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SECTION 2.0

# Project Description

## 2.1 Introduction

The following sections describe 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.

Section 2.1 provides a brief overview of the project. Section 2.2 describes the generating facility, its design, and its proposed operation. Section 2.3 presents the safety design of the facility. Section 2.4 describes facility reliability. Section 2.5 refers to the laws, ordinances, regulations, and standards (LORS) applicable to each engineering discipline which are described in detail in Section 10 and Appendices 10A through 10G.

The Cosumnes Power Plant (CPP) will be a nominal 1,000-megawatt (MW) combined-cycle generating facility, using natural gas-fired combustion turbines, steam turbines, and associated infrastructure. The total electrical power output would be attained by installing the Project in two 500 MW (nominal) blocks of power (i.e., Phase 1 and Phase 2). The CPP will connect to the power grid through the existing 230-kilovolt (kV) switchyard at the Rancho Seco Nuclear Plant (Rancho Seco Plant) which is now being decommissioned. Initially, two tower-mounted 230 kV aerial circuits will connect the CPP to the existing Rancho Seco Plant switchyard. No additional new transmission lines will need to be constructed except for this 0.4-mile intertie on Sacramento Municipal Utility District (District) property. Natural gas would be delivered to the project via the District-owned, high-pressure pipeline used to transport gas from PG&E’s backbone transmission system to the District’s cogeneration facilities in the Sacramento area. The District-owned gas pipeline is 20 inches in diameter and 51 miles long and connects to Lines 400 and 401 of PG&E’s backbone transmission system near Winters, California. The District’s gas pipeline terminates approximately 26 miles northwest of the CPP site at the Carson Energy Ice-Gen Facility. The project would use water that the District has available (up to 60,000 acre-feet per year (AFY) of Central Valley Project water) through a contract with the United States Bureau of Reclamation (the Bureau). In addition, the District has available from the Bureau approximately 15,000 AFY of non-project water. Water is delivered from the American River at Nimbus Dam to the site through the Folsom-South Canal. Water is then conveyed to the site through an existing 66-inch-diameter underground water line currently servicing the existing Rancho Seco Plant during decommissioning.

Cooling water will be cycled from 3 to 10 times (depending on water quality) in the cooling tower before being discharged to Clay Creek. Domestic water will be provided by diverting a portion of the Folsom-South Canal water to a package treatment plant for domestic use.

The CPP will be located on approximately 30 acres of a 2,500-acre parcel owned by the District on which the Rancho Seco Plant is situated. The site is in Sacramento County, approximately 4 miles north of the San Joaquin County line, and 5 miles west of Amador County. Figure 2.1-1 (all figures are at the end of this section) shows the locations of the generating facility and natural gas supply line. In order to show the entire natural gas supply line on one figure, the scale was adjusted to approximately 1:150,000. More detailed maps of the gasline are provided in Section 6.0. Additional information on ownership and location of CPP are included in Section 1.0.

## 2.2 Generating Facility Description, Design, and Operation

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

### 2.2.1 Site Arrangement and Access

The site plan, shown on Figure 2.2-1, and typical elevation views on Figure 2.2-2 illustrate the location and size of the proposed generating facility.

Access to the site will be provided via two 30-foot-wide roads leading from Clay East Road to the site and terminating at a control gate and a side gate. Most of the site will be paved to provide internal access to all project facilities and on-site buildings. The switchyard and areas around equipment, where not paved, will have gravel surfacing. Site access roads are shown on Figure 2.2-3.

Approximately 30 acres will be required to accommodate both phases of the generation facilities, including the storage tank areas, parking area, control/administration building, water treatment facility, stormwater retention pond, switchyard, emission control equipment, and generation equipment. Most common facilities will be constructed in Phase 1.

### 2.2.2 Process Description

At buildout, the generating facility will consist of four combustion turbine generators (CTGs) equipped with dry, low oxides of nitrogen ($NO_x$) combustors; four heat recovery steam generators (HRSG); two condensing steam turbine generators (STGs); deaerating surface condensers; mechanical-draft cooling towers; and associated support equipment providing a nominal total generating capacity of 1,000 MW. The District will use a General Electric 7FA combustion turbine. No auxiliary boilers will be used. Each phase will use an 9-cell mechanical-draft evaporative cooling tower to provide cooling water for the steam turbine surface condenser and other cooling loads. Additional auxiliary equipment will include a 370-horsepower (hp) electric fire pump.

Each CTG will generate approximately 170 MW at baseload under average ambient conditions. The CTG exhaust gases will be used to generate steam in the HRSGs. No duct firing will be used. Steam from the HRSGs will be admitted to a condensing steam turbine generator. Approximately 190 MW will be produced by the steam turbine when the CTGs are operating at base load at average ambient conditions. The project is expected to have an overall annual availability in the general range of 92 to 98 percent.

The average generating facility base load operation heat balance is shown on Figure 2.2-4. The heat balance for the peak and lowest point are located in Section 10.0. This balance is based on an ambient dry bulb temperature of 61 degrees Fahrenheit (F) (annual average) with fogging of the combustion air.

Associated equipment will include emission control systems necessary to meet the proposed emission limits. $NO_x$ emissions will be controlled to 2.0 parts per million by volume, dry basis (ppmvd) corrected to 15 percent oxygen on an annual average basis (2.5 ppmvd on a short-term basis) by a combination of low $NO_x$ (@ 15 percent $0_2$) combustors in the CTGs and selective catalytic reduction (SCR) systems in the HRSGs. Space for a carbon monoxide (CO) oxidation catalyst will be provided in the HRSGs to limit CO emissions from the CTGs if necessary to meet emission requirements.

### 2.2.3 Facility Generating Cycle

CTG combustion air flows through the inlet air filter, fogging section, 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 sections of the CTGs, causing them to rotate and drive the electric generators and CTG compressors. The hot combustion gases exit the turbine sections at approximately 1,130 degrees F and enter the HRSGs. 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 expanded steam, referred to as cold reheat steam, is combined with the IP steam and returned to the reheater section of the HRSGs. This mixed, reheated steam (called “hot reheat”) is then expanded in the IP steam turbine section. Steam exiting the IP section of the steam turbine is mixed with LP steam and expanded in the LP steam turbine section. Steam leaving the LP section of the steam turbine 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 four CTGs and two STGs. Each phase will consist of two CTGs and one STG. The following paragraphs describe 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 that drives the combustion turbine compressors and electric generators. The plant will use General Electric 7FA units.

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 foggers
- Inlet air filters

- Metal acoustical enclosures
- Double lube oil cooler
- Dry low $NO_x$ combustion system
- Compressor wash system
- Fire detection and protection system
- Fuel heating system

#### 2.2.4.2 Heat Recovery Steam Generators

The HRSGs transfer heat from the exhaust gases of the CTGs to the feedwater, which is turned into steam. The HRSGs will be three-pressure, natural circulation units equipped with inlet and outlet ductwork, insulation, lagging, and separate exhaust stacks.

Major components of each HRSG include an LP economizer, LP drum, LP evaporator, LP superheater, IP economizer, IP evaporator, IP drum, IP superheaters/reheaters, HP economizers, HP evaporator, HP drum, and HP superheaters. The LP economizer receives condensate from the condenser hot well via the condensate pumps. The LP economizer is the final heat transfer section to receive heat from the combustion gases prior to their exhausting to the atmosphere.

From the LP economizer, 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.

Feedwater from the boiler feed pumps is sent to the HP section of the HRSG. High-pressure feedwater flows through the HP economizer where it is preheated prior to entering the HP steam drum. Within the HP steam drum, a saturated liquid state will be maintained. The saturated water will flow through downcomers from the HP steam drum to the inlet headers at the bottom of the HP evaporator. Saturated steam will form in the tubes as energy from the combustion turbine exhaust gas is absorbed. The HP-saturated liquid/vapor mixture will then return to the steam drum where the two phases will be separated by the steam separators in the drum. The saturated water will return to the HP evaporator, while the vapor continues on to the HP superheater. Within the HP superheater, the temperature of the HP steam will be increased above its saturation temperature, or “superheated” prior to being admitted to the HP section of the steam turbine.

Feedwater will also be sent to the IP section of the HRSG by an interstage bleed from the boiler feed pumps. Similar to the HP section, feedwater will be preheated in the IP economizer, and steam will be generated in the IP evaporator. The saturated IP steam will pass through an IP superheater and then be mixed with “cold reheat” steam from the discharge of the steam turbine HP section. The blended steam will then pass through two additional IP superheaters reheating the steam to a superheated state. The “hot reheat” steam will then be admitted to the steam turbine IP section.

Condensate will be preheated by the LP economizer prior to entering the LP steam drum. Similar to the HP and IP sections, steam will be generated in the LP evaporator and super-heated in the LP superheater. The superheated LP steam will then be admitted to the

LP section of the steam turbine along with the steam exhausting from the steam turbine IP section.

The HRSG will be equipped with an SCR emission control system that will use ammonia vapor in the presence of a catalyst to reduce $NO_x$ in the exhaust gases. The catalyst module will be located within the HRSG casing. Diluted ammonia vapor ($NH_3$) will be injected into the 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 a $NO_x$ concentration in the HRSG exhaust gas no greater than 2.0 ppmvd at 15 percent oxygen (on an average annual basis). Exhaust from each HRSG will be discharged from individual 160-foot-tall exhaust stacks.

#### 2.2.4.3 Steam Turbine Generator and Condensor

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 HRSG HP, IP, and LP superheaters 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 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 District's transmission system, as well as directly connected to the Independent System Operator (ISO)-controlled grid. A small amount of electric power will be used on-site to power auxiliary equipment such as pumps and fans, control systems, and general facility loads including lighting, heating, and air conditioning. Some will also be converted from alternating current (AC) to direct current (DC), which is used as backup power for control systems and other uses. Transmission and auxiliary uses are discussed in following subsections.

#### 2.2.5.1 AC Power—Transmission

Power will be generated by the four CTGs and two STGs at 18 kV and then increased by 6 generator step-up transformers to 230-kV for transmission to the grid. An overall single-line diagram of the facility's electrical system is shown on Figure 2.2-5. Each generator will be provided with a generator circuit breaker for isolation and synchronization. The generators will be connected to the generator circuit breakers and to the generator step-up transformers with isolated-phase buses. Surge arresters will be provided at the high-voltage bushings of the generator step-up transformers 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 where required. The high-voltage side of the step-up transformers will be connected via overhead cables to the plant's 230-kV switchyard. From the switchyard, power will be transmitted via transmission line owned by the District to the main switchyard at the Rancho Seco Plant.

The new generating facility would be connected to the existing switchyard by means of two 230-kV lines running 0.4 mile north from the facility to the Rancho Seco Plant switchyard. A detailed discussion of the transmission system is provided in Section 5.0.

### 2.2.5.2 AC Power—Distribution to Auxiliaries

Each combustion gas turbine generator will be provided with two oil-filled, 18-kV to 4160-volt unit auxiliary/station service stepdown transformers. The high-voltage side (18-kV) of the unit auxiliary/ station service transformers will be connected to the outputs of the CTGs through underground duct banks using solid dielectric cables to terminals in the iso-phase bus. The low voltage side (4160-volt) will be connected to two double-ended 4160-volt switchgear line-ups through a main-tie-main incoming circuit breaker arrangement with automatic transfer capability upon loss of either main feed.

In addition to the unit auxiliary/station service stepdown transformers, a reserve auxiliary transformer will be provided. The primary of this transformer will be connected to the existing overhead, pole-mounted 69-kV circuit running along Clay East Road. This transformer will be close-coupled to an outdoor 4160-volt switchgear. From this switchgear, any one of the four main 4160-volt buses may be manually connected for plant startup or maintenance.

The 4160-volt switchgear buses supply power to the various 4160-volt motors, to the combustion turbine starting system, and to the load center (LC) transformers rated 4160 to 480 volts, for 480-volt power distribution. The switchgear will have vacuum interrupter circuit breakers. Motors fed from the 4160-volt switchgear will be provided with fuse/contactor medium voltage motor controllers. The LC transformers will be oil-filled, each supplying 480-volt, 3-phase power to the 480-volt double-ended load centers.

The load centers will provide power through feeder breakers to the various 480-volt motor control centers (MCCs) and larger 480-volt motors. The MCCs will distribute power to smaller 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. Transformation of 480-volt power to 120/208-volt power will be provided by 480-208Y/120-volt dry-type transformers or to 277/480-volt power will be provided by 480-480Y/277-volt dry-type transformers.

The 4160-volt system will be a 3-phase, 3-wire system with resistance grounding at the unit auxiliary transformers. The 480-volt system will be a 3-phase, 3-wire, solidly grounded system. All low voltage distribution will be either single-phase, 3-wire or 3-phase, 4-wire, solidly grounded.

### 2.2.5.3 125-Volt DC Power Supply System

Two 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 generator equipment in each of the electrical switchgear buildings. The switchyard will be provided with separate battery systems and redundant chargers.

Under normal operating conditions, the battery chargers supply DC power. The battery chargers receive 480-volt, 3-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 power supply system loads. Recharging 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 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

Each 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, two static transfer switches, 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 emissions 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. The maximum natural gas requirement during base load operation is approximately 170,000 million British thermal units (MMBtu)/hr (lower heating value basis) for each gas turbine.

Natural gas will be delivered to the site (see Section 6.0) at 500 psig. The natural gas will flow through gas scrubber/filtering equipment, a gas pressure control station, a fuel gas heater, and a flow-metering station prior to entering the combustion turbines. Pressure safety relief valves are located downstream of the control station. If gas pressure drops below 475 psig, it will be boosted by 2 on-site gas compressors.

## 2.2.7 Water Supply and Use

This section describes the quantity of water required, the source(s) of the water supply, and water treatment requirements. Two water balance diagrams are included, representing the annual average operation at 61° F with four CTGs operating at 100-percent load and CTG inlet air fogging (see Figures 2.2-6a and 2.2-6b).

### 2.2.7.1 Water Requirements

The estimated average (61 degrees F) and peak (104 degrees F) daily quantity of water required is presented in Table 2.2-1. The daily water requirements shown are estimated quantities based on the combined-cycle plant operating at a constant 1040-MW at an ambient temperature of 61 degrees F. Peak water requirements are based on the plant operating at a constant 997 MW at an ambient temperature of 104 degrees F. The water balances and water requirements for the peak condition reflect the use of CTG inlet air fogging on a continuous basis.

**TABLE 2.2-1**
Estimated Average (61 degrees F) and Peak (104 degrees F) Water Requirements

| Conditions | Flow Requirements |
|---|---|
| Average (61 degrees F) 1040 MW, no fogging | 4,920 gpm (7.1 million gallons per day [gpd]; or 8,000 AFY) |
| Peak (104 degrees F) 997 MW, inlet fogging | 7,706 gpm (11.1 million gpd; 12,431 AFY) |

### 2.2.7.2 Water Supply

During normal operation, 97 percent of the total water requirements for the CPP are for cooling water that is used to condense steam discharging from the steam turbine. The cooling water is then circulated through the cooling tower to transfer the heat gained from condensing the steam into the atmosphere. During peak operation (maximum CTG output and inlet air fogging), 96 percent of the total water requirements are for cooling water makeup.

The remaining water needed for the plant is for process makeup water for the HRSGs, CTG inlet air fogging, miscellaneous leaks and drains, plant general service water, and potable water for domestic use.

### 2.2.7.3 Water Quality

An analysis of the water quality from the Bureau is provided in Section 8.14, Water Resources.

### 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 three levels based on the quality required: (1) water for the circulating or cooling water system and service water for the plant, which includes all other miscellaneous uses; (2) demineralized water for makeup to the HRSGs; and (3) potable water. Water treatment required to obtain these three levels of quality is described in the following paragraphs.

#### 2.2.7.4.1 Water for the Circulating Water System

Makeup water for the circulating water system will be surface water from the Folsom-South Canal. This water will be fed directly into two, 2.5-million-gallon aboveground storage tanks (ASTs). These tanks will serve the following purposes: (1) the tanks will provide approximately 16 hours of operational storage for a flow of 4,920 gpm in the event that there is a disruption in the flow of the raw water; (2) the tanks allow a means to provide an air gap to protect the Bureau's raw water supply from potential contamination by plant circulating water; and (3) the tanks will provide 2 hours of backup fire protection water storage at a flow rate of 1,500 gpm. In addition, backup water will be supplied by Rancho Seco Reservoir by connecting to an existing 48-inch-diameter gravity feed line. Makeup water will be fed from the storage tanks to the cooling tower basin as required to replace water lost from evaporation, drift, and blowdown.

A chemical feed system will supply water-conditioning chemicals to the circulating water to minimize corrosion and control the formation of mineral scale and biofouling. If required, sulfuric acid may be fed into the circulating water system in proportion to makeup water flow for alkalinity reduction to control the scaling tendency of the circulating water. The acid feed equipment will consist of a sulfuric acid storage tote and two full-capacity 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 full-capacity scale inhibitor metering pumps.

To prevent biofouling in the circulating water system, sodium hypochlorite (bleach) will be fed into the system as a biocide. The hypochlorite feed equipment will consist of a bulk storage tank and two full-capacity hypochlorite metering pumps. Systems will also be provided for the feeding of alternate biocides. A bulk storage tank and two full-capacity metering pumps will be provided for the feeding of either stabilized bromine or sodium bromide. Facilities for feeding a non-oxidizing biocide will include 200- to 400-gallon totes and 2 full-capacity chemical metering pumps.

Service water will include all water uses at the plant except for the circulating water previously discussed and the demineralized water used in the HRSG (discussed in the following section). Water will be supplied from the raw water storage tank.

#### 2.2.7.4.2 Makeup Water for the HRSGs

Makeup water for the HRSGs will be taken from the service water storage tank and treated before it is used. The expected treatment methods include multimedia filtration, reverse osmosis (RO), and demineralization by ion exchange to remove suspended and dissolved solids.

The filtered demineralized water will be stored in two 250,000-gallon demineralized water storage tanks. This capacity provides approximately 16 hours of supply for a 104-degree F day. HRSG makeup water and inlet fogging water will be drawn from the demineralized water storage tanks.

Chemical feed systems will provide additional conditioning of the water in the HRSGs to minimize corrosion and scale formation. The system will feed an oxygen scavenger to the feedwater to control dissolved oxygen and a chemical to control pH. The design will provide for the automatic feeding of the oxygen scavenger in proportion to the HRSG makeup flow. The system will include an oxygen scavenger solution feed tank and two full-capacity chemical feed pumps.

The cycle chemical feed systems will also feed sodium phosphate to control pH and minimize scale formation. The systems will be designed for operation using the low solids, congruent phosphate method of boiler water treatment. The design will provide for feeding sodium phosphates to the boiler water to react with any hardness present. For congruent phosphate treatment, a dilute solution of a disodium phosphate and trisodium phosphate mixture will be prepared manually in a phosphate solution tank dedicated to each steam drum. Phosphate feeding to each steam drum will be initiated manually based on boiler water phosphate residual and pH. One full-capacity phosphate feed pump will be provided for each steam drum, with one common spare pump serving each drum pressure level.

#### 2.2.7.4.3 Potable Water System

The potable water system will consist of a bulk storage tank, transfer pumps, pressurized tank, chlorine dosing system, and distribution system. Water into the system will come from water that has passed through the ultra-filter that also supplies the reverse osmosis system. This water will meet all potable water purity requirements and will be stored in the bulk water tank with a capacity of 2,500 gallons. Water will be withdrawn from the bulk storage tank to replenish the pressurized water tank, with a capacity of 250 gallons, when the tank pressure falls below a prescribed level. This water, as it is being transferred to the pressurized tank, will be dosed with chlorine to meet the chlorination requirements for drinking water. Upon demand from the potable water system, water under pressure will be withdrawn from the pressurized water tank. A sampling program will be instituted to ensure proper ultra-filter operation and chlorine dosing operation.

### 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 steam turbine and condense it into water for reuse. The surface condenser will be a shell-and-tube heat exchanger with the steam condensing on the shell side and the cooling water flowing in one or more passes inside the tubes. The condenser will be designed to operate at sub-atmospheric pressure, ranging from 1 to 5 inches of mercury, absolute (in Hga.), depending on ambient temperature and plant load. It will remove up to 1,000 MMBtu/hr, depending on ambient temperature and plant load. Approximately 126,000 gallons per minute (gpm) of circulating cooling water is required per condenser to condense the steam at maximum plant load.

The circulating water will circulate through a counter-flow mechanical draft cooling tower, which uses electric-motor-driven fans to move the air in a direction opposite to 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 some of the circulating water. Maximum drift, which is 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. 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, boiler feed pump lube oil and seal water coolers, air compressor, vacuum pump seal coolers, and sample coolers. Auxiliary cooling water pumps will pump circulating water from the cooling tower basin through heat exchangers to remove heat from the closed loop system.

## 2.2.9 Waste Management

Wastes from CPP include wastewater, solid waste, and hazardous waste, both liquid and solid. Waste management is discussed in detail in Section 8.13.

### 2.2.9.1 Wastewater Collection, Treatment, and Disposal

There are two separate wastewater collection systems. The first and primary system will collect process wastewater from all of the plant equipment, including the HRSGs, cooling tower, and water treatment equipment. The water balance diagrams, Figures 2.2-6a and 2.2-6b, show the expected wastewater streams and flow rates for the CPP. The second system will collect sanitary wastewater from sinks, toilets, showers, and other sanitary facilities, and discharge it to a package sanitary waste treatment system and leach field.

#### 2.2.9.1.1 Circulating Water System Blowdown

Circulating water system blowdown will consist of raw water from the Bureau along with various process waste streams that have been concentrated between 3 and 10 times and residues of the chemicals added to 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 Clay Creek after treatment to meet discharge requirements.

#### 2.2.9.1.2 Plant Drains and Oil/Water Separator

Miscellaneous general plant drains will collect area washdown, sample drains, equipment leakage, and drainage from facility equipment areas. 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 an oil/water separator. Discharge from the oil/water separator will be directed to the septic tank for disposal in the leach field. Wastewater from combustion turbine water washes will be collected in a holding tank. If cleaning chemicals were not used during the water wash procedure, the wastewater will be discharged to the oil/water separator. Wastewater containing cleaning chemicals directed to the holding tank will be trucked off-site for disposal at an approved wastewater disposal facility.

#### 2.2.9.1.3 Power Cycle Makeup Water Treatment Wastes

Wastewater from the power cycle makeup water treatment system will consist of the reject stream from the makeup RO units that will initially reduce the concentration of dissolved solids in the plant makeup water before it is treated in the mixed bed ion exchange vessels and backwash water from the multi-media filters upstream of the RO units. The RO reject stream will contain the constituents of the Bureau's raw water, concentrated up to five times; residues of the chemicals such as aluminum sulfate, ferric chloride, and polymer added to the raw water to coagulate suspended solids prior to filtration; sodium bisulfite or sodium sulfite added to the RO feedwater to eliminate free chlorine that would otherwise damage the RO membranes; and phosphate to prevent scaling of the membranes. The filter backwash water will contain the suspended solids removed from the raw water and residues of the coagulants used to enhance filtration efficiency. These waste streams will be collected and recycled to the cooling tower basin along with the HRSG blowdown.

##### 2.2.9.1.5 HRSG Blowdown

HRSG blowdown will consist of boiler water discharged from the HRSG steam drums to control the concentration of dissolved solids and silica within acceptable ranges. Boiler blowdown will be discharged to flash tanks where the steam is vented to atmosphere and the condensate is cooled by mixing it with a small amount of circulating water. The quenched condensate will be discharged to the cooling tower basin, thus reclaiming the majority of the boiler blowdown.

#### 2.2.9.2 Solid Wastes

The CPP will produce maintenance and plant wastes typical of power generation operations. Generation plant wastes include broken and rusted metal and machine parts, defective or broken electrical materials, empty containers, and other miscellaneous solid wastes including the typical refuse generated by workers. These materials will be collected by the local waste disposal company (see Section 8.13). Recyclable materials will be taken off-site. Waste collection and disposal will be in accordance with applicable regulatory requirements to minimize adverse health and safety effects.

#### 2.2.9.3 Hazardous Wastes

Several methods will be used to properly manage and dispose of hazardous wastes generated by the CPP. 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 catalyst will be recycled by the supplier or disposed of in a Class I landfill. 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 on-site in portable tanks, and disposed of off-site by the chemical cleaning contractor in accordance with applicable regulatory requirements.

### 2.2.10 Hazardous Materials Handling

There will be a variety of chemicals stored and used during construction and operation of the CPP project. 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 other chemicals will be stored in returnable delivery containers. Chemical storage and chemical feed areas will be designed to contain leaks and spills. Berm and drain piping design will allow a full-tank capacity spill without overflowing the berms. For multiple tanks located within the same bermed area, the capacity of the largest single tank will determine the volume of the bermed area and drain piping. Drain piping for volatile chemicals will be trapped and isolated from other drains to eliminate noxious or toxic vapors. After neutralization, if required, water collected from the chemical storage areas will be directed to the cooling tower basin.

Aqueous ammonia (29 percent solution) will be stored in an 18,000-gallon tank within a containment basin.

Safety showers and eyewashes will be provided adjacent to or in the vicinity of all chemical storage and use areas. Hose connections will be provided near the chemical storage and feed areas to flush spills and leaks to the plant wastewater collection system. State-approved personal protective equipment will be used by plant personnel 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 on-site for spill cleanup. Electric equipment insulating materials will be specified to be free of polychlorinated biphenyls (PCB).

A list of the chemicals anticipated to be used at the generating facility and their locations is provided in Table 8.12-2 of the Hazardous Materials Handling section. This table identifies each chemical by type, intended use, and estimated quantity to be stored on site. Section 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. Emissions that will be controlled include $NO_x$, reactive organic compounds (ROCs), CO (if required), and particulate matter. To ensure that the systems perform correctly, CEM will be performed. Section 8.1, Air Quality, includes additional information on emission control and monitoring.

### 2.2.11.1 $NO_x$ Emission Control

SCR will be used to control $NO_x$ concentrations in the exhaust gas emitted to the atmosphere. $NO_x$ emissions will be controlled to 2.0 ppmvd, dry basis corrected to 15 percent oxygen on an annual average basis (2.5 ppmvd on a short-term basis). The SCR process will use aqueous ammonia. Ammonia slip, or the concentration of unreacted ammonia in the exiting exhaust gas, will be limited to 5 ppmvd at 15 percent oxygen from the gas turbines/HRSGs. 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 Reactive Organic Compound Emission Control

CO and ROC will be controlled at the CTG combustor with state-of-the-art combustion technology. CO emissions will be further controlled by means of a CO oxidation catalyst, if required. Since CO catalysts have not been proven to control ROC emissions effectively and consistently in practice, no ROC reductions at the CO catalyst shall be assumed.

#### 2.2.11.3 Particulate Emission Control

Particulate emissions will be controlled using combustion air filtration and natural gas, which is low in particulates, as the sole fuel for the CTGs. Cooling tower mist eliminators will control the emission of particulate matter from the cooling tower.

#### 2.2.11.4 Continuous Emission Monitoring

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. This system will generate reports of emissions data in accordance with permit requirements and will send alarm 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. Rancho Seco Reservoir was designed to provide emergency water for the nuclear plant and is currently served by a 48-inch bi-directional flow water pipe. A water line serving CPP will be connected to the existing 48-inch pipe as additional backup for emergency situations. Should the reservoir water be unavailable due to repair or other interruption, a fire water storage supply of a minimum of 180,000 gallons in the raw water storage tanks will be used. This water supply reserve is sized in accordance with National Fire Protection Association (NFPA) 850 to provide 2 hours of protection from the on-site worst-case single fire. The raw water storage tanks will include a level indication alarm to ensure adequate reserve during those times when the reservoir water is not available.

An electric jockey pump and electric-motor-driven main fire pump will be provided to increase the water pressure in the plant fire mains to the level required to serve all fire fighting systems. In addition, the electric fire pump will be connected to the 69 kV feeder system as a backup electrical supply to the 230 kV supply system.

Both fire pumps will discharge to a dedicated underground fire loop piping system. 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, turbine lube oil equipment, and the aqueous ammonia storage tank. Sprinkler systems will also be installed in the Administration and Maintenance buildings and Fire Pump enclosure as required by NFPA and local code requirements. The CTG units will be protected by an FM200 fire protection system. Hand-held 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 having a flame-spread rating of 25 or less and will, therefore, not be sprinklered.

Section 8.12, Hazardous Materials Handling, includes additional information for fire and explosion risk, and Section 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 heat from ground current 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 exothermal welding process or mechanical clamps (see Appendix 10D.5, which refers to IEEE 837 compression connectors). 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 stingers 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 Distributed Control System (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 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 alarms, 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:

- Control display operator consoles
- 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 composed of a group of similar redundant processing units linked to a group of operator consoles and the engineer work station 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 Freeze Protection

The freeze protection system will provide heating to protect various outdoor piping, gauges, pressure switches, and other devices from freezing. Power to the self-limiting freeze protection circuits will be controlled by an ambient thermostat.

#### 2.2.13.6 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.

#### 2.2.13.7 Instrument Air

The instrument air system provides 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 four CTGs and two STGs will each be connected to a dedicated 3-phase step-up transformer (GSU) that will be connected to the plant's 230-kV switchyard. The switchyard will consist of a breaker and one-half arrangement with $SF_6$ circuit breakers and manually operated disconnect switches on each side of each breaker. A new 0.4-mile 230-kV double-circuit transmission line will interconnect the plant's switchyard bus with that of the existing Rancho Seco Plant substation. See Section 5.0 for additional information on the switchyard, transmission line, and connection to the District interconnections.

### 2.2.15 Project Construction

Construction of the first phase of the generating facility, from site preparation and grading to commercial operation, is expected to take place winter 2002 to the first quarter of 2005, or a total time of 24 months. Major milestones are listed in Table 2.2-2.

**TABLE 2.2-2**
Project Schedule Major Milestones

| Activity | Date |
|---|---|
| Begin Construction | Fourth Quarter 2002 |
| Startup and Test – Phase 1 | First Quarter 2005 |
| Commercial Operation – Phase 1 | First Quarter 2005 |
| Startup and Test – Phase 2 | Fourth Quarter 2007 |
| Commercial Operation – Phase 2 | First Quarter 2008 |

The site will be accessed for construction by proceeding east on Twin Cities Road (State Route [SR] 104) to Clay East Road to the project site. The land to the west and south of the site will be available for use as construction and laydown areas.

Construction of CPP will create approximately 328 peak and 175 average construction jobs, including construction craft people, supervisory, support, and construction management personnel on site during construction (see Section 8.8, Socioeconomics). Construction of the linear facilities (gas line, transmission line) will require 50 to 55 workers.

Construction will be scheduled to occur between 5:30 a.m. and 5:30 p.m., Monday through Saturday. Additional hours may be necessary to make up schedule deficiencies, or to complete critical construction activities. However, some construction activities may need to occur continuously over several days. During the startup phase of the project, some activities will continue 24 hours a day, 7 days a week.

The peak construction site workforce level is expected to last from Month 11 through Month 13 of the construction period for Phase 1. The peak construction site workforce level for Phase 2 is expected to occur during Month 34 through Month 36.

Table 2.2-3 provides an estimate of the average and peak construction traffic during the 24-month construction period.

**TABLE 2.2-3**
Average and Peak Construction Traffic

| Vehicle Type | Average Daily Trips | Peak Daily Trips |
|---|---|---|
| Construction Workers | 300 | 590 |
| Heavy Trucks | 10 | 20 |
| **Total** | **310** | **610** |

Construction laydown and parking areas will be located to the west and south of the plant. Construction access will be from Twin Cities Road (State Route 104) to Clay East Road, as shown on Figure 2.2-3. Materials and equipment will be delivered by truck. Major equipment may be delivered by rail along the existing Union Pacific rail spur to the Rancho Seco Plant.

## 2.2.16 Power Plant Operation

The CPP will be operated by 20 employees, 2 operators per 12-hour rotating shift, plus 2 relief operators, 5 maintenance technicians, and 5 administrative personnel during the standard 8-hour work day (see Table 2.2-4). The facility will be operated 7 days a week, 24 hours a day.

**TABLE 2.2-4**
CPP Staffing Plan

| Administrative | Maintenance | Operations | | | |
|---|---|---|---|---|---|
| Plant Manager | I&C Technician | "A" Operator | "B" Operator | "C" Operator | "D" Operator |
| Plant Engineer | I&C Technician | "A" Operator | "B" Operator | "C" Operator | "D" Operator |
| Office Manager | Electrical Technician | Relief Operator | Relief Operator | | |
| Plant Administrator | Mechanical Technician | | | | |
| O & M Manager | Mechanical Technician | | | | |

The CPP is expected to have an annual IEEE availability in the general range of 92 to 98 percent. Given anticipated maintenance requirements, plant IEEE availability should average 95 percent during a 12-month period. The general operational profile of the plant will be either base load or load following.

Because excess capacity may be sold through contract and the prices that will be offered for spot purchases are unknown at this time, the exact mode of operation of the CPP cannot be anticipated. It is conceivable, however, that the facility could be operated in one or all of the following modes:

- **Base Load**. The facility would be operated at maximum continuous output for as many hours a year as possible to keep plant output at the sum of customer load and regional demand.
- **Load Following**. The facility would be operated to meet customer load and whatever regional sales could be made, but the sum would be less than maximum continuous

output at all times of the day. The output of the unit would therefore be adjusted periodically to meet whatever load is necessary to supply customers and the regional market.

- **Partial Shutdown**. At certain times of any given day and at certain times of any given year, the sum of the customer load and regional sales can be expected to drop to a level at which it would be economically favorable to shut down one or two CTG(s)/HRSG(s). This mode of operation can be expected to occur during late evening and early morning hours and on weekends, when customer load could decrease or regional sales would not be economical.
- **Full Shutdown**. This would occur if forced by equipment malfunction, fuel supply interruption, or transmission line disconnect. The facility is limited in operation below maximum continuous output (base load) by economics since gas turbine efficiency decreases sharply as output is decreased. The facility will also experience operational problems including exceeding of air quality limits at outputs below 60 percent of CTG output.

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 CEC will be notified. Depending on the length of shutdown, a contingency plan for the temporary cessation of operations may be implemented. Such a contingency plan will conform to 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 CPP operations cease permanently, the plant will be decommissioned (see Section 4.0, Facility Closure).

# 2.3 Facility Safety Design

The CPP 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 hazards associated with the CPP site are earthquakes and flooding. The site is located in Seismic Risk Zone 3. Structures will be designed to meet the seismic requirements of CCR Title 24 and the 1997 Uniform Building Code (UBC). Section 8.15, Geologic Hazards and Resources, discusses the geological hazards of the area and site, and Appendix 10G, Exhibit A, addresses the results of a relatively recent geotechnical investigation of the adjacent Rancho Seco Plant site. These sections include a review of potential geologic hazards, seismic ground motion, and potential for soil liquefaction due to ground-shaking. The investigation indicated geologic hazards are not expected at the project site. Appendix 10G and Appendix 10B, Structural Engineering, include the structural seismic design criteria for the buildings and equipment.

The site is essentially flat with an average elevation of approximately 150 feet above mean sea level (msl). According to the Federal Emergency Management Agency (FEMA), the site is not within either the 100- or 500-year flood plain. Section 8.14, Water Resources, includes additional information on the potential for flooding.

## 2.3.2 Emergency Systems and Safety Precautions

This section discusses the fire protection systems, emergency medical services, and safety precautions to be used by project personnel. Section 8.8, Socioeconomics, includes additional information on area medical services, and Section 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 on-site fire protection systems and local fire protection services. The on-site 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 on-site fire protection systems.

#### 2.3.2.1.1 FM 200 Fire Protection System

This system protects the combustion turbine, generator, and accessory equipment compartments from fire. The system will have fire detection sensors in all 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 FM 200. The FM 200 will be discharged at a design concentration adequate to extinguish the fire.

#### 2.3.2.1.2 Transformer Deluge Spray System

This system provides fire suppression for the generator transformers and auxiliary power transformers in the event of a fire. The deluge systems are fed by the plant underground fire water system.

#### 2.3.2.1.3 Steam Turbine Bearing Preaction Water Spray System

This system provides suppression for the steam turbine bearing in the event of fire. The preaction system is fed by the plant underground fire water system.

#### 2.3.2.1.4 Steam Turbine Lube Oil Areas Water Spray System

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

#### 2.3.2.1.5 Fire Hydrants/Hose Stations

This system will supplement the plant fire protection system. Water will be supplied from the plant underground fire water system.

#### 2.3.2.1.6 Fire Extinguisher

The plant Administrative and Maintenance buildings, water treatment facility, and other structures will be equipped with portable fire extinguishers as required by the local fire department.

#### 2.3.2.1.7 Local Fire Protection Services

In the event of a major fire, plant personnel will be able to call upon the Herald Fire District for assistance. The Hazardous Materials Risk Management Plan (see Section 8.12, Hazardous Materials Handling) for the plant will include all information necessary to permit all firefighting 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 CPP 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 Section 8.7, Worker Health and Safety.

## 2.4 Facility Reliability

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

### 2.4.1 Facility Availability

Because of CPP's predicted high efficiency, 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 25 and 100 percent of base load to support dispatch service in response to customer demands for electricity.

The CPP 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 block 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 CPP 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 | Four trains | Steam turbine bypass system allows the CTG/HRSG trains to operate at base load with the steam turbine out of service. |
| STG | Two | See note above pertaining to CTGs and HRSGs. |
| HRSG feedwater pumps | Two - 100 percent per HRSG | |
| Condensate pumps | Three - 50 percent capacity | |
| Condenser | Two | Condenser must be in operation for combined cycle operation or operation of CTG in steam turbine bypass mode. The condensers will be provided with split water boxes to allow online tube cleaning and repair. |
| Circulating water pumps | Three - 50 percent capacity | Per cooling tower. |
| Cooling tower | Two | Cooling tower is multi-cell mechanical draft design. Basin will be divided to allow a portion to be isolated for cleaning. |
| Auxiliary cooling water pumps | Two - 100 percent capacity | Per power block. Power blocks will have independent cooling water systems. |
| Closed-loop cooling water pumps | Two - 100 percent capacity | See above. |
| Closed-cycle cooling water heat exchangers | Two - 100 percent capacity | See above. |
| Demineralizer—RO Systems | Two - 100 percent capacity trains | Redundant pumps will be provided. |

### 2.4.2.1 Combined-Cycle Power Block

Four separate combustion turbine/HRSG power generation trains will operate in parallel within the combined-cycle power plant. The facility will contain two power blocks each with two CTG/HRSGs and one STG. Each train will be powered by a combustion turbine. Each CTG will provide approximately 32 percent of the total combined-cycle power block output. The heat input from the exhaust gas from each combustion turbine will be used in the steam generation system to produce steam. Thermal energy in the steam from the steam generation system will be converted to mechanical energy, and then electrical energy in the STG subsystem. The expanded steam from the steam turbine will be condensed and recycled to the feedwater system. Power from the STG subsystem will contribute approximately 36 percent of total combined-cycle power block output.

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

#### 2.4.2.1.1 CTG Subsystems

The combustion turbine subsystems include the combustion turbine, inlet air filtration and fogging system, generator and excitation systems, 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 either be hydrogen or air cooled. The generator excitation system will be a solid-state static (or brushless) system. Combustion turbine control and instrumentation (interfaced with the DCS) will cover the turbine governing system, the protective system, and the sequence logic.

#### 2.4.2.1.2 HRSG Subsystems

The steam generation subsystem will consist of the HRSG and blowdown systems. The HRSG system provides for the transfer of heat from the exhaust gas of a combustion turbine for the production of steam. 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, 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 STG Subsystems

The steam turbine converts the thermal energy in the main 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 combined-cycle power block is served by the balance-of-plant systems below.

### 2.4.2.2 Distributed Control System

The DCS will be a redundant microprocessor-based system that will provide control, monitoring, and alarm functions for plant systems and equipment. The following functions will be provided:

- Control the HRSGs, STGs, CTGs, 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. 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 combustion turbine and steam turbine 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.

Consideration will be given to the action performed by the control and safety devices in the event of control circuit failure. Controls and controlled devices will move to the safest operating condition upon failure.

Plant operation will be controlled from the operator panel located in the control room. The operator panel will consist of two individual display/keyboard consoles and one engineering work station. Each display/keyboard console will be an independent electronic package so that failure of a single package does not disable more than one display/keyboard. The engineering work station 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 two pumps per HRSG, each pump sized for 100-percent-capacity for supplying one HRSG. The pumps 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.

#### 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

Makeup to the demineralized water system will be from one of the sources described in Section 2.2.7.2, Water Supply. The demineralized water system will consist of two 100 percent capacity makeup RO and mobile mixed-bed demineralizer trains. Demineralized water will be stored in two, 250,000-gallon demineralized water storage tanks.

#### 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 tanks, providing an approximate 16-hour supply of demineralized water at base, and two full-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 and steam turbine bypass steam. In addition, the system supplies cooling water to the closed-cycle cooling water heat exchangers. Major components for this subsystem are three, 50 percent, motor-driven vertical circulating water pumps; two, 100 percent auxiliary cooling water pumps; and associated piping and valves, as required.

#### 2.4.2.8 Closed-Cycle Cooling Water System

The closed-cycle cooling water system transfers heat from various plant equipment heat exchangers to the circulating water system through the cooling water heat exchangers. Major components for this subsystem are two, 100 percent, motor-driven centrifugal pumps, and two, 100 percent cooling water heat exchangers.

#### 2.4.2.9 Compressed Air

The compressed air system comprises the instrument air and service air subsystems. The service air system supplies compressed air to the instrument air dryers and to hose connections for general plant use. The service air system will include two, 100-percent-capacity, motor-driven compressors, service air headers, distribution piping, and hose connections. The instrument air system supplies dry compressed air at the required pressure and capacity for all control air demands, including pneumatic controls, transmitters, instruments, and valve operators. The instrument air system will include two, 100-percent-capacity air dryers with pre-filters and after filters, an air receiver, instrument air headers, and distribution piping.

### 2.4.3 Fuel Availability

The District will enter into long-term gas supply contracts to provide fuel for the plant. This fuel will be conveyed via PG&E's Lines 400 and 401 to the District's Regulating Station at Winters, California, which is supplied by a high-pressure interstate transmission line carrying natural gas from Canada (see Section 6.0, Natural Gas Supply). There is sufficient capacity through the interstate line and at the terminal to supply the first phase of the CPP. A new line parallel to the existing SMUD gas line would be required for operation of the second phase. It is conceivable that the transmission line or lines supplying the Regulating Station or the 20-inch connecting lines to the CPP could become temporarily inoperable due to a breach in the line or from other causes, resulting in fuel not being available at the CPP. The CPP has no backup supply of natural gas and would, therefore, have to shut down until the situation was corrected and gas became available through the lines again.

### 2.4.4 Water Availability

The primary source of makeup water for the CPP will be raw water from the Bureau. The Bureau issued a contract to the District for 100 percent of its water needs for the CPP (Appendix 7.0A). The availability of water to meet the needs of the CPP is discussed in more detail in Section 7, Water Supply.

### 2.4.5 Project Quality Control

The Quality Control Program that will be applied to the CPP is summarized in this section. 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
- **Manufacturers' 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 power plant components in a system in a controlled manner to ensure that the performance of systems and components conform to specified requirements
- **Plant Operation**: Actual operation of the power plant system

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 the 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 CPP 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 Section 10.0, Engineering, and the Engineering Appendices (Appendix 10). The project will be constructed to conform with all applicable laws and ordinances.

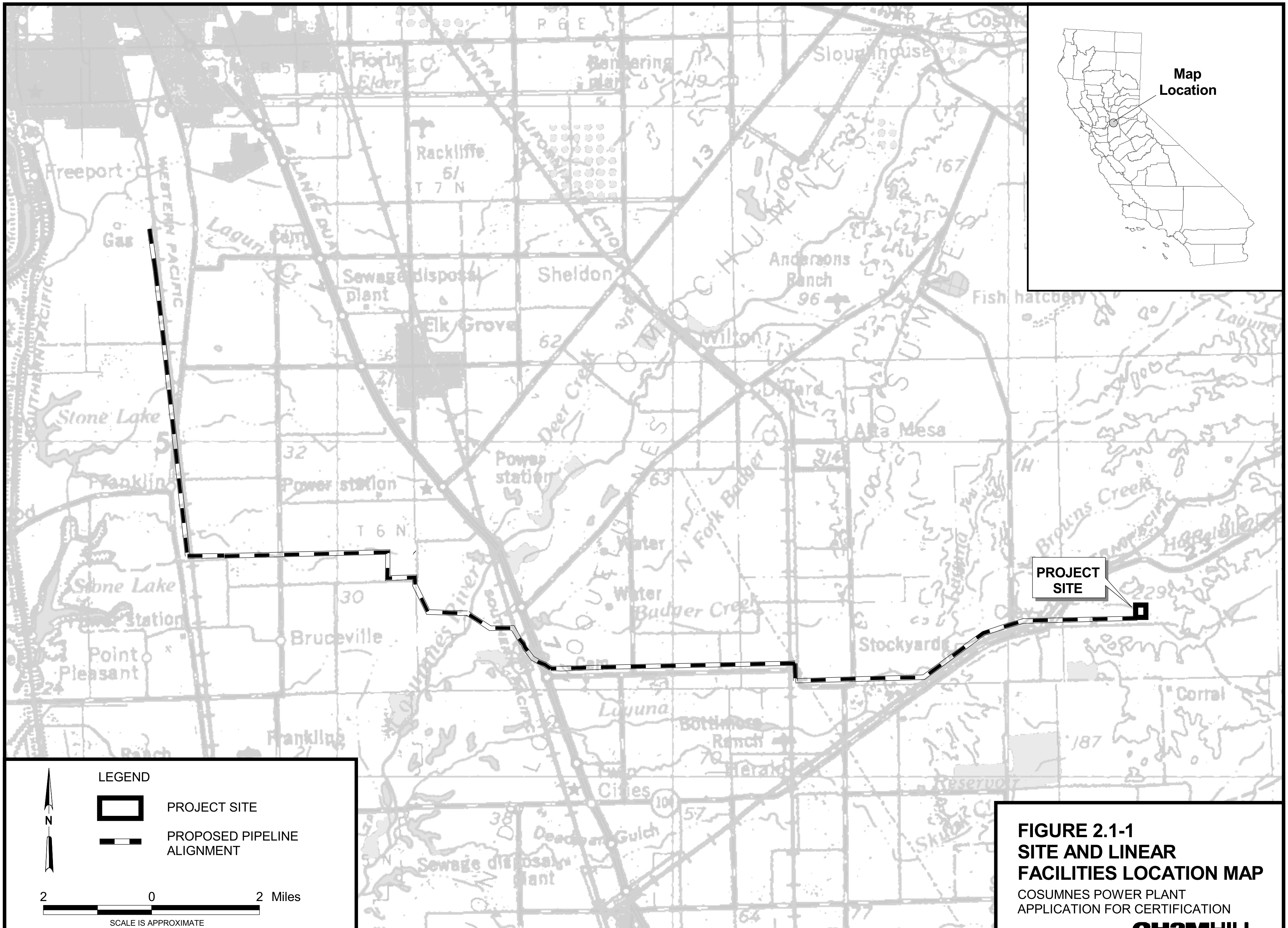


**FIGURE 2.1-1**
**SITE AND LINEAR FACILITIES LOCATION MAP**
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION
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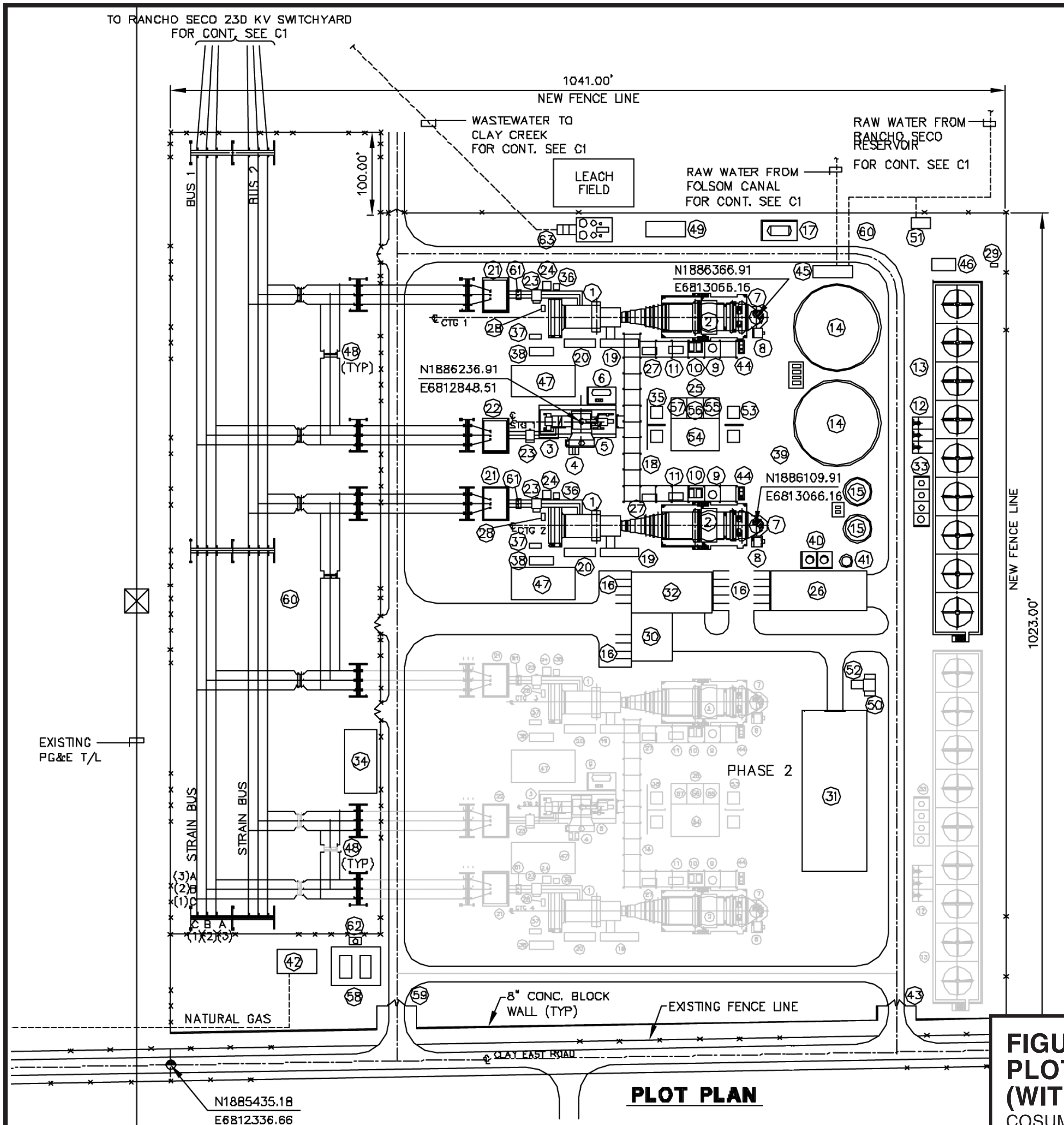


**LEGEND:**

1. COMBUSTION TURBINE GENERATOR
2. HEAT RECOVERY STEAM GENERATOR (HRSG)
3. STEAM TURBINE GENERATOR
4. CONDENSATE PUMPS
5. DEAERATING SURFACE CONDENSER
6. STG LUBE OIL MODULE
7. HRSG STACK
8. CEMS ENCLOSURE
9. BLOWDOWN TANK
10. HRSG BOILER FEED PUMPS
11. AMMONIA INJECTION SKID
12. CIRCULATING WATER PUMPS
13. COOLING TOWER
14. RAW WATER STORAGE TANK AND PUMPS (INCLUDES FIREWATER)
15. D.I. WATER STORAGE TANK AND PUMPS
16. PARKING AREA
17. AMMONIA STORAGE TANK
18. PIPE RACK
19. ACCESSORY MODULE (LUBE OIL, HYDRAULIC, LIQUID FUEL)
20. ELECTRICAL CONTROL PANEL
21. CTG STEP-UP TRANSFORMER
22. STG STEP-UP TRANSFORMER
23. GENERATOR BREAKER
24. ISOLATION & EXCITATION TRANSFORMER
25. ELECTRICAL BUILDING
26. D.I. WATER TREATMENT BUILDING
27. WATER WASH SKID
28. AIR PROCESS SKID
29. OIL/WATER SEPARATOR
30. CONTROL ROOM
31. MAINTENANCE BUILDING AND WAREHOUSE
32. CONFERENCE ROOM AND OFFICES
33. COOLING TOWER CHEMICAL FEED SYSTEM
34. SWITCHYARD CONTROL BUILDING
35. 4160V AUXILIARY TRANSFORMERS
36. DC LINK REACTOR
37. $CO_2$ FIRE PROTECTION SKID
38. GENERATOR AUXILIARY & STATIC START
39. ASPHALTIC SURFACING
40. ACID AND CAUSTIC TANK
41. NEUTRALIZATION TANK
42. NATURAL GAS METERING STATION
43. MAIN GATE
44. HRSG CHEMICAL FEED SYSTEM
45. RAW WATER TREATMENT
46. WASTE WATER SUMP
47. MAINTENANCE CRANE PARKING
48. 230 KV CIRCUIT BREAKER
49. SANITARY WASTEWATER TREATMENT BUILDING
50. 89-4.16 KV RESERVE AUXILIARY TRANSFORMER
51. FIREWATER PUMP
52. 4160 V SWITCHGEAR BUS E
53. 480V AUXILIARY TRANSFORMERS
54. SWITCHGEAR ROOM
55. BATTERY ROOM
56. DCS ROOM
57. STEAM/WATER SAMPLE LAB
58. GAS COMPRESSOR BUILDING
59. SIDE GATE
60. CRUSHED ROCK
61. AUXILIARY TRANSFORMER CABLE TERMINAL BOX
62. NATURAL GAS COMPRESSOR RECYCLE COOLER
63. WASTEWATER CLARIFIER SYSTEM

SOURCE: PB POWER, INC.
D062001002RDD_16(8/23/01)

**FIGURE 2.2-1**
**PLOT PLAN**
**(WITH GE 7FA AND NORTH UNIT AS PHASE 1)**
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

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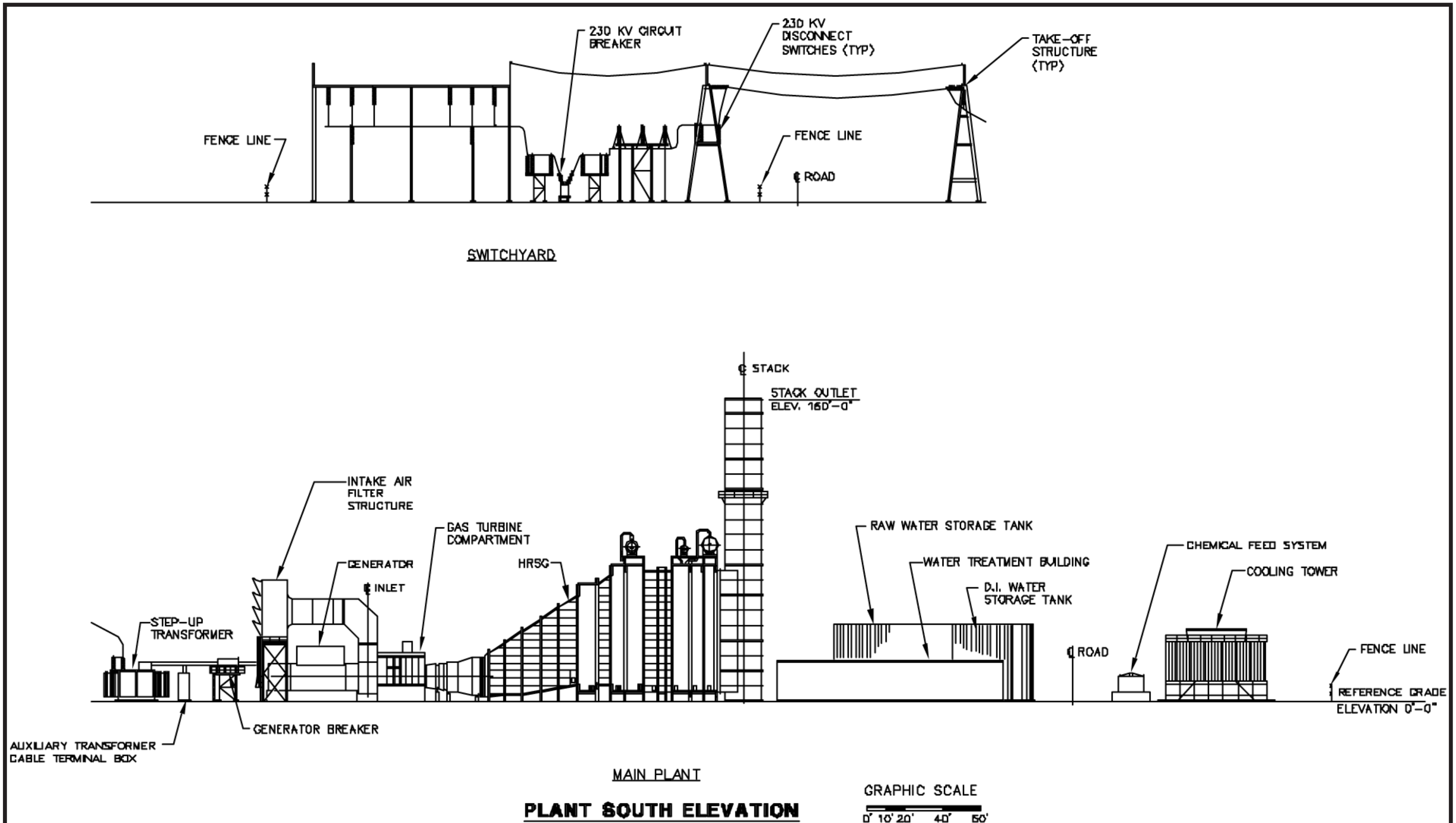


SOURCE: PB POWER, INC.

D062001002RDD_20 (8/28/01)

**FIGURE 2.2-2**
**PLANT SOUTH ELEVATION**
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION
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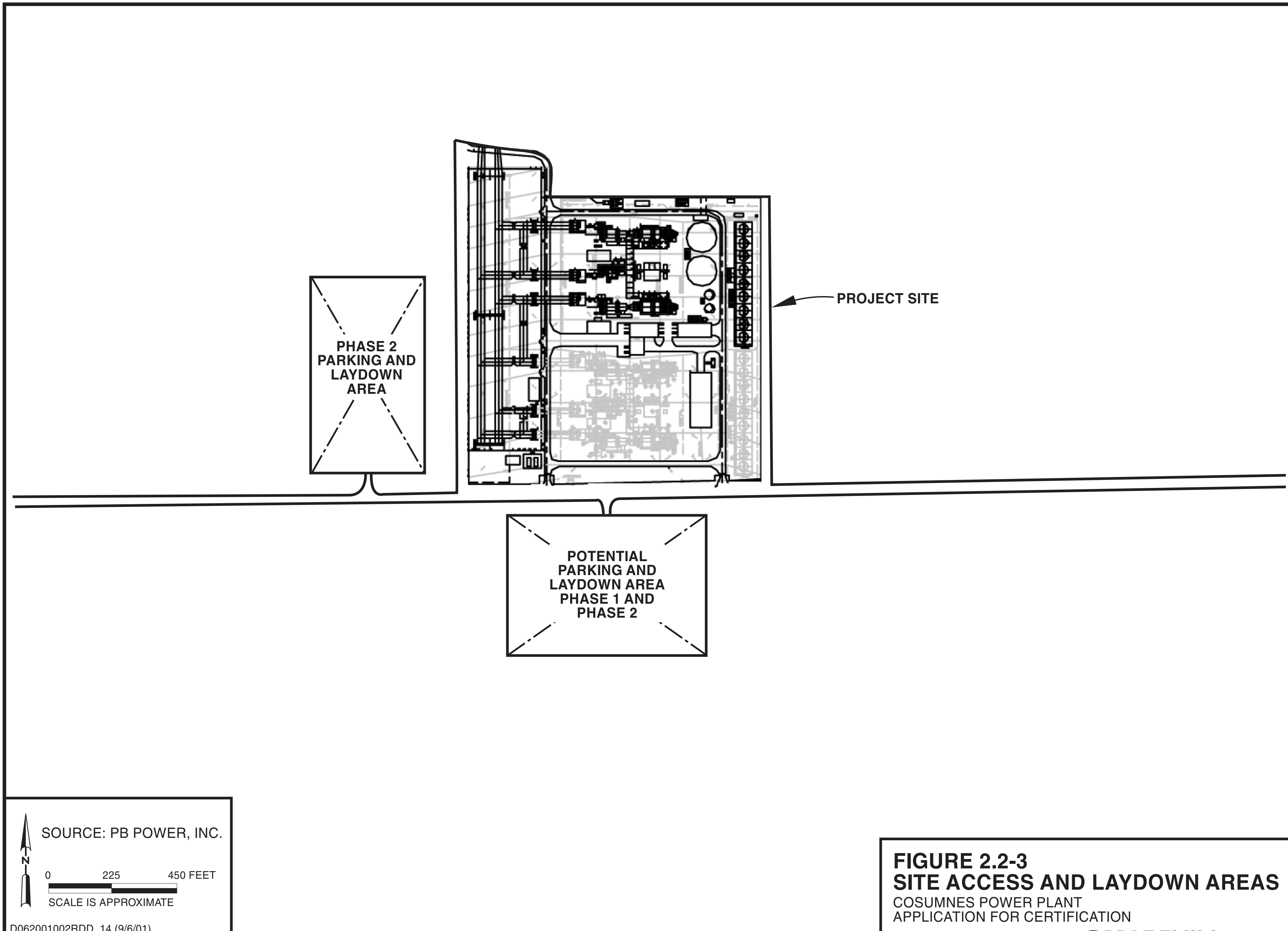


D062001002RDD_14 (9/6/01)

**FIGURE 2.2-3**
**SITE ACCESS AND LAYDOWN AREAS**
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

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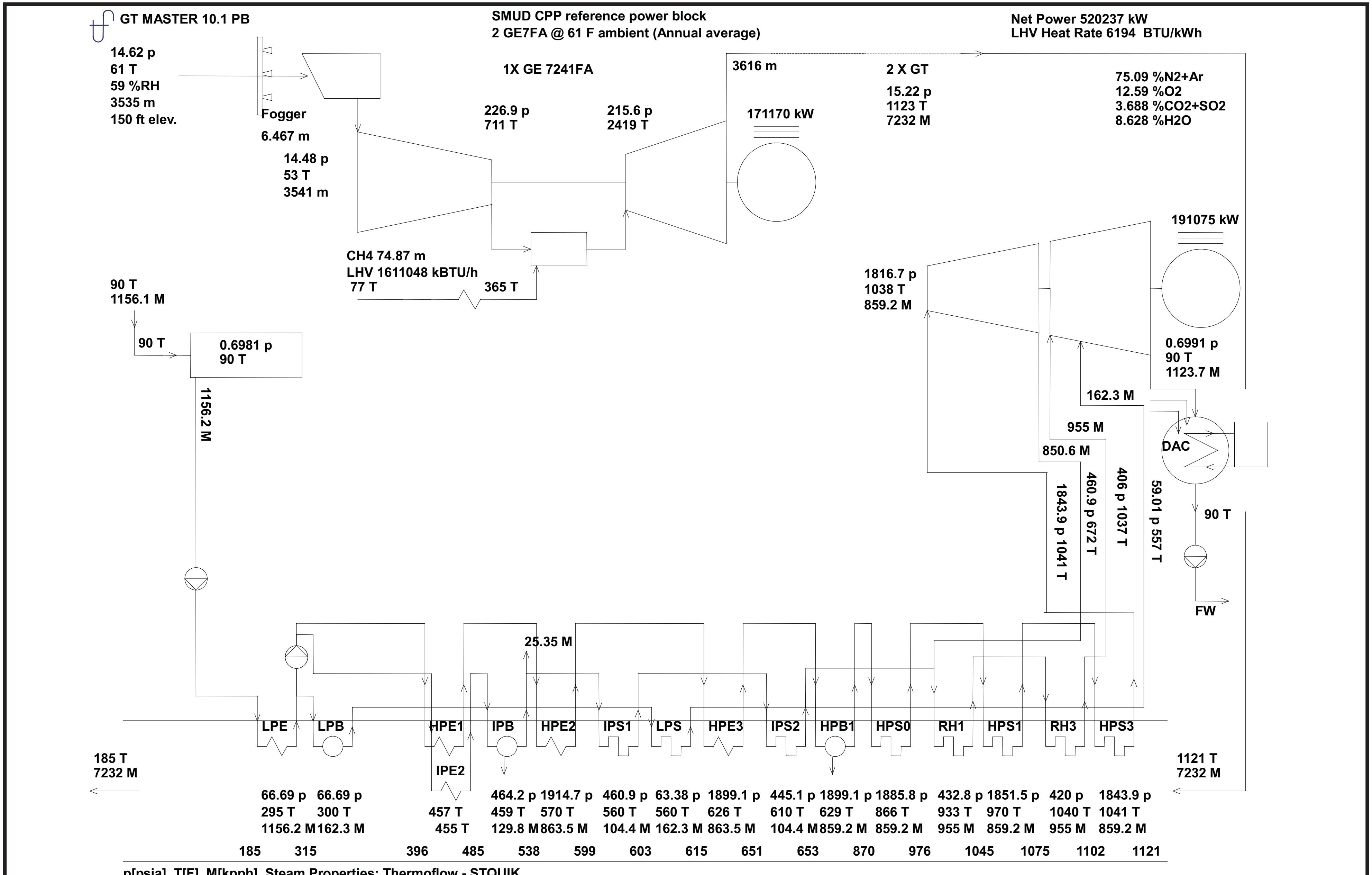


SOURCE: PB POWER, INC.

D062001002RDD_09 (8/21/01)

**FIGURE 2.2-4**
**HEAT AND MASS BALANCE AVERAGE**
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

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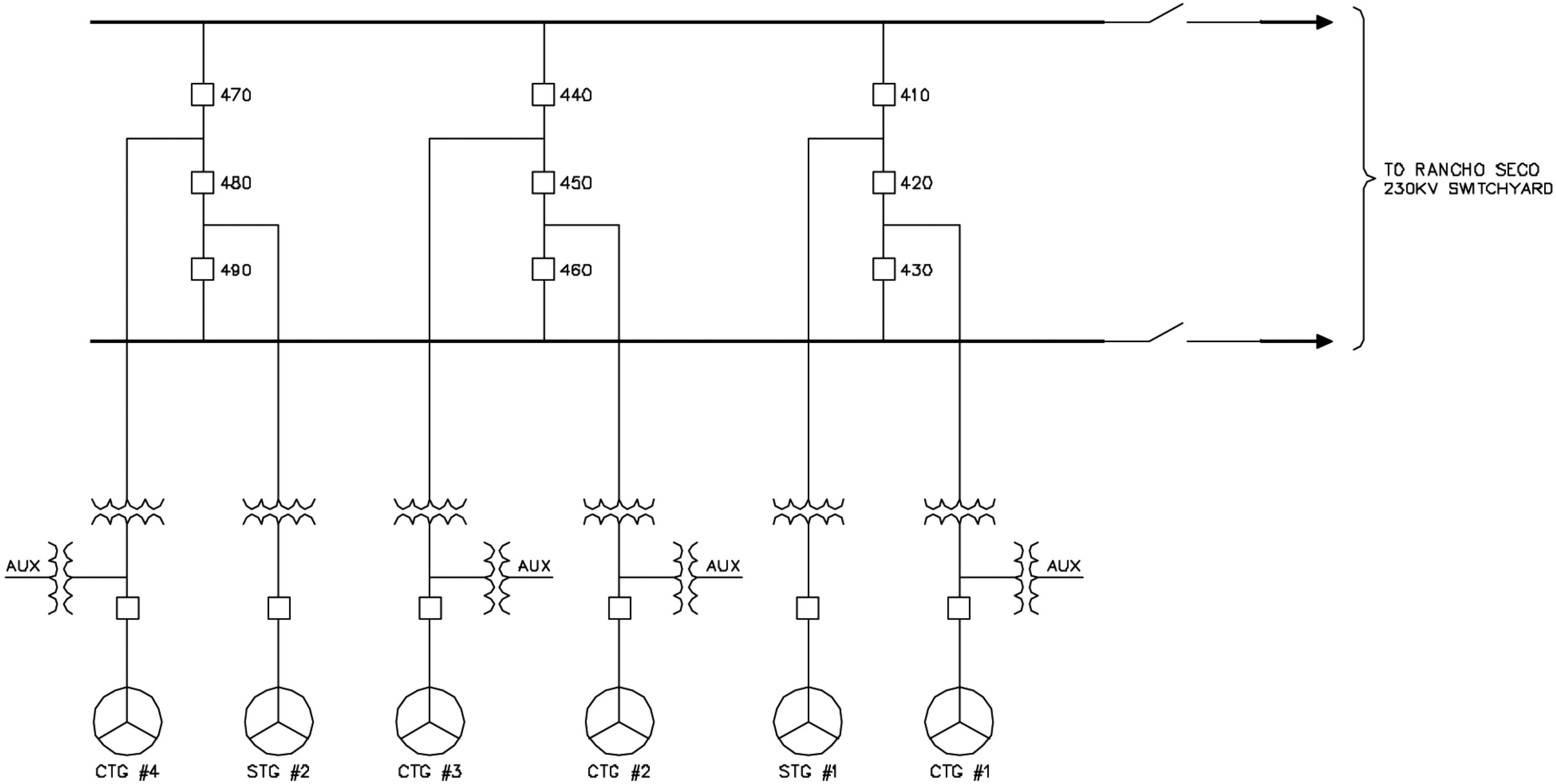


SOURCE: PB POWER, INC.

D062001002RDD_18(8/23/01)

**FIGURE 2.2-5**
**ONE LINE SCHEMATIC OF THE PROPOSED 230kV SWITHCHYARD**
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION
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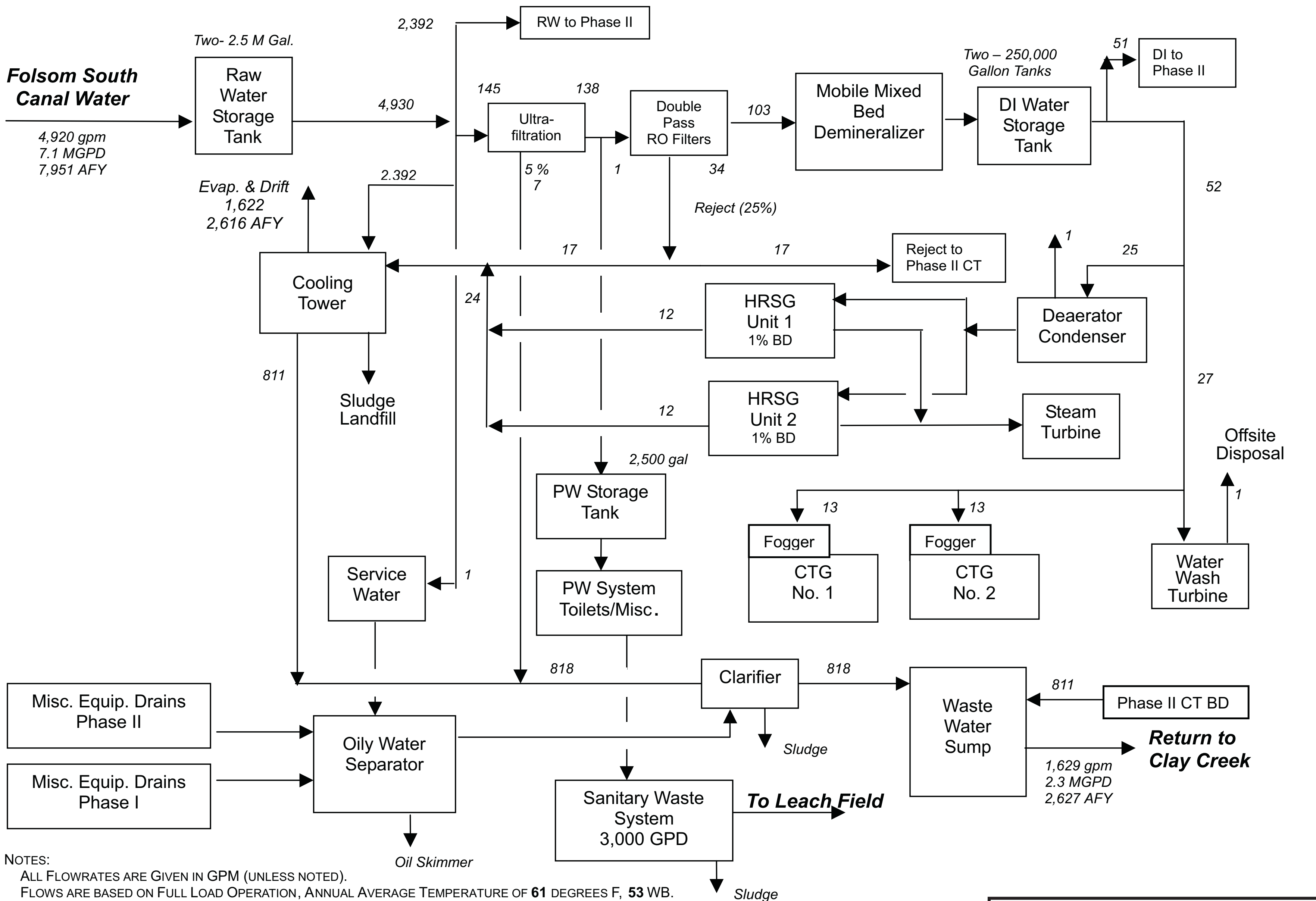


NOTES:
ALL FLOWRATES ARE GIVEN IN GPM (UNLESS NOTED).
FLOWS ARE BASED ON FULL LOAD OPERATION, ANNUAL AVERAGE TEMPERATURE OF **61** DEGREES F, **53** WB.
COOLING TOWER BLOWDOWN IS BASED ON MAINTAINING **3.0** CYCLES OF CONCENTRATION.
FLOWS ARE BASED ON FOLSOM SOUTH CANAL WATER CONSTITUENTS SPECIFIED.

SOURCE: PB POWER, INC.

**FIGURE 2.2-6aR**
**PHASE I – ANNUAL AVERAGE WATER BALANCE DIAGRAM**
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

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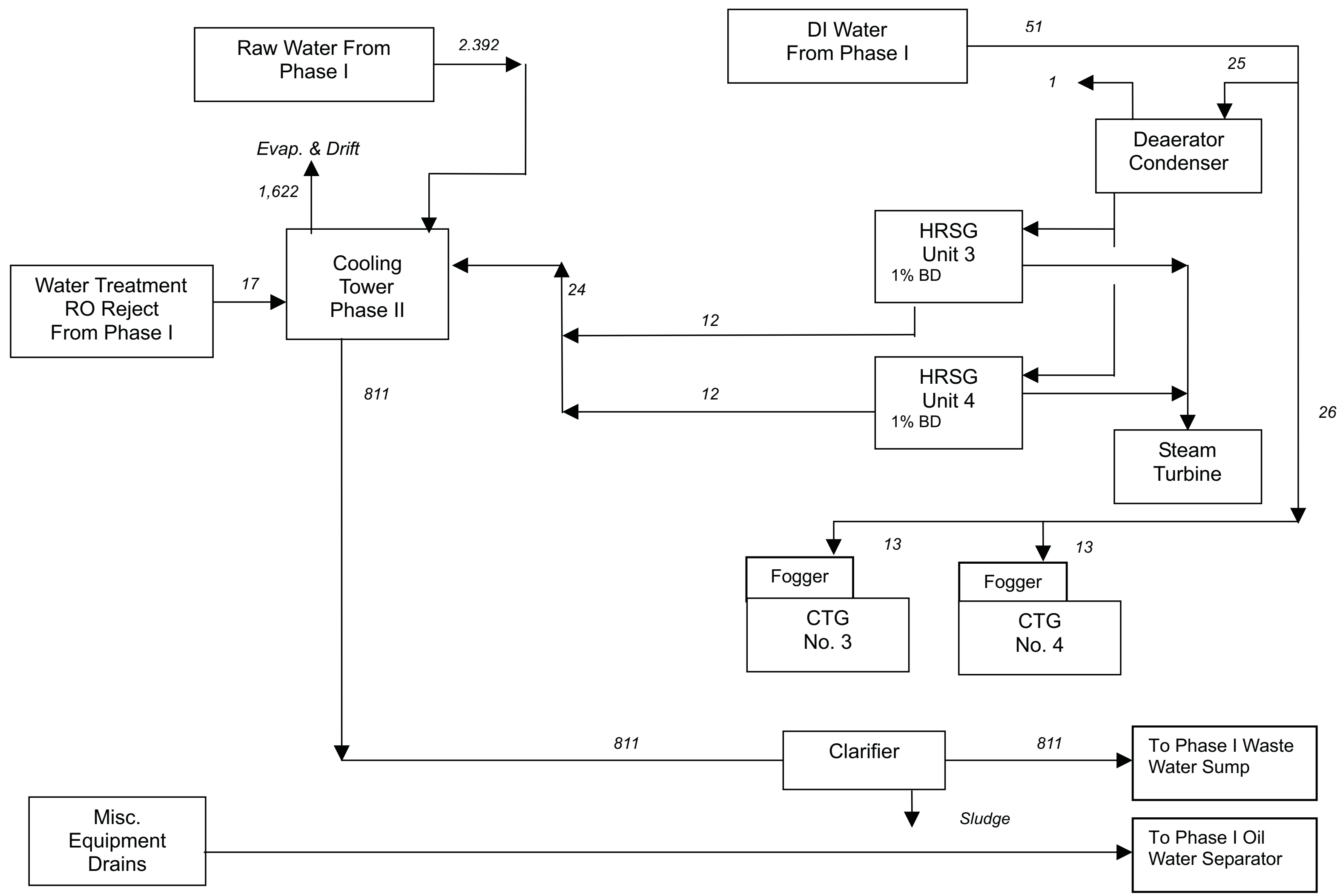
D062001002RDD_09 (11/9/01)




NOTES:

ALL FLOWRATES ARE GIVEN IN GPM.
FLOWS ARE BASED ON FULL LOAD OPERATION, ANNUAL AVERAGE TEMPERATURE OF **61** DEGREES F, **53** WB.
COOLING TOWER BLOWDOWN IS BASED ON MAINTAINING **3.0** CYCLES OF CONCENTRATION.
FLOWS ARE BASED ON FOLSOM SOUTH CANAL WATER CONSTITUENTS SPECIFIED.

SOURCE: PB POWER, INC.

D062001002RDD_09 (8/21/01)

**FIGURE 2.2-6b**
**PHASE II – ANNUAL AVERAGE WATER BALANCE DIAGRAM**
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

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