage, vertical, motor-driven condensate pumps.

2.4.2.5 Demineralized Water System

The demineralized water system will consist of three 50-percent demineralizer trains from an onsite water treatment system consisting of multimedia filters, ultrafiltration, a reverse osmosis unit and an e-cell exchanger. The unit will be a self-contained skid mounted unit. Demineralized water will be stored in a 250,000-gallon demineralized water storage tank.

2.4.2.6 Power Cycle Makeup and Storage

The power cycle makeup and storage subsystem provides demineralized water storage and pumping capabilities to supply high-purity water for system cycle makeup and chemical cleaning operations. Major components of the system are the demineralized water storage tank, providing for more than a 24-hour supply of demineralized water at peak load, and two 100-percent capacity, horizontal, centrifugal, cycle makeup water pumps.

2.4.2.7 Circulating Water System

The circulating water system provides cooling water to the condenser for condensing steam turbine exhaust steam and steam turbine bypass steam. In addition, the system supplies cooling water to the open-loop auxiliary cooling water system. Major components for this subsystem are a 14-cell mechanical draft cooling tower, two 60-percent capacity motor-driven vertical wet-pit circulating water pumps, and associated piping and valves.

2.4.2.8 Compressed Air

The compressed air system provides instrument air and service air to points of use throughout the facility. The compressed air system will include two 100-percent capacity motor-driven air compressors, two 100-percent capacity air dryers with prefilters and after filters, an air receiver, instrument air header, and service air header. All compressed air will be dried. A control valve will be provided in the service air header to prevent high consumption of service air from reducing the instrument air header pressure below critical levels.

2.4.3 Fuel Availability

Fuel will be delivered via a new 2,300-foot-long pipeline that will interconnect into SoCalGas' Line 765 at E. 50th Street and Downey Road. It is conceivable that the connecting line to VPP could become temporarily inoperable due to a breach in the line or from other causes, resulting in fuel not being available at the VPP.

2.4.4 Water Availability

The VPP project will use up to 6,266 afy of recycled water provided by the CBMWD for cooling tower make-up. Cooling water will be cycled in the cooling tower five times. The blowdown will be concentrated and the water will be discharged to the city/LACSD sewer system. Potable water will be used as an emergency supply should the availability of recycled water be interrupted for more than 8 hours.

Potable water for drinking, safety showers, fire protection water, service water, and sanitary uses will be served from the City's potable water system.

The availability of water to meet the needs of VPP is discussed in more detail in Subsection 8.14, Water Resources.

2.4.5 Project Quality Control

The Quality Control Program that will be applied to VPP is summarized in this subsection. The objective of the Quality Control Program is to ensure that all systems and components have the appropriate quality measures applied; whether it be during design, procurement, fabrication, construction, or operation. The goal of the Quality Control Program is to achieve the desired levels of safety, reliability, availability, operability, constructibility, and maintainability for the generation of electricity.

The required quality assurance for a system is obtained by applying controls to various activities, according to the activity being performed. For example, the appropriate controls for design work are checking and review, and the appropriate controls for manufacturing and construction are inspection and testing. Appropriate controls will be applied to each of the various activities for the project.

2.4.5.1 Project Stages

For quality assurance planning purposes, the project activities have been divided into the following nine stages that apply to specific periods of time during the project:

- **Conceptual Design Criteria.** Activities such as definition of requirements and engineering analyses.
- **Detail Design.** Activities such as the preparation of calculations, drawings, and lists needed to describe, illustrate, or define systems, structures, or components.
- **Procurement Specification Preparation.** Activities necessary to compile and document the contractual, technical, and quality provisions for procurement specifications for plant systems, components, or services.
- **Manufacturer's Control and Surveillance.** Activities necessary to ensure that the manufacturers conform to the provisions of the procurement specifications.
- **Manufacturer Data Review.** Activities required to review manufacturers' drawings, data, instructions, procedures, plans, and other documents to ensure coordination of plant systems and components, and conformance to procurement specifications.
- **Receipt Inspection.** Inspection and review of product at the time of delivery to the construction site.

- **Construction/Installation.** Inspection and review of storage, installation, cleaning, and initial testing of systems or components at the facility.
- **System/Component Testing.** Actual operation of generating facility components in a system in a controlled manner to ensure that the performance of systems and components conform to specified requirements.
- **Plant Operation.** As the project progresses, the design, procurement, fabrication, erection, and checkout of each generating facility system will progress through the nine stages defined above.

2.4.5.2 Quality Control Records

The following quality control records will be maintained for review and reference:

- Project instructions manual
- Design calculations
- Project design manual
- Quality assurance audit reports
- Conformance to construction records drawings
- Procurement specifications (contract issue and change orders)
- Purchase orders and change orders
- Project correspondence

For procured component purchase orders, a list of qualified suppliers and subcontractors will be developed. Before contracts are awarded, the subcontractors' capabilities will be evaluated. The evaluation will consider suppliers' and subcontractors' personnel, production capability, past performance, and quality assurance program.

During construction, field activities are accomplished during the last four stages of the project: receipt inspection, construction/installation, system/component testing, and plant operations. The construction contractor will be contractually responsible for performing the work in accordance with the quality requirements specified by contract.

The subcontractors' quality compliance will be surveyed through inspections, audits, and administration of independent testing contracts.

A plant operation and maintenance program, typical of a project this size, will be implemented by the VPP to control operation and maintenance quality. A specific program for this project will be defined and implemented during initial plant startup.

2.5 Laws, Ordinances, Regulations, and Standards

The applicable LORS for each engineering discipline are included as part of the Engineering Appendixes 10A through 10G. A summary of all LORS is provided in Appendix 1D.

FIGURE 2.1-1
VPP SITE AND LINEAR FACILITIES LOCATION MAP
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA

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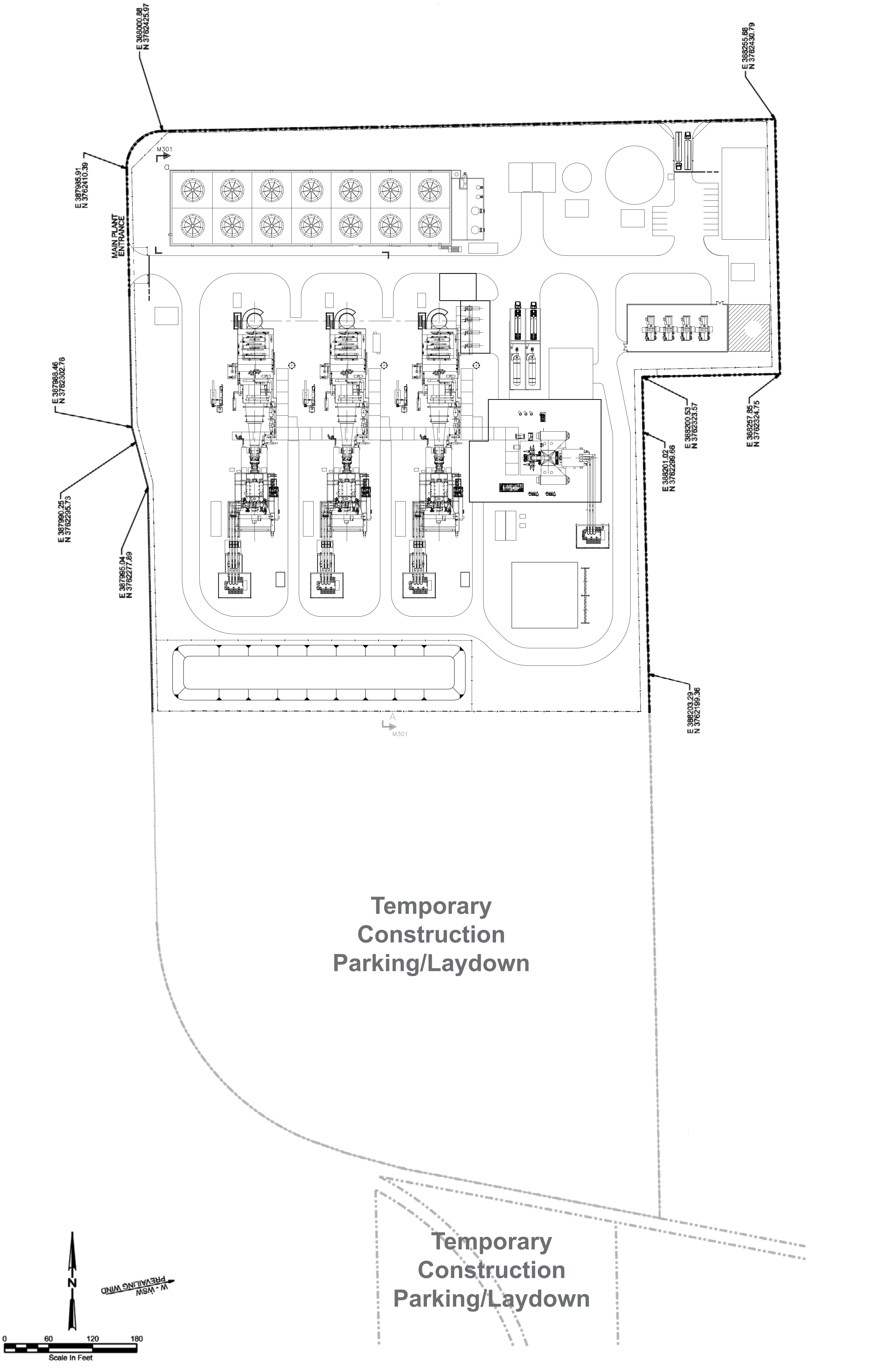

FIGURE 2.2-1
SITE PLAN
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA

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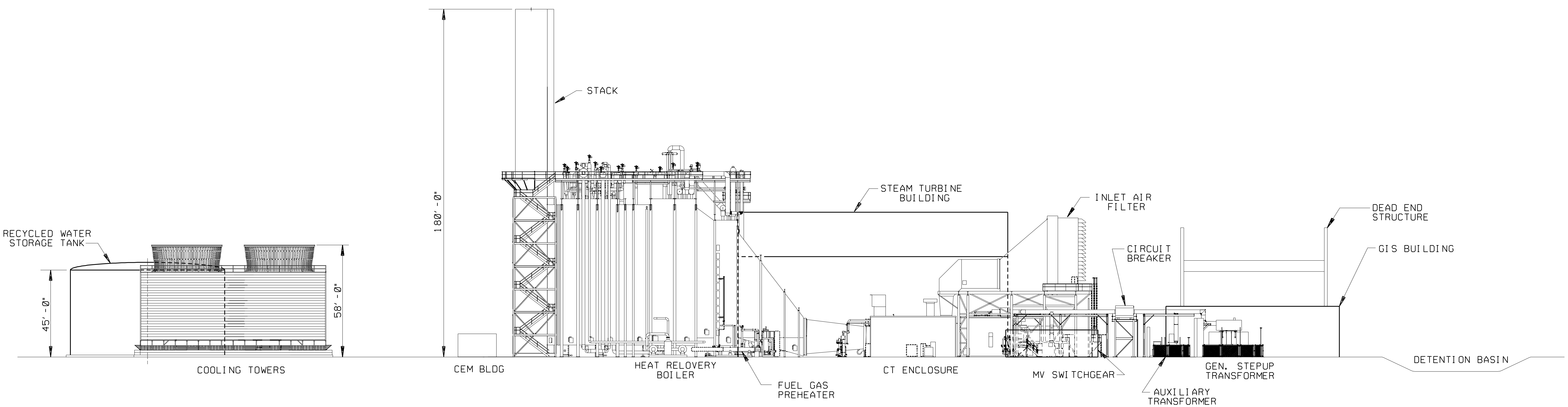

SECTION A-A
(M300)

FIGURE 2.2-2
TYPICAL ELEVATION
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA

Source: Burns and Roe, Dwg. No. M301, Rev. D.

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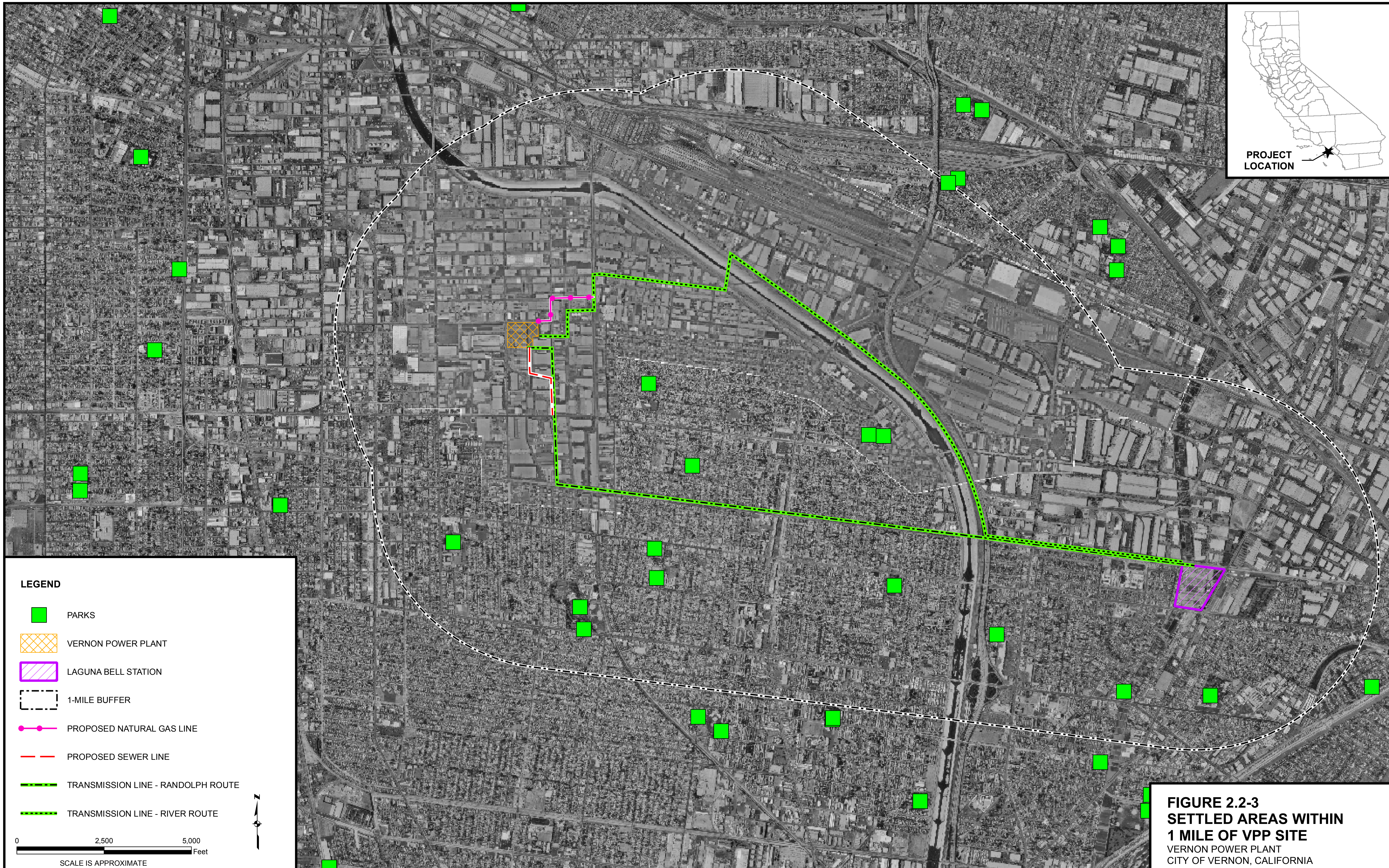

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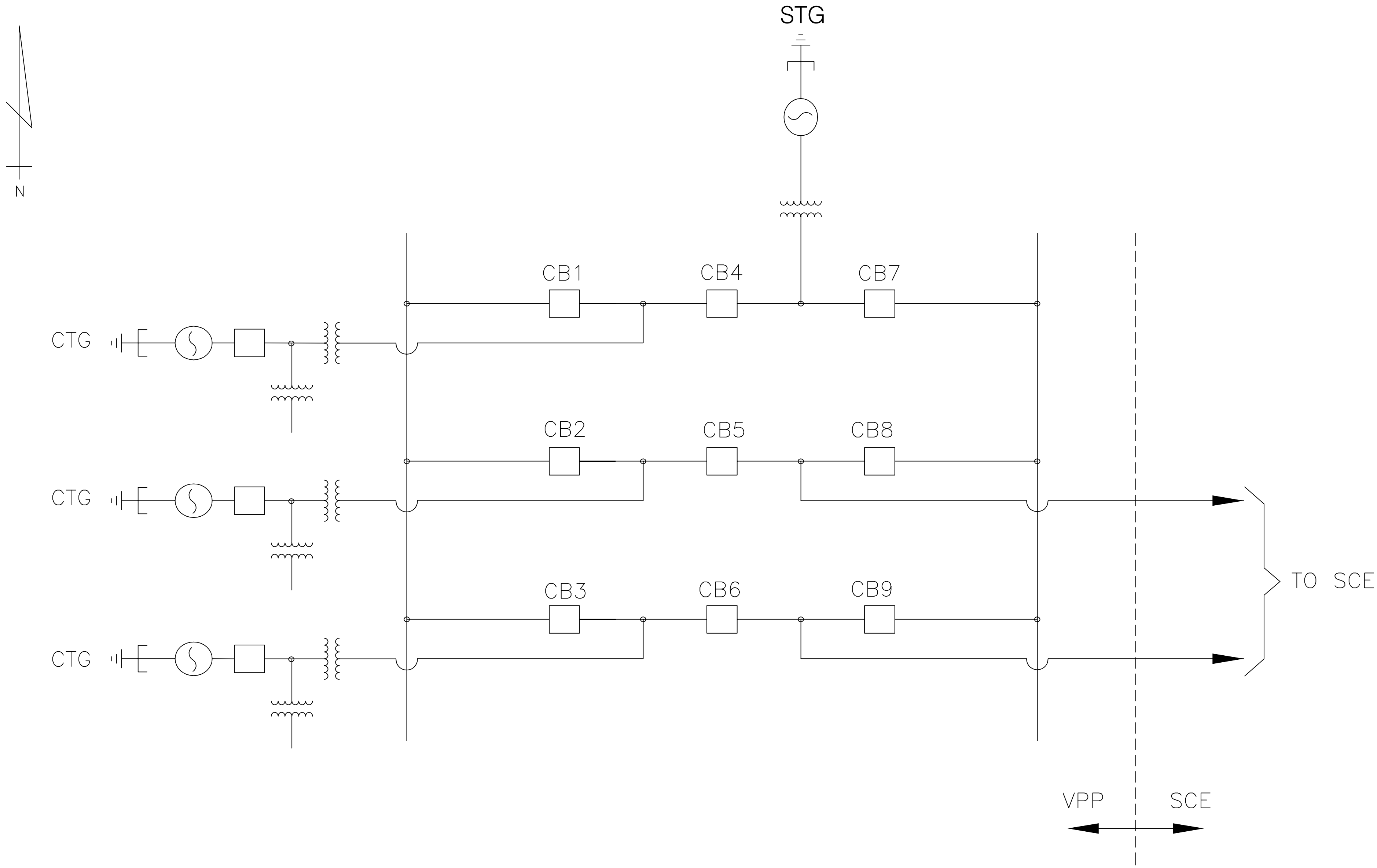
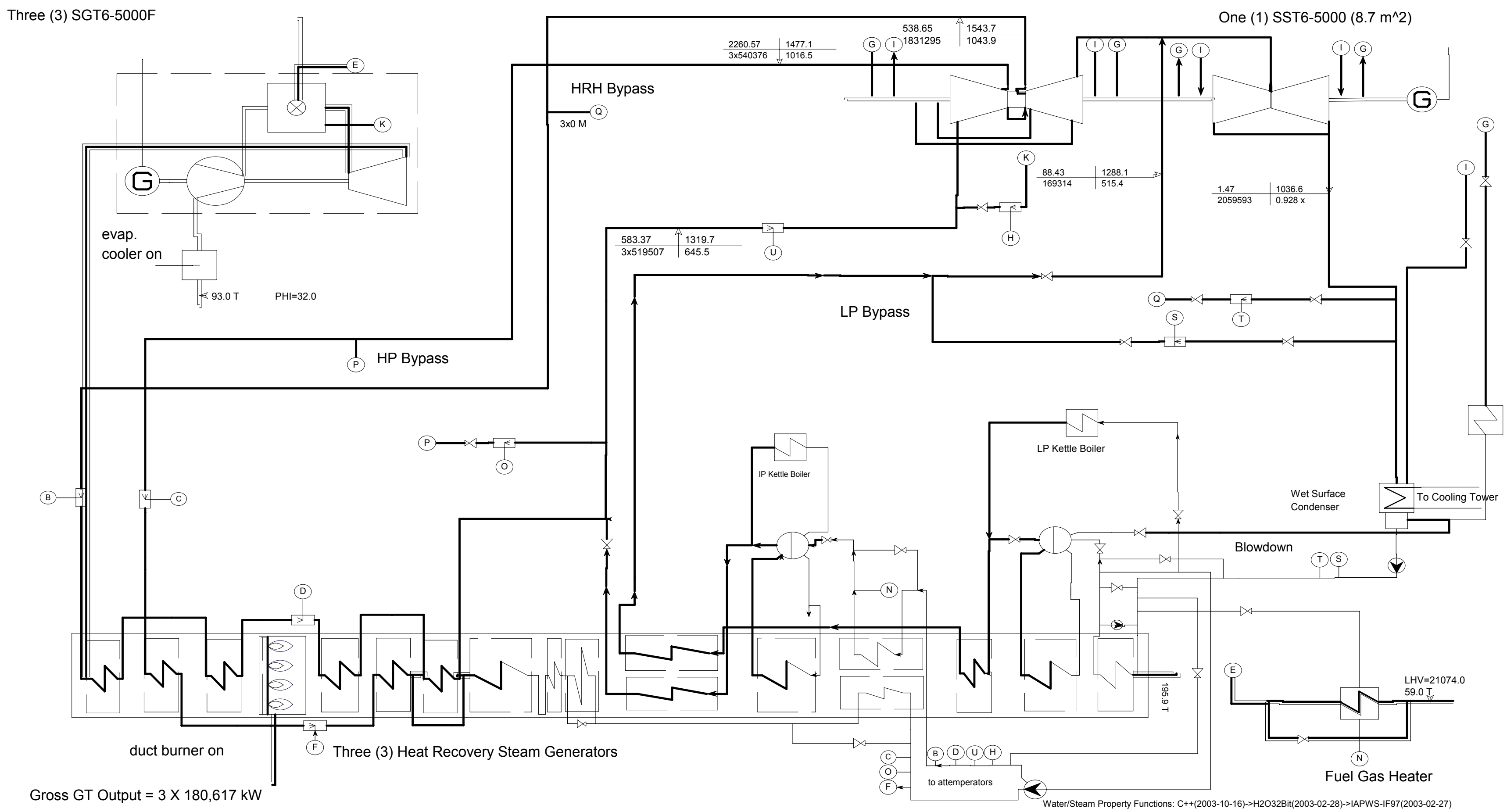


Source: Commonwealth Associates Inc., 04/25/06.

FIGURE 2.2-4
ONE-LINE SCHEMATIC OF THE SWITCHYARD
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA

CH2MHILL

EY052006001SAC figure_2.2-4.ai 06/14/06 tdaus



Gross GT Output = 3 X 180,617 kW

Gross ST Output = 360,744 kW

Estimated Net Power Output = 873,750 KW

Estimated Net Plant Heat Rate = 6,236 Btu/Kwhr (LHV)

psia	Btu/lbm
lbm/h	°F (X)

all pressures are absolute
P..pressure..psia
T..temperature..°F
H..enthalpy..Btu/lbm
M..mass flow..lbm/h
PHI..atmospheric humidity..%
fuel sensible heat included

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Source: SIEMENS

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FIGURE 2.2-5a
HEAT FLOW DIAGRAM
PEAK TEMPERATURE (93F)
WITH DUCT BURNER
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA

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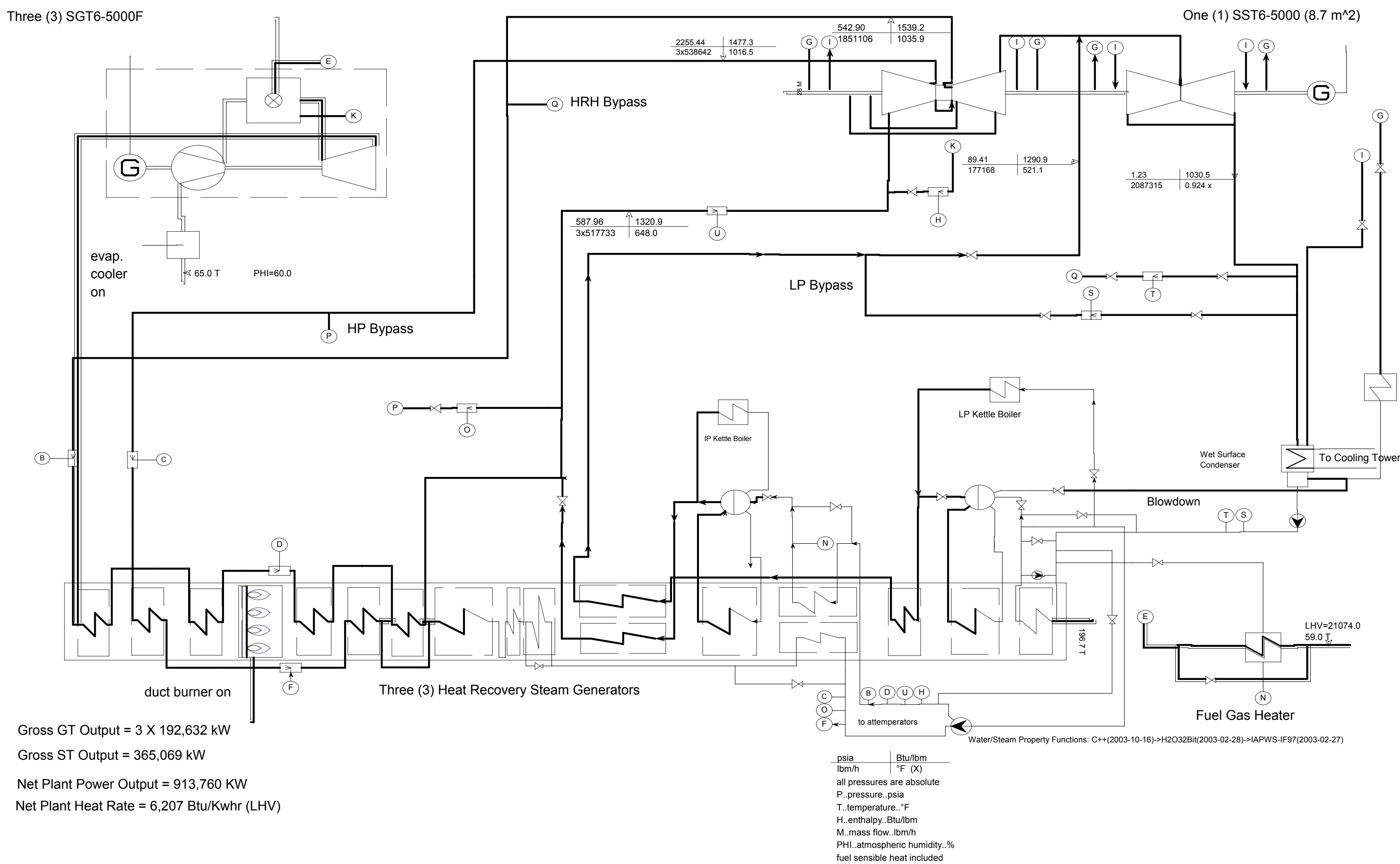

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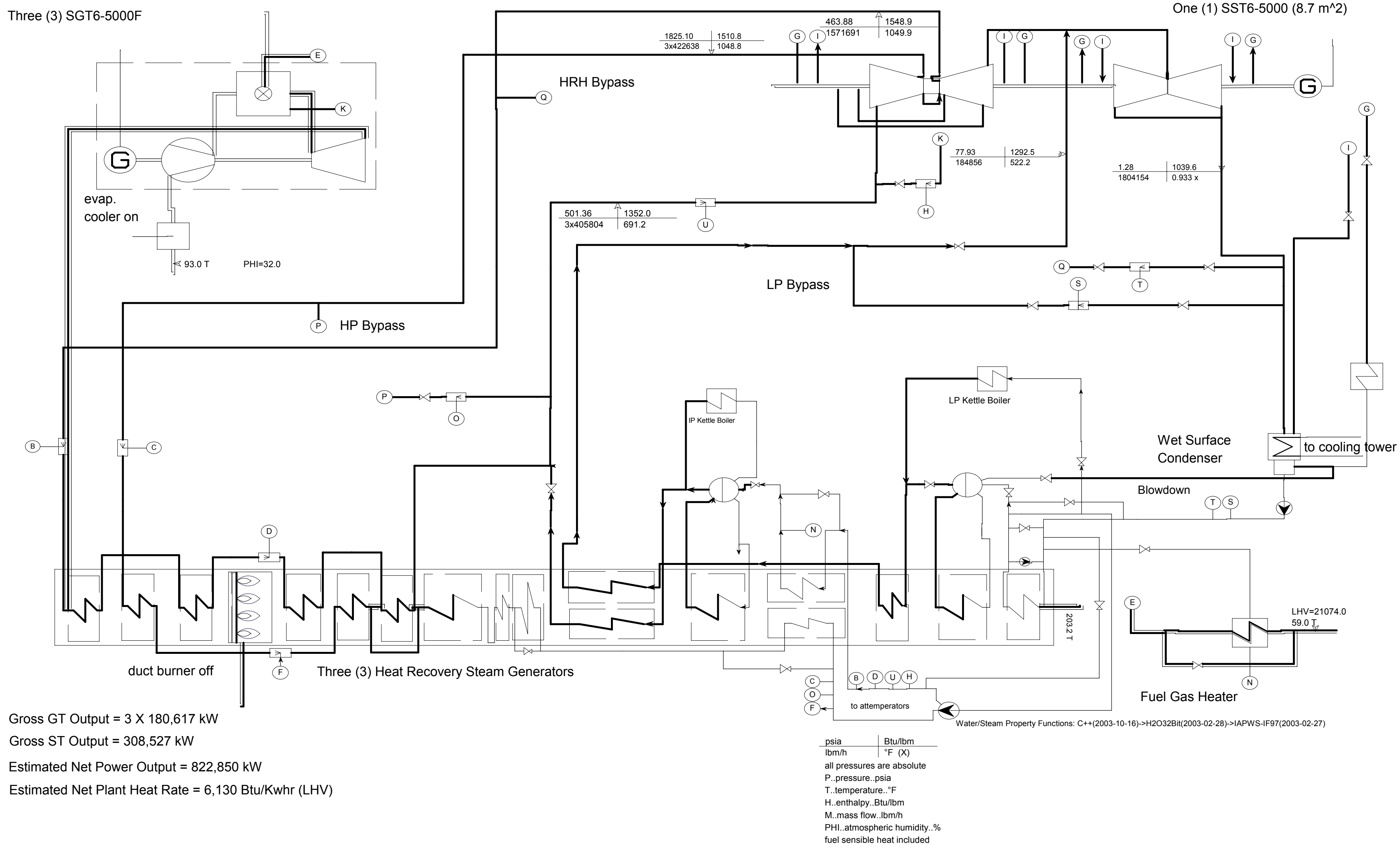
FIGURE 2.2-5b
HEAT FLOW DIAGRAM
AVERAGE TEMPERATURE (65F)
WITH DUCT BURNER

VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA

CH2MHILL



Gross GT Output = 3 X 180,617 kW

Gross ST Output = 308,527 kW

Estimated Net Power Output = 822,850 kW

Estimated Net Plant Heat Rate = 6,130 Btu/Kwhr (LHV)

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FIGURE 2.2-5c
HEAT FLOW DIAGRAM
PEAK TEMPERATURE (93F)
WITHOUT DUCT BURNER
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA

CH2MHILL

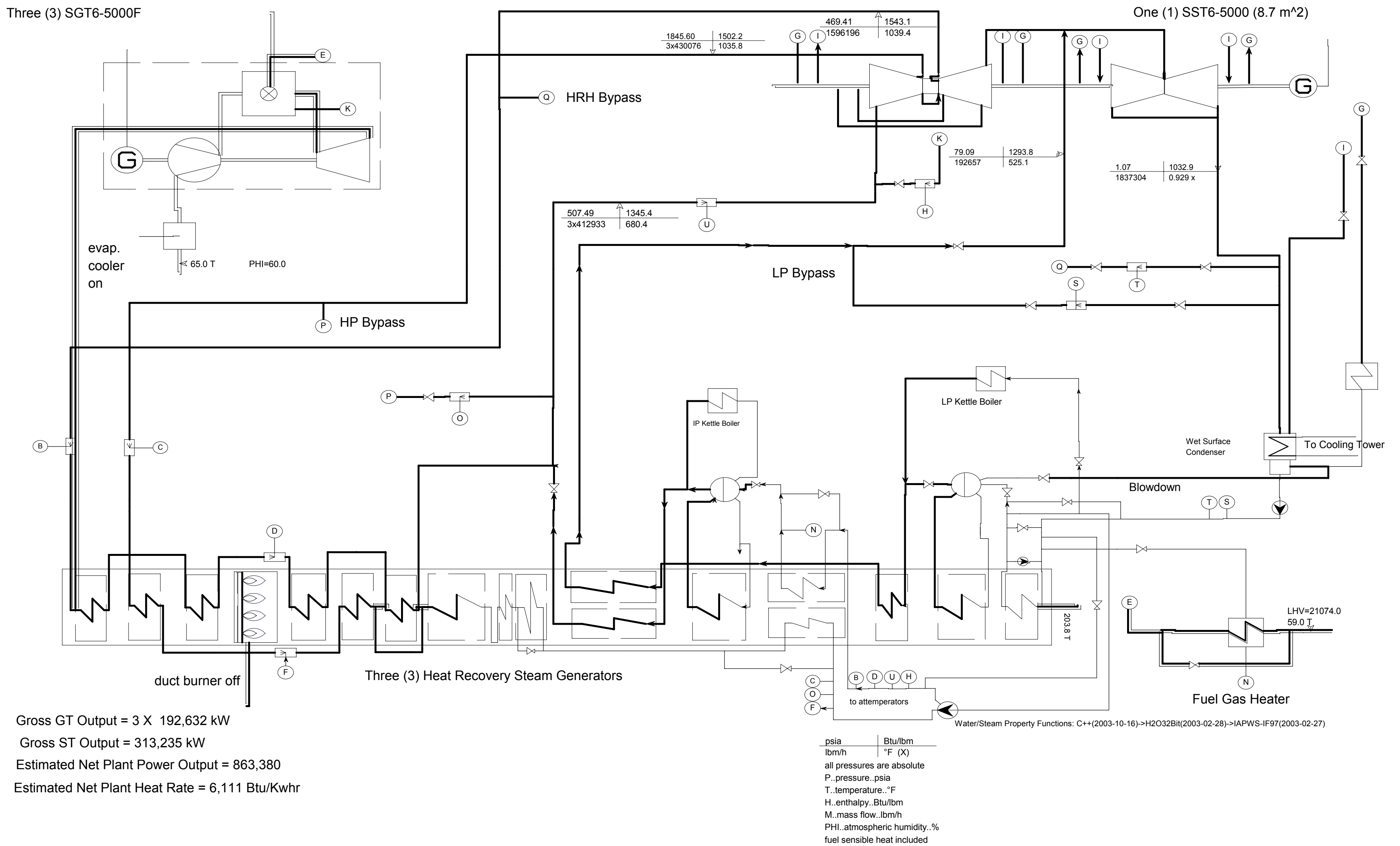

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FIGURE 2.2-5d
HEAT FLOW DIAGRAM
AVERAGE TEMPERATURE (65F)
WITHOUT DUCT BURNER
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA

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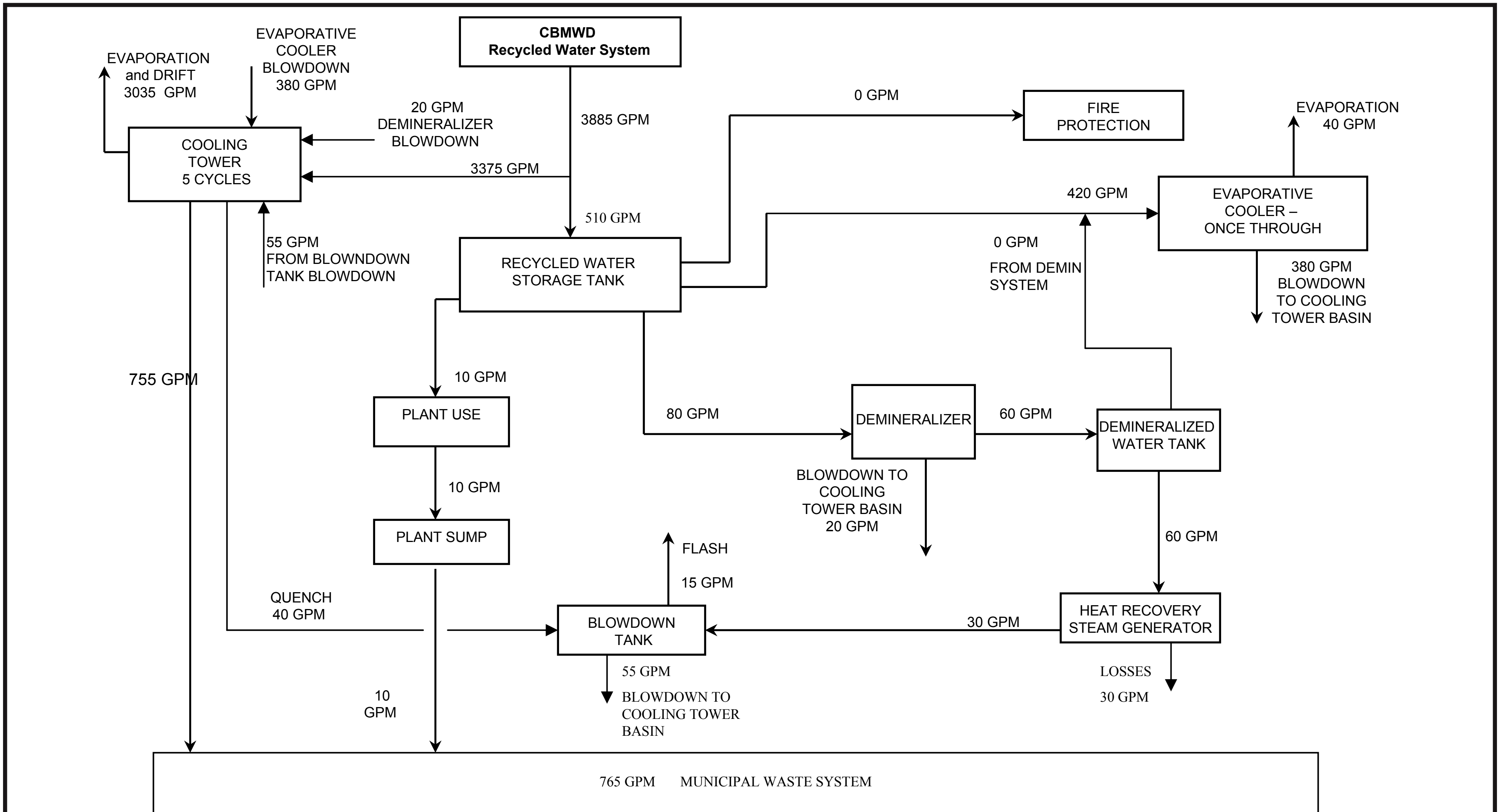
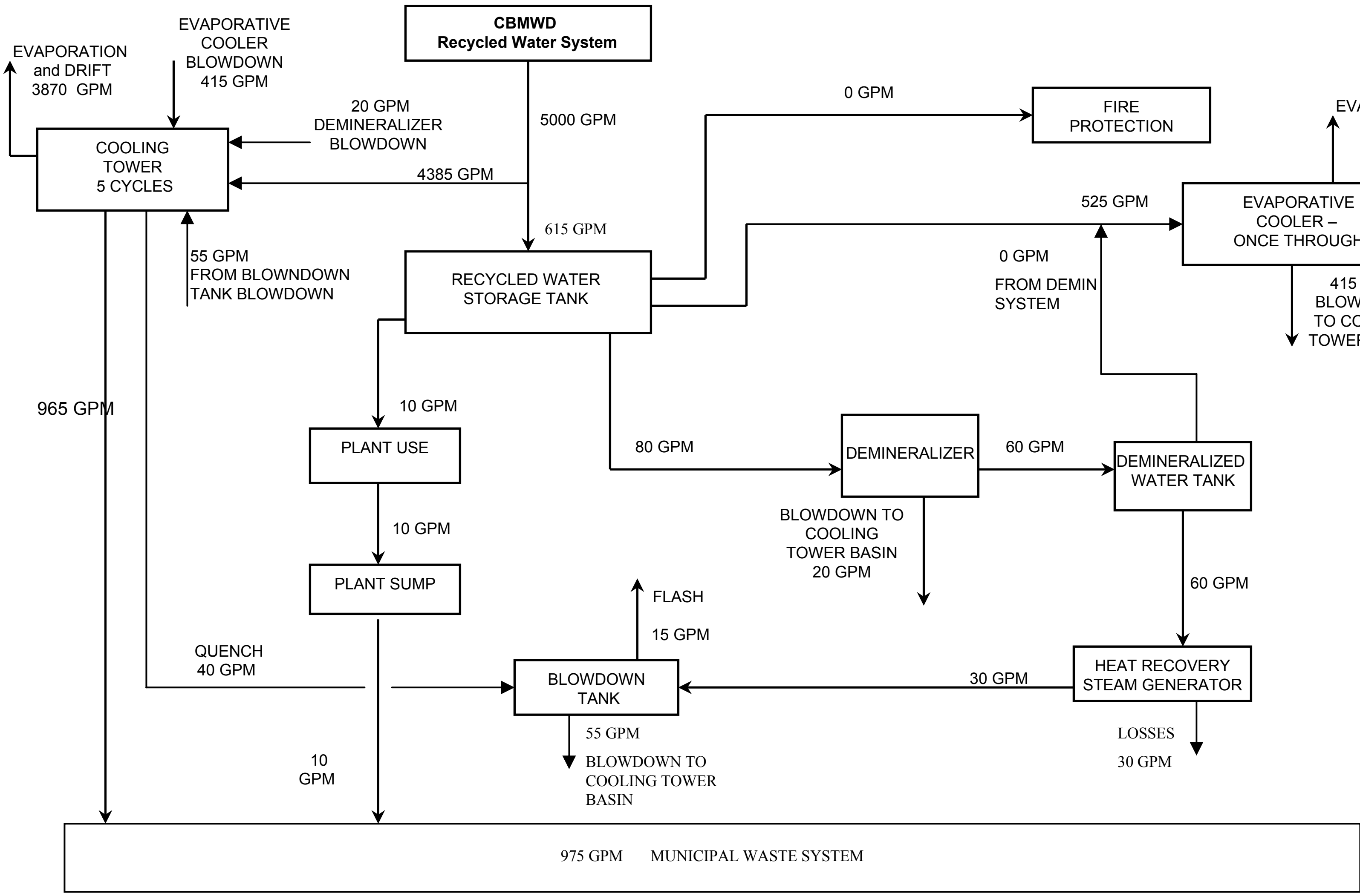


PRELIMINARY USE ONLY

3 X 1 cc, 501F, City of Vernon, duct firing & evaporative cooler on		
DATE: 10/28/05	DRAFTER: KML	WATER BALANCE
ENGINEER: KM Lambert		AMBIENT TEMPERATURE: 65 F RELATIVE HUMIDITY: 60 % ELEVATION 182 FT
APPROVED BY Preliminary		
LOCATION ORL		
CUST NO.		Drawing No.

FIGURE 2.2-6a
ANNUAL AVERAGE WATER BALANCE DIAGRAM
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA
CH2MHILL

EY052006001SAC figure_2.2-6a.ai 05/31/06 tdaus



PRELIMINARY USE ONLY

3 X 1 cc, 501F, City of Vernon, duct firing & evaporative cooler on		
DATE: 10/28/05	DRAFTER: KML	WATER BALANCE
ENGINEER: KM Lambert		AMBIENT TEMPERATURE: 105 F RELATIVE HUMIDITY: 35 % ELEVATION: 182 FT.
APPROVED BY Preliminary		
LOCATION ORL		
CUST NO.		Drawing No.

FIGURE 2.2-6b
PEAK WATER BALANCE DIAGRAM
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA
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EY052006001SAC figure_2.2-6b.ai 05/31/06 tdaus

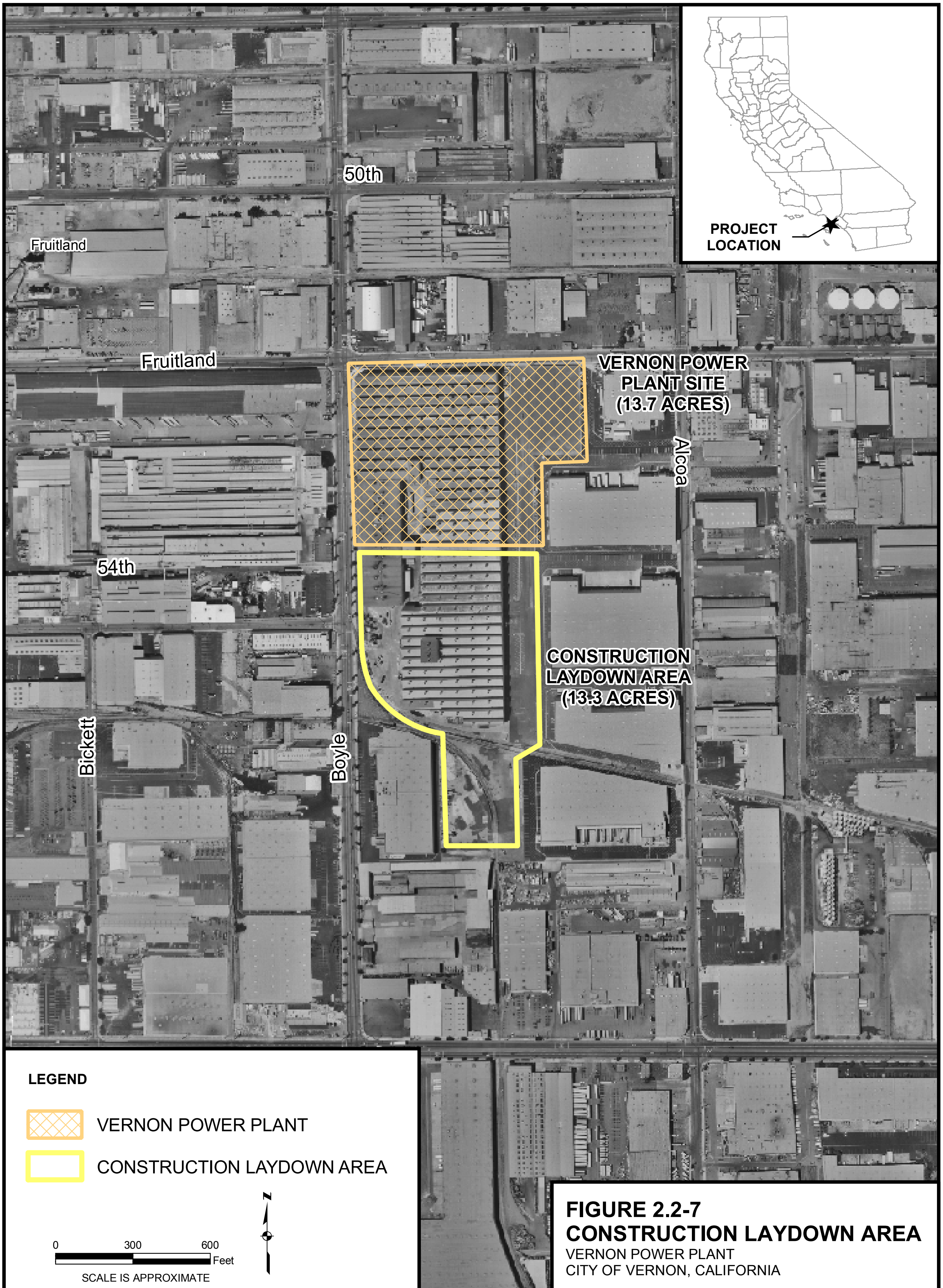

FIGURE 2.2-7
CONSTRUCTION LAYDOWN AREA
VERNON POWER PLANT
CITY OF VERNON, CALIFORNIA

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