SOIL & WATER RESOURCES-ERRATA

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INTRODUCTION

This section of staff's Final Staff Assessment (FSA) analyzes potential effects on soil and water resources by the Moss Landing Power Plant Project (MLPPP), specifically focusing on the potential for the project to induce erosion and sedimentation, adversely affect surface and groundwater supplies, and degrade ocean, inland surface and groundwater quality. This assessment also addresses the project's ability to comply with all applicable federal, state and local laws, ordinances, regulations and standards, identifies mitigation measures and recommends conditions of certification.

Flooding and drainage issues are addressed in the **Facility Design** section of this document. Biological issues associated with cooling water intake and discharge are addressed in the **Biological Resources** section and sediment and soil contamination is addressed in the **Waste Management** section of this FSA.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

FEDERAL

CLEAN WATER ACT

The Clean Water Act (33 USC § 1257 et seq.) requires states to set standards to protect water quality. Point source discharges to surface water are regulated by this act through requirements set forth in specific or general National Pollutant Discharge Elimination System (NPDES) permits. Stormwater discharges during construction and operation of a facility and incidental non-stormwater discharges associated with pipeline and transmission line construction also fall under this act, and are addressed through a general NPDES permit. In California, requirements of the Clean Water Act regarding regulation of point source discharges and stormwater discharges are delegated to and administered by the nine Regional Water Quality Control Boards (RWQCB). For this project, the California Regional Water Quality Control Board, Central Coast Region will issue a new NPDES permit for the project that will regulate point and stormwater discharges during operation. A separate general construction activity permit will still be required.

Section 316 [33 U.S.C. 1326] of the Clean Water Act specifically addresses thermal discharges and cooling water intake structures. Subsection (a) provides that "…the owner or operator of any such source… can demonstrate to the satisfaction of the …the State that any effluent limitation proposed for the control of the thermal component of any discharge from such source will require effluent limitations more stringent than necessary to assure the projection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made…the State may impose an effluent limitation …that will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water.

Subsection (b) requires that "…the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact".

The Environmental Protection Agency (EPA), under a court decree, will be proposing draft regulations regarding cooling water intake structures in July, 2000 for new sources of discharge. Specifically, the

Section 404 of the act regulates the discharge of dredged or fill material into waters of the United States, including rivers, streams and wetlands. Site specific or general (nationwide) permits for such discharges are issued by the Army Corp of Engineers (ACOE) and are certified by the RWQCBs under section 401 of the Act.

RIVERS AND HARBOR ACT OF 1899 (AS AMENDED):

Section 10 of the River and Harbors Act regulates work in navigable waters of the United States and is enforced by US Army Corps of Engineers. Repair, rehabilitation and or replacement of structures that had prior authorization or permits are addressed in Rivers and Harbors Act Section 10, 33 USC 40 et seq., 33 USC 1344, 1413; 33 CFR Part 330.3 and applies to modification of intake and outfall structures. Such work requires a Nationwide Permit no. 3 from the US Army Corps of Engineers. Rivers and Harbors Act Section 10, 33 USC 403; 33 CFR Part 322 provides for temporary structures, work and discharges associated with construction activities, access fills or dewatering to minimize impacts on aquatic resources. Such work requires a Nationwide Permit no. 33 issued by the Corp.

STATE

PORTER-COLOGNE WATER QUALITY CONTROL ACT

The Porter-Cologne Water Quality Control Act of 1967, Water Code section 13000 et seq., requires the State Water Resources Control Board (SWRCB) and the nine RWQCBs to adopt water quality criteria to protect state waters. These criteria include the identification of beneficial uses, narrative and numerical water quality standards and implementation procedures. These criteria for the proposed project are contained in the Central Coast Region Water Quality Control Plan (Basin Plan 1994), the California Ocean Plan (1997) and the Thermal Plan (1975).

STATE WATER RESOURCES CONTROL BOARD POLICIES

The SWRCB has also adopted a number of policies that provide guidelines for water quality protection. The principle policy of the State Board which addresses the specific siting of energy facilities is the "Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling" (adopted by the Board on June 19, 1976 by Resolution 75-58). While this policy specifically discourages the use of fresh inland waters for power plant cooling, it does give priority to the use of ocean water for this purpose.

The principal policy of the State Board which addresses enclosed bays and estuaries is the “Water Quality Control Policy for the Enclosed Bays and Estuaries of California” (adopted by the Board on May 16, 1974 by Resolution 74-43). This policy contains a number of prohibitions on waste discharges including chemical, biological and petroleum related waste.

STATE WATER RESOURCES CONTROL BOARD PLANS

CALIFORNIA THERMAL PLAN

In 1972, the State Water Resources Control Board adopted the “Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California”, more commonly known as the Thermal Plan. The Thermal Plan, which was later amended in 1975, sets limits on the discharge of wastewaters with elevated temperatures into coastal, estuarine and interstate waters in order to meet water quality objectives. A major aim of the Thermal Plan is to protect marine resources in the ocean, enclosed bays and estuaries from the adverse impacts of thermal waste.

Thermal waste is defined as cooling water and industrial process water used to carry waste heat from such large point sources as power plants. Two categories of discharges exist: “existing” which are discharges in place or under construction prior to the plan’s 1971 adoption and “new” which are discharges developed after the plan was adopted. The proposed project is considered a new discharge under the Thermal Plan by Energy Commission and RWQCB staff (Thomas 1999;2000). The project will be discharging to the existing outfall located in Monterey Bay. Under the Thermal Plan, Monterey Bay is considered to be coastal waters.

Therefore, specific water quality objectives in the Thermal Plan applicable are:

- Elevated temperature wastes shall be discharged to the open ocean away from the shoreline to achieve dispersion through the vertical water column.
- Elevated temperature wastes shall be discharged a sufficient distance from areas of special biological significance to assure the maintenance of natural temperature in these areas.
- The maximum temperature of thermal waste discharges shall not exceed the natural temperature of receiving water by more than 20^{o} F.
- The discharge of elevated temperature wastes shall not result in increases in the natural water temperature exceeding 4^{o} F at (a) the shoreline, (b) the surface of any ocean substrate, or (c) the ocean surface beyond 1,000 feet from the discharge system. The surface temperature limitation shall be maintained at least 50 percent of the duration of any complete tidal cycle.

- Additional limitations shall be imposed when necessary to assure protection of beneficial uses.

The Thermal Plan provides the authority for the RWQCB to grant exceptions to the specific water quality objectives in accordance with Section 316(a) of the Clean Water Act. Such exemptions also require the approval of the SWRCB.

CALIFORNIA OCEAN PLAN

In 1997, the SWRCB (Resolution 97-026) adopted the latest version of the Water Quality Control Plan for Ocean Waters of California (California Ocean Plan). The California Ocean Plan establishes beneficial uses and water quality objectives for the state's ocean waters outside of enclosed bays, estuaries and lagoons. The plan also sets forth effluent limitations, management practices and prohibitions. Every three years the plan is reviewed and, if necessary, updated.

CALIFORNIA COASTAL ACT OF 1976 (PUB. RESOURCES CODE §30000 ET SEQ.)

Chapter 3. Coastal Resources Planning and Management Policies. Article 4. Marine Environment. Section 30231. This section requires that the "…biological productivity and the quality of coastal waters, wetlands, estuaries and lakes shall be maintained by minimizing adverse effects of wastewater discharges and entrainment, controlling runoff, preventing depletion of groundwater…"

LOCAL

Monterey County-Regulations for Development in the North County Land Use Plan Area-Chapter 20.144: Section 20.144.070-

Water Resources Development Standards-These regulations set forth standards, including the development of erosion control and hydrologic reports for new development.

Water Service Policy from the Monterey County General Plan (1982), Chapter IV, Area Development: Policy 53.1.3 states that Monterey County shall not allow water-consuming development in areas that do not have proven adequate water supplies.

Monterey County Coastal Implementation Plan (Chapter 20.144) which requires, for expanded wastewater discharges, "tests of ocean waters at the proposed discharge site and surrounding waters to establish baseline or background levels of various water quality parameters no more than 1 year prior to submittal of the proposal."

Monterey County Grading Ordinance sets forth grading requirements.

ENVIRONMENTAL SETTING

TOPOGRAPHY AND SOILS

The 239-acre MLPPP site is located inland approximately one-quarter mile from the edge of the Pacific Ocean adjacent to Monterey Bay in Central California. Forming a barrier from the Central Valley, the Coast Ranges lie several miles to the east. MLPPP is located in the Salinas River Basin, a broad alluvial plain between the Salinas River and Elkhorn Slough. The project vicinity consists of industrial development, recreational beaches, dunes, tidal wetlands, agricultural lands and commercial and recreational boat harbors. Located in DWR Hydrological Unit 18060011, the sites is bounded by the Moss Landing Harbor to the west, the Elkhorn Slough and the Elkhorn Estuarine Research Reserve to the north, agricultural lands to the east and the Moro Cojo Slough to the south (CPUC 1997). The power plant site is relatively flat with an elevation of approximately 30 feet above mean sea level. In 1986, the Federal Emergency Management Agency determined that the site was outside the 100-year flood plain (Duke Energy 1999a)

The site is underlain by a thick series of westerly dipping beds of sand, silt and clay. Major soil types in the project area include Elkhorn fine sandy loam, Oceano loamy sand, Santa Ynez fine sandy loam, and Dune land (DEML 1999a) While Dune land is highly susceptible to wind-induced erosion, the other soils are reported to have only a slight to moderate erosion hazard rating to wind-induced soil erosion (DEML 1999a). Some artificial fill has been deposited on the site consisting of clayey sands and native silty sands in the upper 3-12 feet below grade (PG&E 1996).

Land uses in the vicinity of MLPPP include agriculture (cattle grazing, cropland), open space/wildlife habitat (including Elkhorn Slough National Estuarine Research Reserve), and marine-related uses. The site is currently zoned heavy industrial by the Monterey County General Plan.

HYDROLOGY

Temperatures in the area are mild, ranging between 40-70 degrees ^{o}F, although summer maximums can reach 90 ^{o}F. Average annual rainfall at the site is nearly 30 inches, with most rainfall occurring between November and April. The 24-hour one-year storm event is measured at 3.6 inches (PG&E 1996). Prevailing winds are from the west in the winter, from the east in the summer and variable during the spring and fall (PG&E 1996; Duke Energy 1999a).

GROUNDWATER

Four water-bearing formations exist below MLPPP. Forming the uppermost hydrologic unit, the marine terrace and alluvial deposits are of poor water quality and occur up to 200 feet below the surface. Aromas Reds Sands consisting of well-sorted sands and gravels with thin clay interbeds is the major water-bearing unit in the area. This formation occurs between 200 to 800 feet below the surface with variable water quality. Below this formation is the Purisima Formation occurring at a depth of 800 to at least 1,200 feet The lower-most hydrologic unit, Tertiary sediment, is comprised of consolidated marine sediments of sandstone, siltstone and mudstone underlain by granite bedrock. The tertiary sediment is of poor water quality and is characterized by high salinity.

The groundwater table at the site occurs about 3.6 to 9 feet below the surface with flow converging from the northeast and southeast into a western trending potentiometric trough beneath the plant. The thick clay layer underlying Elkhorn Slough forms a major barrier to groundwater flows in the area. In its 1996 assessment, PG&E suggested that this trough might be related to pumping in the area. The groundwater gradient is relatively flat, ranging from 0.0004 ft/ft to 0.005 ft/ft during 1999 (Duke 2000). Surface water and precipitation infiltration, irrigation return flows and water-bearing formations that underlie the uplands east of the plant are the major sources of groundwater recharge in the project vicinity (PG&E 1996;Duke Energy 1999a). Saltwater intrusion due to groundwater pumping and poor well construction is a problem in the Moss Landing area.

Onsite wells were tested to determine the transmissivity of the aquifer. Two shallow test wells were installed and the maximal pumping rate for these wells was determined. As a result of the tests, a transmissivity value of 14,035 $ft.^2$/day and storativity of 0.004 were calculated. This indicates a highly transmissive formation that is unconfined to semi-unconfined (AFC pg. 6.5-14).

SURFACE WATER

Surface water bodies in the vicinity of the project include Monterey Bay, Elkhorn Slough, Moro Cojo Slough and Moss Landing Harbor. Beneficial uses of these water bodies identified by the RWQCB (1994) are identified in **Soil & Water Resources Table 1**.

MONTEREY BAY

Located along California's Central Coast, Monterey Bay is about 26 miles long and 10 miles wide. Deep ocean currents driven by seasonal winds cause an upwelling of cold water in the bay and the near-shore currents result in a high degree of circulation in the Moss Landing area (Duke Energy 1999a). Subject to variations, the semidiurnal tides have a mean range of 3.6 feet and diurnal range of 5.3 feet (Duke Energy 1999a). Ocean and bay waters are typically 45 ^{o} and 60 ^{o} F (PG&E 1996).

Water quality information on Monterey Bay is available from a variety of sources including the Central Coast RWQCB and the National Oceanic and Atmospheric Agency. To meet Monterey County Local Coastal Plan requirements, Duke Energy will be conducting water quality analysis of source water taken from in front of the cooling water intake, adjacent to the cooling water discharge location in the bay and a location farther out into the bay. Constituents sampled include pH, oil and grease, total suspended solids, metals and organics considered a threat to marine aquatic life and human health. Analyses will be to the parts per billion (ppb) or lower, as required.

SOIL & WATER RESOURCES TABLE 1
Surface Water Beneficial Uses

	Moss Landing Harbor	Elkhorn Slough	Moro Cojo Slough	Monterey Bay*
Water contact recreation	●	●	●	●
Non-contact water recreation	●	●	●	●
Industrial water supply	●			●
Navigation	●	●		●
Marine habitat	●	●		●
Shell fish harvesting	●	●	●	●
Commercial and sport fishing	●	●	●	●
Preservation of rare and endangered species	●	●	●	●
Wildlife habitat	●	●	●	●
Warm fresh water habitat		●	●	
Cold fresh water habitat		●	●	
Migration of aquatic organisms		●	●	
Spawning, reproduction or early development		●	●	
Preservation of biological habitat of special significance		●	●	
Estuarine habitat		●	●	
Aquaculture		●		
~~Migration of Aquatic Organisms~~			●	
Ground water recharge			●	

Source: SWRCB Water Quality Control Plan, Central Coast Region, 1994.
*Soquel Pt. To Salinas River

ELKHORN SLOUGH

One of the four major tributaries that flows into Monterey Bay, Elkhorn Slough is approximately 6 miles long and 300 feet wide at its mouth narrowing as it travels inland. The slough's watershed is approximately 43,000 acres. It is a shallow estuary, decreasing in depth from 16 feet at the mouth to 3.3 feet inland. The Slough is subject to tidal influences for approximately half its length. Near the slough are marshes and mud flats, representing only 10 percent of the wetlands historically present in the 1880s. At the outlet of the Slough to the Bay, the channel is maintained and a man-made harbor, Moss Landing Harbor, extends to the south in what was the Old Salinas River channel. The harbor is regularly dredged.

EXISTING MOSS LANDING POWER PLANT SITE

Duke Energy has proposed to repower and modernize the existing Moss Landing Power Plant that was formerly owned by Pacific Gas and Electric (PG&E). The PG&E site occupied 380-acres and consisted of 19 fuel oil storage tanks, 7 generating units, 10 exhaust stacks, 2 seawater intakes and outfalls, wells, buildings and related equipment (DEML 1999a). Operation of the first three units by PG&E began in 1950 with Units 4 & 5 starting operation in 1952. Units 1 through 5 had a net capacity of 1,478 MW. These five units have not operated since January 1995 and cannot operate since PG&E surrendered the air quality permits for these units in 1997 (Suwell 2000). Units 6 & 7, still operating, came on line in 1968. Each of these two units has a net capacity of 739 MW or a total of 1,478 MW. Duke Energy acquired the power plant site in 1998. PG&E has retained ownership of its adjacent 140-acre Moss Landing Substation north of the plant.

PG&E operated the Moss Landing Power Plant under a NPDES permit last reissued in 1995 (No. CA0006254) by the Central Coast RWQCB (Order No. 95-22). Although Units 1 through 5 have not operated since January 1995 and can not operate without new air quality permits, the NPDES permit provides discharge limitations for Units 1 through 5. Duke is currently operating Units 6 & 7 under this NPDES permit, which expired February 1, 2000. Although the permit is lapsed, its conditions are in place until the new permit is issued. A new, final NPDES permit will be issued for the facility following certification of the project (Thomas 1999). A draft permit, Order No. 00-41,NPDES No. CA006254, is attached as Appendix A. As noted in the permit, this is an agency review draft and may change prior to adoption.

The cooling water intake structure for Units 6 & 7 is located on the eastern shore of Moss Landing Harbor, 700 feet south of the Unit 1 through 5-intake structure. Spent cooling water is discharged approximately 600 feet offshore in Monterey Bay. Permitted discharge limits cannot exceed 890 million gallons per day. The average daily temperature limitations are 28^{o} F above the temperature of the water intake. During heat treatment of the conduit to remove mussels, the daily temperature of the discharge can not exceed the average daily temperature of the intake water by 40^{o} F.

Duke Energy has recently discovered that they exceeded their discharge limitation several times last year due to high operation levels, jelly fish clogging the screens and other factors (RWQCB 2000). The 28^{o} F thermal limitation was apparently exceeded by 2^{o} F. In addition, Duke detected non-permitted discharges from the Moss Landing facility. These involved high temperature discharges to Moss Landing Harbor resulting from backflushing of heated water to clear the cooling water intake structure of marine organisms. Water temperatures of as high as 98^{o} F were detected in the harbor. Duke will discontinue all backflushing and will only conduct manual cleaning of the cooling water intake structures for the existing Units 6 & 7 and the new combined cycle units.

In addition, effluent limitations for the Units 6 & 7 discharge are specified for a variety of constituents to protect aquatic life and human health. The NPDES permit allows stormwater runoff to be discharged to Elkhorn Horn Slough, Moro Cojo Slough and Monterey Bay and Moss Landing Harbor.

Currently there are three permitted hazardous waste surface impoundments at the existing power plant. Waste streams discharged to these impoundments include: wastewater from boiler chemical cleaning operation; air preheater washes; fireside washes; and boiler blowdown. These waste streams are classified as hazardous, non-hazardous or restricted hazardous under California Code of Regulations Title 22, Division 4 Chapter 30 (DTSC 1995).

Wastewater flows to these ponds are anticipated to remain unchanged with operation of the new units compared to when the original Units 1- 7 were operating (Duke 1999a). Each of the impoundments consist of a concrete base, and walls, three high density polyethylene liners, two leachate collection and removal systems and a groundwater monitoring system (DTSC 1998). Treatment of the wastewater streams consist of raising the pH of the wastewater to neutralize acidity and to precipitate metals. A filter press is used to dewater the resulting sludge which then is transported off-site by a hazardous waste transporter (DTSC 1995). The remaining filtrate is tested before being discharged to Monterey Bay through the Units 6 & 7 discharge system. This latter discharge is addressed through the NPDES permit.

These surface impoundments are permitted by the RWQCB for Waste Discharge Requirement for Class I Waste Water Surface Impoundments. The Board (Schwartzbart 2000; Order No. 99-132) just recently renewed this permit in November, 1999. In addition, the facility has a Hazardous Waste Facility Permit from the Department of Toxic Substances Control (DTSC) which was issued in March of 1995 and is good until March, 2005. This permit allows storage of hazardous waste at the impoundments for up to one year. Both permits allow discharge of waste streams that would result from operation of the original seven units. Staff anticipates that wastewater flows to these impoundments from the proposed units will be significantly less than permitted.

An environmental site assessment of the Moss Landing facility indicated the presence of soil and groundwater contamination (CPUC 1997; Duke Energy 1999a; Levine Fricke 1999). PG&E retains all liability for soil and groundwater contamination at the sites resulting from on-site PG&E activities (CPUC 1997). For more information on soil contamination please refer to the **Waste Management** section of this document. Chromium, petroleum hydrocarbons and volatile organic compounds (VOCs) have been identified in groundwater beneath the site. Please see Figure 6.14-2 in the AFC (Duke Energy 1999a) for a map showing the location and concentrations of these contaminants in the groundwater. It is unclear to staff when exactly PG&E will remediate the site and to what cleanup standards.

Domestic water for the facility is provided by the Moss Landing Mutual Water Company, from two wells south of the facility. The water company is a nonprofit mutual benefit corporation consisting of three members, Duke energy, P.G.& E. and a local dairy (Flake 2000). In 1999, the Mutual Water Company delivered a total of approximately 93-acre feet of water. Approximately 21 acre feet of water was used by Duke (Flake 2000).

WASTE DISCHARGE

Currently, the existing power plant has two structures for cooling water discharge. Outfall 001 (for the retired Units 1-5) discharges into Elkhorn Slough. Outfall 002 (for the operating Units 6 & 7) discharges into Monterey Bay with two vertical risers, approximately 12 feet in diameter located about 20 feet below the water surface (Duke Energy 1999a; PG&E 1996).

As part of a thermal compliance study discussed further below, Duke (2000a) characterized the extent and temperature range for the existing thermal discharge from Units 6 & 7. At highest power plant loading, it appears that the extent of the thermal plume is approximately seven acres, although warm water discharged from the Elkhorn Slough may be influencing this. Temperature survey data halfway between the discharge point and the beach indicates a temperature rise of 4-5 ^{o}F (Duke 2000).

Stormwater runoff is currently discharged to Monterey Bay, Moro Cojo Slough, Elkhorn Slough or Moss Landing Harbor in accordance with an existing Stormwater Pollution Prevention Plan and NPDES requirements.

ENVIRONMENTAL IMPACTS

PROJECT SPECIFIC IMPACTS

Duke Energy proposes to construct two 530 MW, natural gas-fired, combined cycle, units (Duke Energy 1999a,i). Duke Energy also proposes to upgrade each of the existing Units 6 and 7 by 15 MW through replacing the turbine rotors (Duke Energy 1999b,i). The upgrade of Units 6 & 7 are not a portion of this project and are being addressed by the Monterey Bay Air District (Duke Energy 1999i). These changes will result in an overall generating capacity of 1060 MWs. In addition, eight 225-foot tall stacks associated with Units 1-5 will be removed and replaced with four exhaust stacks for the new turbines. Nineteen fuel oil storage tanks (120,000 to 165,000 barrels) are located on the eastside of the overall plant site and will be removed (Duke Energy 1999a). Monterey County (2000) is conducting the environmental assessment associated with removal of these tanks and has recently issued a proposed negative declaration. The new combined cycle units will be located where the current fuel oil tanks 3, 4 and 10 are located. The project will not require any new transmission lines or natural gas pipelines.

WATER SUPPLY

Ocean and groundwater will supply the proposed project's needs. Cooling water requirements for the project will be met through ocean water taken from the existing Units 1 through 5 intake structure located in Moss Landing Harbor. Duke Energy (1999a,b) is proposing to modify this intake structure, which was constructed in 1949, to meet Clean Water Act 316(b) requirements. The existing traveling screens will be moved forward 350 feet from their present location within the existing Units 1-5 cooling water intake structure to within 10 feet of the intake structure entrance. The screens will also be inclined to reduce entrainment and impingement. This is discussed further below.

Each of the two proposed combine cycle units will require approximately 125,000 gallons per minute (gpm), for a total of 250,000 gpm (Duke Energy 1999b). In comparison, Units 6 & 7 require a total of approximately 600,000 gpm. This water will be used for steam turbine condenser and auxiliary cooling requirements.

Average daily boiler makeup water demand is estimated to be 92,200 gallons per day (gpd). This volume will consist of 31,700 gpd recovered boiler blowdown and approximately 60,500 gpd of ocean water, which will be desalinated by vapor compression evaporation system followed by a polishing demineralizer.

Biological impacts associated with the use of ocean water for once-through cooling facilities deal with the entrainment and impingement of aquatic organisms and thermal effects on aquatic organisms associated with the thermal discharge. For further discussion of these issues, please see the **Biological Resources** section of this Final Staff Assessment. For discussion of compliance of the proposed project with Clean Water Act cooling water intake structure requirements, please see the discussion under Compliance with Applicable Laws, Ordinances and Standards below**.**

Fire, service water and domestic water needs will be supplied through groundwater. Potable water is supplied by the Moss Landing Mutual Water Company from two wells located to the south of the plant. This water is chlorinated before distribution. During construction, Duke Energy (1999a) estimates 10,000 gpd of drinking water will be required. Duke Energy (1999c) also estimates that annual domestic water demand during operation will be no greater than 1.1 million gallons. Potable water may also be used for maintenance activities on an intermittent basis. Water for fire safety for the proposed combine cycle units will also come from potable water. See Soil & Water Resources Table 2 for the proposed water balance.

Historically, 54,200 gpd of well water or approximately 60-acre feet per year was used by the Moss Landing facility (Duke Energy 1999a). This apparently includes groundwater used for plant washdown activities by Units 1 through 5. Duke Energy (1999a) estimates that operation of the proposed project will require 43,000 gpd or approximately 48-acre feet per year.

WATER QUALITY

Wastewater disposal can lead to soil, surface and groundwater degradation and impairment of beneficial uses.

WASTE WATER DISCHARGE

Duke Energy (1999a) proposes to discharge the spent cooling water from the proposed units to the existing Units 6 & 7 wastewater outfall system. This outfall facility is located approximately 600 feet offshore in Monterey Bay and consists of two 12-foot diameter pipes for each of the two existing units. These pipes terminate in head works that direct the discharge flow towards the surface (Duke Energy 1999c). These head works are roughly 12 feet by 18 feet in cross-section and the tops are located approximately 20-feet off the bottom and 20 feet below the surface at low mean tide (Duke Energy 1999c). The head works are approximately 18 feet apart. Flows to the discharge facility will increase above the current 3.1 five feet per second to approximately 4.48.6 feet per second (Waters 2000).

Other wastewater discharge streams include the concentrated brine from the evaporator system, boiler blowdown, washwater and others. These waste streams are routed to the three-wastewater treatment ponds where they are neutralized, solids are removed and the wastewater is discharged to Monterey Bay. These discharges are allowed under permits issued by the RWQCB and DTSC. These existing permits, however, do not address discharges from the two new combined cycle units. Therefore, Duke may have to update these permits to reflect these discharges (Schwartzbart 2000).

According to RWQCB staff, the ponds are in good shape and there is no evidence of any contamination or leakage from the ponds to the soil or groundwater (Schwartzbart 2000). A review of the 1999 annual monitoring report (Duke 2000d) indicates that the system is meeting permit requirements and does not appear to be impacting groundwater quality.

Although Duke will not discharge cooling water to Elkhorn Slough, stormwater will continue to be discharged to the slough as permitted by the existing NPDES permit and covered in their Stormwater Pollution Prevention Plan (SWPPP).

Non-hazardous wastewaters, including cooling water, intake screen wash, evaporator blowdown, boiler blowdown, bearing cooling water, stormwater, floor drainwater, demineralization unit bleed, ion exchange washwater will be generated and disposed of via existing outfalls. Other waste streams will be neutralized and routed to the wastewater treatment ponds for further treatment before discharge. Waste streams that may be contaminated by oil are routed through an oil and water separator before discharge. Sanitary waste will be handled by the existing on-site septic systems.

THERMAL DISCHARGE

Duke Energy evaluated the proposed discharge of MLPPP to determine whether or not operation of the proposed combined cycle units can comply with the California Thermal Plan standards (Duke Energy 1999m). A study plan was developed by Duke Energy in consultation with the Central Coast Regional Water Quality Control Board. The objective of the study was to characterize the existing thermal plume from operation of Units 6 & 7, predict temperature changes in the discharge plume resulting from operation of the proposed combined cycle units and determine if there is a potential for interference with larval fish in the vicinity of the discharge (pg. 4). The study, which also included an assessment of alternatives and modifications that can be made to the project to achieve compliance with the thermal plan, if necessary, was initiated in March 1999. After a series of draft reports reviewed by a technical advisory group, the Final Thermal Plan Compliance Report was issued on May 1, 2000 (Duke 2000). The existing, design and predicted discharge flow rates are shown in **Soil & Water Resources Table 2**.

Soil & Water Resources Table 2
Specifications of the Cooling Water Systems at MLPP

	Design	Actual	Projected
Units 6 & 7	600,000 gpm	532,000 gpm	600,000 gpm
Units 1 & 2	250,000 gpm	-	250,000 gpm
All four units	850,000 gpm	850,000 gpm	850,000 gpm

Source: Duke 2000c

The thermal discharge study was based on data collected over 3 to 8 months by stationary temperature recorders placed in the bay, harbor and Elkhorn Slough, temperature measurements from a boat during March and July 1999 and aerial infra-red plume surveys at the same time as the boat surveys.

Data collected from the stationary recorders consisted of hourly temperature readings from seventeen permanent and three temporary recorder locations from March to October 1999. Also used was data for Units 6&7 output (thermal loading) and sea levels during these months. Boat-based temperature readings for the study were collected at various sites and depths from the point of discharge to well beyond the plume. These measurements were taken at times that coincided with the aerial thermal imaging, six occasions in March and three occasions in July 1999. The empirical data sets produced were used to generate mathematical projections to describe future plume configurations.

To predict future thermal plume characteristics (Duke 2000) selected three monitoring stations where temperature changes correlated with thermal loading from Units 6 & 7. A temperature difference time series between each primary site and a range of reference sites was created. Temperature variation due to tidal conditions was removed and the correlation between the residual temperature values and thermal loading from Units 6 & & were calculated. Average slope and intercept values with the highest correlation were then computed. Extrapolated temperature differences were computed using the average temperature and future peal operating loads. These estimates are based upon two assumptions. First, that the spatial extent of the future thermal plume will be the same as the existing plume. Second, changes in temperature values in the future plume will increase over present temperature values proportionately to future increases in heat loading. Future maximum heat loading for both the new units and Units 6 & 7 is estimated to average 93.6 million BTU/min. with the maximum reaching 182.0 BTU/min (Duke 2000a, table 1-2). The worse case considered for the future plume estimation occurs under maximum thermal loading from all four units – 182.0 BTU/min. and incoming (flood) tide. Given these conditions, Soil & Water Figure 1, extrapolated from Figure 2-20 of the Final Thermal Plan Compliance Report (Duke 2000a), shows the estimated surface temperature rise relative to offshore reference values based upon present conditions. This figure is based upon an infrared photo of the existing plumes with the isotherms reflecting worse case conditions added. Since an oblique photo was used, the entire extent of the plume is not depicted. It is assumed in the study that the future plume is expected to have a configuration

Insert figure 1 here

-similar to the present plume with temperature increases about 600 feet from the discharge up to 41 percent higher (Duke 2000a, page 53). Based upon this evaluation, Duke (2000a) does not expect, even under worse case conditions, to exceed the 4^{o} F above receiving water temperatures 1,000 feet from the discharge, at the shoreline or at the surface of any ocean substrate for more than 50 percent of any tidal cycle. The Thermal Plan does not specify how a tidal cycle is determined, therefore, varying amounts of time could be calculated to represent 50 percent of the cycle. As shown on the figure, the thermal plume with temperatures of 3.5^{o} F approach the beach south of the harbor entrance.

The study also concludes that the maximum thermal plume temperatures will not exceed the natural water temperatures by more than 20^{o} F under most operating conditions at any point on the ocean surface based on vigorous mixing around the discharge point (Duke 2000a, page 55). However, the study (Duke 2000a, page 55) also states that "…maximum temperature of the thermal discharge will exceed the natural temperature of the receiving water by more than 20^{o} F under some operating conditions." It is anticipated that this would occur when only the older units, 6 & 7 are operating or during extended periods of high power generation with all units operating. Therefore, Duke has requested an exemption from the Thermal Plan to allow, under certain operating conditions, exceedance of the 20^{o} F standard. The Regional Water Quality Control Board, in response to a request from Duke has proposed the following daily and instantaneous thermal effluent limitations based upon varying operating conditions.

SOIL & WATER RESOURCES TABLE 3
Proposed NPDES Thermal Effluent Limitations

Operating Condition	Daily Temperature*	Instantaneous Maximum*
Case A	28°F (15.6°C)	34°F (18.9°C)
Case B	26°F (14.4°C)	32°F (17.8°C)
Case C	20°F (11.1°C)	26°F (14.4°C)

* These are the maximum temperatures by which discharge water temperatures are allowed to exceed receiving water temperatures for each time period.

Case A: Either one or both Units 6 and 7 in operation, but neither Unit 1 nor 2 in operation.
Case B: Either one or both Units 1 and 2 in operation, and either one or both Units 6 and 7 in operation.
Case C: Either one or both Units 1 and 2 in operation, but neither Unit 6 nor 7 in operation.

Staff feels that there are several limitations in the monitoring program used to characterize the existing plume and to predict of the temperature increase in the future thermal plume. For example, Assessment of temperature rises for existing conditions were made using an elaborate 7-step procedure (Duke 2000a, pages 44-49) which has the following limitations:

The procedure includes removing the "best-fit semidiurnal constituent from each day of the difference (between projection and reference points) time series". The motivation is to remove the effect of natural heating at some of the reference points at low tide. However, some of the tidal variations of temperature differences are due to the presence or absence of the plume and these should not be removed from the evaluation.

For example, Station ML 11/10 located at the navigation buoy near the discharge at 10 ft depth was selected as representative of "ambient" conditions relative to the 20^{o}F maximum discharge temperature rise criterion.

It was found that, on average, the intake temperature was 1.9 ^{o}F higher than this "ambient" and it is proposed to subtract 1.9 ^{o}F from measured intake temperatures to evaluate compliance with the maximum temperature rise requirement. There are several issues with this proposal:

- Being so close to the discharge, it is not clear that station ML 11/10 is not occasionally affected by the discharge, which would have the effect of raising the "ambient" temperature used for compliance monitoring.
- The temperature difference between ML 11/10 and the intake temperature varies during the year from 0.7 to 3.8 ^{o}F, and using a constant 1.9 ^{o}F is not representative.
- The procedure does not resolve the distance from the discharge point, i.e. projections of temperature rises are made for three points without regard to their distance from the discharge point.
- The procedure predicts negative temperature rises for plant loads below about 800 MW.

To extrapolate the monitoring data to the proposed discharge, plume temperatures inferred from the monitoring were increased by 41%, reflecting the increase in heat loading. While this approach is not entirely inappropriate and would be suitable for a preliminary evaluation, it does not account for the change in plume dynamics that will accompany the increase in discharge flowrate. This increase will result in an increase of the plume size, which is not well represented by simply increasing temperature rises by 4%. It is said in the Final Thermal Plan Compliance Report (Duke 2000a) that "the modeling experts from both coasts that were consulted believe that the behavior of the MLPP discharge structure cannot be accurately simulated by an available hydrodynamic model". In fact, the discharge configuration is relatively simple and could be modeled using existing models. Near field plume dynamics can be modeled using a three-dimensional Computational Fluid Dynamic (CFD) model, whose results would be input to a three-dimensional regional model. However, because the California Thermal Plan criteria are primarily far-field criteria, the near field model may actually not be required. An advantage of using a model is that the effect of the plant can be separated from the natural heating that occurs in the harbor and Elkhorn Slough.

Staff agrees that compliance with the California Thermal Plan cannot be considered to have been demonstrated and that exceedences could occur both in terms of the 20 ^oF maximum temperature rise and the 4 ^oF maximum temperature rise beyond 1,000 ft and on the shore. This issue will be discussed further under the section titled Compliance with Applicable Laws, Ordinances and Standards found below.

Because Duke requested an exemption from the Thermal Plan, they provided a discussion of potential alternatives that could be implemented at the facility to ensure compliance with the Thermal Plan. The evaluation includes a separate offshore discharge for the new units, use of closed-cycle cooling technology and additional pumping to limit temperature rise.

The evaluation for a new offshore discharge system would separate the discharge from the new combined cycle units from the existing discharge from Units 6 & 7 that would continue to use the existing facility. The new offshore discharge system would consist of two new 10-foot concrete pipes that would be routed west from the power plant, across Moss Landing Harbor and out to sea approximately 700 feet at a depth of 30 feet. Duke (2000a) estimates the cost to construct this alternative is approximately $19 million. A key concern for this alternative, besides those environmental impacts associated with construction of the line is that the modifying effects of the combined cycle discharge on Unit 6 & 7 discharge would be lost.

Closed-cycle cooling systems, either mechanical or natural draft cooling towers or dry cooling, could be used in place of once-through cooling and would drastically reduce the temperature and volume of the wastewater discharge. Installed cost estimates for wet or dry cooling range from $13 million to $15 million above the anticipated costs of the proposed cooling water intake structure improvements. In addition, there would be costs associated with decreased capacity. For wet cooling towers, blowdown disposal would raise environmental concerns.

Another alternative considered is additional pumping of water to reduce the thermal load per volume of water. While thermal loading would go down, entrainment and impingement would increase.

The final alternative considered was general curtailment of Units 6 & 7 to ensure compliance with the Thermal Plan standard of 20 ^oF. above the receiving water. Since the proposed combined cycle units are more efficient than the existing units, curtailment would probably focus on the older units. Costs associated with this would result from lost capacity for the project owner. Duke (2000a) estimates that replacement costs for this lost capacity, about 430 MW, would range from $150 million to $260 million.

An alternative not considered by Duke (2000a) is the use of a multiport diffuser. The existing structure proposed for discharging the cooling water to Monterey Bay consists of two 12-ft pipes discharging vertically about 20 ft below the water surface. This type of discharge appears to provide “intense mixing”, as evidenced by the clearly visible boil at the water surface. However, in fact, this discharge provides relatively little dilution of the effluent with ambient water. The distance from the outlet to the water surface is less than the length of the zone of flow establishment (ZOFE) of the buoyant jets, in which the radial velocity and temperature profiles gradually change from their essentially uniform shape at the outlet to a Gaussian shape in the zone of established flow. In the ZOFE, both the velocity and temperature remain equal to the discharge values in an area of diminishing size at the center of the jet. The length of the ZOFE is on the order of 6 times the discharge diameter, here 72 ft. Thus, when the discharge jets impinge on the water surface, the temperature in a significant portion of the jet is essentially unchanged from the discharge temperature. Some amount of dilution occurs as the jet rises through the water column, but because of the relatively small distance, this dilution is limited. A comparatively greater amount of dilution occurs in the internal hydraulic jump which forms just downstream of the impingement zone. For over 20 years, most if not all, new power projects in the US using once through cooling with discharge to the ocean have used multiport diffusers. Thus, the proposed project cannot be considered to qualify as using BTA relative to its cooling water disposal.

The design of a multiport diffuser for any given application depends on numerous factors including discharge flowrate, water depths, currents, stratification and required performance. For the Moss Landing Project, a separate diffuser could be built for the proposed new combined cycle units. As a very preliminary estimate, a diffuser length of 1,000 ft can be used with a cost of $10,000 per ft (including engineering design and construction supervision). The resulting cost would be approximately $10 Million, in addition to the $19 Million cost estimated in the Final Thermal Plan Compliance Report for the separate outfall for the combined cycle units. Another alternative would be to append a multiport diffuser to the existing outfall. The required length of this diffuser would depend on whether compliance is sought for both existing and proposed units or only for the new units. Assuming a 2,000 ft diffuser length, the cost would be approximately $20 Million. The exit velocity of the proposed cooling water discharge will increase from approximately 5.2 ft/s for the 532,000 gpm present discharge to 8.4 ft/s for the proposed 600,000 discharge. Because the discharge depth is less than the length of the zone of flow establishment of the discharge jets, the velocity impinging on the surface is approximately equal to the discharge velocity and the height of the boil is approximately equal to the corresponding velocity head, V2/2g. This boil height will increase from about 0.4 ft to 1.1 ft. While this boil height remains relatively small relative to the waves which can occur at this location, the new boil will have considerably more energy than the existing one and the issue of potential hazard to boating should be reviewed.

WATER QUALITY

The attached NPDES permit identifies a number of effluent limitations that the proposed discharge must meet to protect marine aquatic life and human health. These effluent limitations reflect those contained in the California Ocean Plan (State Water Resources Control Board 1997). Duke (Fleck 2000b, RWQCB 2000a) uses sodium hypochlorite for bio-fouling reduction and calcium hypochlorite as a backup. The effluent limitations include the requirement that residual chlorine does not exceed 0.2 mg/l.

EROSION CONTROL AND STORM WATER MANAGEMENT

Accelerated wind and water induced erosion may result from earth moving activities associated with construction of the proposed project. Removal of the vegetative cover and alteration of the soil structure leaves soil particles vulnerable to detachment and removal by wind or water. Significant precipitation typical of California's coastal region may increase the potential for water erosion. Grading activities may redirect runoff into areas more vulnerable to erosion.

Upgrades to Units 6 & 7 will occur within the boundaries of the existing 10-acre site at the southwest portion of MLPPP. Soils in the area of the tank removal where the new combined cycle units are to be located are the Elkhorn loams and Santa Ynez loams. These soils have obviously been significantly modified by construction activities. Once the protective covering of the soil has been disturbed during project construction, these soils can be highly vulnerable to erosion.

Because of previous activities and uses at the site, it is essentially flat with little grading required. Demolition of the existing tank farm is part of a separate project under the jurisdiction of Monterey County. Existing grades and slopes in the tank farm areas will be maintained and existing swales and culverts will be used to divert surface run-off. See Figure 6.3-4 in the AFC (Duke Energy 1999a) and Figure ML-1 in Duke Energy (1999e). The finished grade will be approximately 20 feet msl. Surface drainage will primarily be gravity flow accomplished with a mild slope away from structures of about 2 percent and a minimum of 1 percent (AFC pg. 2-26). Site preparation for the construction laydown area and for construction of the new combined cycle units will result in new temporary and permanent disturbances. No new offsite linear facilities will be needed to serve the project. Duke Energy (1999i) submitted a copy of the existing Stormwater Pollution Prevention Plan (SWPPP) for the operation of the facility and plot plans showing proposed drainage patterns. In addition, Duke (2000c) has submitted a draft erosion control plan for the construction phase of the project. This plan identifies best management practices to be used to control erosion and the discharge of contaminated stormwater offsite.

Once tanks are removed, soil testing for contamination can occur. Concern has been expressed by DTSC and the Coastal Commission about earth moving activities occurring prior to site remediation by PG&E. As noted above, PG&E is responsible for site remediation, but has not initiated this activity. DTSC was unable to provide staff with an expected schedule of when this would occur and when it may be completed. Staff has proposed a condition of certification to ensure the protection of water resources and associated aquatic habitat.~~will need to further evaluate this issue and hopes to have it resolved prior to the evidentiary hearings.~~

During project operation wind and water action can continue to erode unprotected soils. A net increase in the amount of impervious surfaces at the site will occur and may increase the amount of stormwater runoff from the site (Duke Energy 1999a). Unprotected soils may be eroded as a result of this increased run-off. Onsite drainage will be gravity flow whenever possible accomplished through mild slopes and existing culverts. According to Duke (2000c), excavation for the new combined cycle units and associated pipelines are not expected to be encounter groundwater, therefore, significant amounts of dewatering are not anticipated. Given the shallow depth of groundwater at the site and concern about the source of water found in the wetlands present at the tank farm, staff does not share this confidence. The graded areas will have approximately a 2 percent slope away from structures. Site drainage facilities and ditches will be designed for 100-year, 24-hour rainfall. As proposed, the majority of surface drainage will be directed to the outfall in Monterey Bay. Stormwater run-off from industrial areas, roof drains and storm drains will be directed to an oil/water separator prior to being combined with the cooling water discharge (Outfall 002). Stormwater from roads and parking lots will be routed directly to Moss Landing Harbor via existing structures (Outfall 004). Plant modifications will include a small reduction in the amount of surface drainage directed to Elkhorn Slough via the existing Outfall 001 and Moro Cojo Slough via the existing Outfall 003 (Duke Energy 1999a, Figures 6.5-3 & Figure 6.5-20).

As noted above, the existing SWPPP addresses pollutant sources that may affect stormwater quality and control measures and management practices to reduce pollutants in stormwater run-off. Duke Energy has indicated that it will design and construct the new facilities in conformance with the existing SWPPP or if necessary, seek amendments to the plan to reflect specific project components and pollution prevention practices (Duke Energy 1999a). A review of operational stormwater monitoring information submitted by Duke (1999j) indicates no significant water quality impacts and staff concludes that, with implementation of the best management practices contained in the Stormwater Pollution Prevention Plan, operation of the new units will not lead to the discharge of stormwater pollution.

INSTALLATION AND MAINTENANCE OF THE NEW INTAKE STRUCTURE

To supply cooling water to the proposed project, Duke (1999a,b) intends to modify the existing Units 1 through 5 cooling water intake facility. This includes: moving the traveling screens closer to the intake; using incline instead of vertical screens, installing new stop log guides; replacement of the silt diversion structures; modification of the inlet tunnel to allow for thermal treatment; and removal of collected sediment from the entrance of the intake structure (Lynch 1999). This will require:

- Construction of a coffer dam around the front of the intake structure to dewater the facility.
- The water will be pumped back into the harbor.
- Sediment to be removed will be sampled for contamination, and disposed of based on the sample results.
- The existing bar racks and stop logs will be replaced.
- A new silt diversion system will be inserted.
- Pumping will stop and the cofferdam will be removed.

The Army Corps of Engineers (Grass 1999) has granted for Duke Energy to install a sheet pile cofferdam into Moss Landing Harbor to allow dewatering of the cooling water inlet structure to remove silt accumulations, relocate the traveling screens, install new stop log guides, replace the silt diversion structures, and modify the inlet tunnel.

According to Duke Energy, siltation periodically occurs around the existing intake structure for the retired Units 1-5 in Elkhorn Slough. The applicant proposes to replace silt diversion panels and continue practices of periodically clearing the build-up away. Such activities will be undertaken by the Moss Landing Harbor. The harbor conducts dredging operations under an Army Corps of Engineers approved plan. This plan identified dredging and disposal operations as well as sediment testing procedures. **Waste Management** has a proposed condition regarding testing of this dredge material prior to disposal.

INTAKE MODIFICATIONS

Duke Energy (2000c) submitted a Resource Assessment Report that evaluates alternative cooling water intake designs with respect to Section 316(b) of the Clean Water Act. This section of the act requires that the "…location, design, construction and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact." While the Clean Water Act (CWA) under Section 316(b) requires that the location, design, construction and capacity of the cooling water intake structures reflect the "Best Technology Available (BTA)" for minimizing adverse environmental impacts, the definition of this standard has been a matter of debate. Aquatic life can be impacted in the power plant circulating water intake system by impingement and entrainment. Impingement occurs when fish or other sea life becomes trapped in the cooling water system and entrainment where aquatic organisms such as larvae and fish eggs are drawn in to the facility's cooling system. Compliance with the requirements of subsection 316(b) is affected by several variables and may therefore result in differing approaches for different installations. These variables include site location, local environment, aquatic species and organisms, plant configuration (i.e. new or refurbished facility), and cost-effectiveness. To determine the appropriate BTA for the Moss Landing Power Plant Project the applicant studied and evaluated several alternative technologies. The results and analysis of their efforts have been presented in the "Moss Landing Power Plant Modernization Project 316(b) Resource Assessment (Duke Energy 2000c).

The alternative technologies evaluated in the report included:

1. Offshore and onshore intake locations/configurations.
2. A once-through cooling water system
3. Various behavioral barriers, which include light, sound, bubble screens, and velocity caps.
4. Diversion systems
5. Physical barriers.
6. Fish collection, removal, and conveyance systems.
7. Operational and flow-reduction alternatives.

A hierarchical evaluation system of four criteria using a site-specific approach was applied to assess which alternative intake technologies are both feasible and would reduce biological losses:

1. The alternative technology is available and proven.
2. Implementation of the alternative technology will result in a reduction in the loss of aquatic organisms compared to present conditions.
3. Implementation of the alternative technology is feasible at the Moss Landing Power Plant Project (MLPPP) site.
4. The total economic cost of the alternative technology is proportional to the environmental benefits.

The four criteria were applied progressively such that only alternative technologies that met the previous criterion were evaluated under the next criteria, e.g., if a alternative did not meet the first criterion it was eliminated from evaluation under the next and remaining criteria.

Of the alternatives included above, only those involving operational and flow-reduction alternatives, and those involving behavioral barriers met the first criterion, were considered proven technology by Duke Energy, and were further evaluated under the remaining criteria.

Several alternatives were not considered likely to result in a reduction in the loss of aquatic organisms compared to present conditions. Duke considered both onshore and offshore alternative intake locations and behavioral barriers not acceptable. Entrainment and impingement losses were not expected to be substantially reduced through the use of physical barriers, which include travelling screens, barrier nets, a Gunderboom, and a fish pump system. Cooling system changes and discharge temperature regulation were not expected to substantially reduce entrained organism mortality, and were also rejected from further consideration.

The remaining alternatives were evaluated against the feasibility and cost analysis criterion. Curtailment of power generation, mechanical draft and natural draft cooling options, air-cooled condenser (dry cooling) reduced cooling water flow at reduced loads, and alternatives to chemical biocides were eliminated based on either cost or feasibility.

Duke Energy concluded that the currently proposed design is the best technology available to reduce entrainment and impingement of aquatic organisms. The modifications proposed by Duke (1999a) to the existing Units 1-5 cooling water intake structure will involve the addition of new angled traveling screens to reduce approach velocities and keep the intake free from debris. Approach velocity will be 0.5 feet per second (fps) compared to 0.8 fps at the existing Units 6 & 7 intake.

These screens will be located near the front of the intake, which will eliminate the entrapment of aquatic organisms in the existing 350-foot tunnel which connects from the shoreline to the pumps. The new circulating water system will consist of the shoreline intake with silt diversion skirts, six bar trash racks with 4 inch spacing, a curtain wall with stop logs for isolation, six inclined traveling screens placed at angle of 55° from the horizontal with a 5/16 inch mesh size, the existing 350 foot long intake tunnel, and six 42,000 gpm circulating water pumps. The study's conclusion states that the BTA requirement will be met by a combination of this design, operation and maintenance procedures, and environmental enhancement projects. Duke (2000c) recommends continuing present operating practices, that include reducing the operation of circulating water pumps when the units are out of service for extended periods of time, and periodic dredging around intakes to reduce sediment accumulation in intake areas to maintain intake water velocities.

In utilizing the existing intake and making modifications to comply with BTA requirements, Duke (2000c) has attempted to create an environment that will reduce flow velocities, eliminate the 350 foot long tunnel as an area subject to entrapment, and control debris accumulation within the constraints of the existing intake structure. This is accomplished by using an inclined traveling screen design located at the front of the intake and a reduction in the flow requirements for the combined cycle units. This design approach does create the potential for entrapment and higher than expected flows specifically in the area around the stop log/curtain wall and traveling screens. Insufficient information is available to confirm whether velocities will be above the design, if an even flow distribution across the screens will occur, and if fish entrapment in this area will result.

It should be noted that while a number of alternate technologies have been tested and developed, they may not be universally applicable in all situations. Some ~~may be~~ of these technologies have been used for hydroelectric or irrigation applications involving lakes, rivers, but ~~and may~~ not for seawater once through cooling facilities The following is a brief description of the technologies evaluated by the applicant.

Closed-Cycle Cooling Water System

There are alternate cooling technologies using mechanical or natural draft recirculating cooling towers using either fresh water or seawater as the cooling medium. The application of these systems would totally eliminate the need for the massive intake structures described in the application but would involve other impacts. Water use would be reduced to that required for system makeup from blowdown, evaporative losses, and drift losses. The fresh water towers were ruled out due to the limitations on freshwater supply. The seawater towers were eliminated due to considerations of discharge of concentrated effluent, visibility impacts of the towers themselves, noise, visible vapor plume emissions, additional energy requirements, and capital costs.

Air Cooled Condensers

The use of air-cooled condensers would totally eliminate the use of water for cooling altogether. However, for the Moss landing Power Plant Project these would cover an area of 1.5 acres, extend to a height of 80-90 feet, consume 60 MW of power, and cost an additional $30 million in capital costs. Therefore, air cooled condensers have been eliminated as an alternative technology.

Intake Locations

Offshore

The proposed configuration is to make use of the existing onshore intake structure of units 1 through 5 by modifying it in a manner that would reduce impacts from the old operation. An alternative to this would be to construct a new intake located offshore in either the Moss Landing Harbor or in the Monterey Bay. In either case due to mixing and tidal actions between the Elkhorn Slough, the harbor and the bay, the applicant concluded that "an offshore intake appears to offer little or no potential for reducing the losses of fish and invertebrates entrained or impinged at the new combined cycle units intake."

Alternate Onshore Location

The purpose of using an alternate onshore location would be to take advantage of a shore zone in which the habitat of species would be reduced from the current location. Considering the pattern of tidal currents and sampling studies performed by the applicant, it was concluded that the potential for entrainment and impingement would not be substantially different at any other available shoreline locations.

Behavioral Barriers

Behavioral guidance technologies are designed to produce stimuli that potentially can alter the behavior of fish to produce avoidance responses and thus prevent entrainment into the water intakes. These technologies include the use of strobe lights, air bubble curtains, underwater sounds, mercury lights, electric barriers, and velocity caps. Certain of these technologies have had varying degrees of success with some fish species and it is agreed that in some cases that further study is warranted. For application at the Moss Landing site there is no compelling evidence that behavioral barriers would be an effective deterrent to entrainment or impingement on a consistent basis for the aquatic life in the area.

Physical Barriers

Physical barriers principally are designed to block the passage of fish from entering the intake, usually in combination with low water velocity.

Traveling Screens

Traveling screens have historically been used to block the intrusion of debris and fish from entering the cooling water systems of power generating facilities. As such there is usually a high mortality rate to the sea life that has been drawn into the structures. More recently designs have included various fish handling and operational features to reduce the impingement of fish. Vertical traveling screens equipped with fish lifting buckets will be addressed under Fish Collection, Removal, and Conveyance.

In addition to vertical traveling screens, alternate types of screens include drum type and wedge wire screens. Drum type screens that have been used primarily at irrigation and hydroelectric facilities have experienced problems with impingement and blockage due to poor design application, lack of bypasses and physical seals. Wedge-wire screens utilize a "V" or wedge shaped cross-section that forms a slotted screening element. To work properly, this design requires a small screen slot, low through-slot velocity, and an ambient cross-flow current. Another problem due to a lack of accessibility is the lack of ability to prevent or control biofouling of the interior surfaces by mussels, barnacles and other organisms. Due to these problems drum and wedge wire screens are not currently considered to be applicable technologies for the Moss Landing Power Plant Project.

Barrier Nets

Barrier nets have the ability to exclude fish from water intakes by blocking the entrance to the intake structure. The mesh size and surface area of the net must be properly selected to block fish passage but not cause the fish to become gilled in the net. This can be controlled by the use of relatively low velocities (generally less than 1 ft/sec). Some concerns of barrier nets include blockage due to debris, clogging, and biofouling. While labor intensive, regularly scheduled cleaning programs can address these factors. Barrier nets have been used successfully at a number of power plant installations although it is not practical within the Moss Landing Harbor.

Gunderboom

The Gunderboom is a newer technology for protecting fish at circulating water intakes that consists of polyester fiber strands which are pressed into a water-permeable fabric mat. It is then made into a curtain that is floated and anchored to block the impingement of fish but also has the potential for preventing entrainment of the earlier life stages. While a promising technology the Gunderboom is still acknowledged to be experimental in nature requiring additional development and therefore not currently applicable at the Moss Landing Power Plant Project.

Pours Dikes

Porous dikes allow water to pass through them while preventing fish passage. They have been shown to be effective blocking juvenile and adult fish on an experimental basis; however, they do not reduce entrainment of the passive life stages which will get trapped in the porous medium or entrained in the pump flow. Since this technology is still considered to be experimental and has yet to be demonstrated in cooling water intake applications, it is not considered to be a viable alternative for the Moss Landing Power Plant Project.

Fish Collection, Removal, And Conveyance System

Fish collection technologies have been developed that either actively or passively collect fish for transport back to the source of the cooling water through a return system.

Modified Traveling Screens

Modifications have been incorporated into vertical traveling screens to reduce the mortality of fish and organisms. These modifications incorporate the addition of water-filled buckets that collect the fish and with the aide of low-pressure washes and transport them into a sluice trough. The fish are then transported back to a safe release location. This system used in conjunction with continuous rotation of the screens is a viable alternative for protecting fish.

Fine-Mesh Screens

Fine-mesh screens with openings as small as 0.5 mm have been used in conjunction with the traveling screens described above. The concept of using the fine-mesh screens is that they will collect not only fish but also fish eggs and larvae. However, for some species impingement on the fine-mesh screens can actually result in higher mortality than if the organism were allowed to pass completely through the circulating water system. Therefore, it cannot be concluded that the use of fine mesh screens would enhance the prevention of impingement of the early sea life forms.

Fish Return Conveyance Systems

Duke (2000c) has stated that using a trash pump to transport material away from the intake often results in mechanical abrasion and high mortality of organisms. The study therefore concludes "that no further consideration should be given to a fish pump return system for diverting fishes from the new combined cycle units intake because of the uncertainties associated with the effectiveness of such a system in successfully diverting the fish species found at the site and returning them alive to Moss Landing Harbor."

Recent results using new designs indicate that pumps are available that induce little injury and mortality. These designs include the use of a screw-impeller pump that potentially offers an effective means of transporting larvae, juvenile, and adult fishes with low resultant mortality. Fish return conveyance systems are considered to be a viable application to reduce impacts to fish and other aquatic organisms.

Intake Maintenance and Operational Modifications

To reduce flow velocities through the intake structure it is proposed that dredging to control sediment build up that would block cross-sectional area is used. This control measure is considered proper and effective. Reduction of circulating water pump operation during periods of reduced electrical generation is also considered a viable proposal with potential energy savings by reducing auxiliary load requirements.

Diversion Systems

Fish diversion systems redirect the fish away from the impingement area to a return system or safe area for return to the ambient water source. The alternate designs include angled screens, modular inclined screens, and louvers.

Angled Screens

Traveling screens are set at an angle to the flow of the water (about 25º) in either a "V" or slant configuration. At the apex of the angle are fish bypass slots that collect the fish that are then pumped or sluiced back to the cooling water source. Fish that do not enter the bypass and become impinged on the traveling screens are then removed by a low-pressure backwash system. Even though there are limited applications using seawater-cooling systems, results of fresh water and testing have shown this technology to be viable and worthy of consideration.

Modular Inclined Screens

The modular inclined screen consists of an inclined screen installed after the trash racks at a shallow vertical angle of 10-20 degrees to the flow. Fish are directed to a transport pipe for return to the sea water source. Early laboratory testing has shown modular inclined screens to have potential but this technology has yet to be demonstrated on a full scale circulating water system and is therefore not considered to be a viable application for the Moss Landing Power Plant Project.

Louvers

A louver system consists of an array of evenly spaced, vertical slats aligned across a channel at a specified angle which leads to a bypass. These systems have limited applications at cooling water intake systems but have been applied successfully at hydroelectric and irrigation facilities. Laboratory studies have showed reasonably high diversion efficiencies; however, these are dependent on swimming capabilities, behavioral tendencies, life-stage, and site specific characteristic of the local species impacted. Although louvers may be considered an alternative for the Moss Landing Power Plant Project, further evaluation with the local species would be required to define the full potential of this technology.

The Moss Landing Power Plant Project as proposed makes use of the existing circulating water intake structure originally designed and built to provide cooling water to units 1-5 which have been down since 1995. The applicant has proposed to modify the intakes to relocate the traveling screens to the front of the intake, replace them with inclined traveling screens, and reduce the cooling water flowrate. ~~From an assessment of the existing alternative technologies it is concluded that these measures alone would not constitute compliance with the Clean Water Act section 316(b) requirement to provide the Best Technology Available to minimize adverse environmental impacts~~. Alternate potentially acceptable technologies, which were dismissed by Duke, include barrier nets, fish collection by modifying traveling screens, diversion technologies of angled screens or louvers, and fish return conveyance systems. Most of these technologies address the reduction of impingement of aquatic species. Staff concluded that Duke's proposed modifications to the existing Units 1-5 cooling water intake structure will substantially reduce impingement. Impacts resulting from entrainment by operation of the new units is being addressed by the off-site mitigation agreement between Duke and Energy Commission, RWQCB, CDF&G and Coastal Commission staff. For further discussion of this issue, please see the Biological Resources section of this testimony. ~~While each of these deserves further consideration not all of them would be required to meet BTA requirements.~~

~~It is recommended that further study be done on the design configuration of the intake structure specifically in the area of the stoplogs/wall curtain to verify that low flowrates are achieved and that fish entrapment will be minimized.~~

The following recommendations should be considered in determining BTA. In addition, since there are off-site opportunities to mitigate entrainment and impingement impacts, the proposed mitigation measures identified in the **Biological Resources** section must be taken into account.

It is recommended that traveling screens that have been modified to reduce the mortality of fish and organisms by a collection system using fish buckets in combination with a return conveyance system be considered as a possible viable design.

It is recommended that a diversion design using angled screens or louvers in combination with a return conveyance system be considered as a possible viable design. Therefore, based upon Duke's proposed modifications to the existing Units 1-5 cooling water intake structure and the proposed off-site mitigation package, staff concludes that Duke's proposal represents Best Technology Available.

CUMULATIVE IMPACTS

Staff concludes that the proposed project will not contribute to any significant cumulative impacts to soil and water resources. The one exception may be regarding site contamination and project construction activities. Staff is continuing to evaluate this issue and hopes to have this issue resolved prior to the evidentiary hear. The proposed project's groundwater demand will be less than historic demand. Although the discharge of the once-through cooling water from the new unit will raise, under certain operating conditions, temperatures above that of the receiving water, this will not contribute to cumulative water quality impacts.

FACILITY CLOSURE

For soil and water resources, issues raised by temporary or permanent closure of the proposed facility are addressed, in part, by existing permits from the RWQCB and DTSC. The remaining issues will be addressed in the closure plan that will be prepared by the project owner.

MITIGATION

APPLICANT PROPOSED MITIGATION

Duke (1999a,I, j; 2000c) has proposed implementing best management practices to minimize erosion and sedimentation and the discharge of contaminated stormwater runoff during construction and operation of the proposed facility. In addition, Duke (1999a) indicated that the project will comply with all applicable permit requirements.

CEC STAFF PROPOSED MITIGATION

Staff recommendsis several mitigation measures to ensure the project complies with applicable laws, ordinances and standards.

COMPLIANCE WITH APPLICABLE LORS

Duke Energy has applied to the Central Coast RWQCB for a NPDES permit for the new combined cycle units. The RWQCB (Thomas 1999) has determined that the proposed project, the new combined cycles units, constitutes a "new facility" under the Thermal Plan and a new discharge under the Clean Water Act. To meet these requirements, the RWQCB staff laid out a number of studies Duke Energy must undertake to provide information necessary for the RWQCB to determine the project's compliance with the Thermal Plan.

As discussed above under this plan, the thermal discharge of a new facility into coastal waters must meet several requirements including not exceeding a maximum temperature of 20^{o} F above the receiving water. Under provisions of the Thermal Plan and Clean Water Act Section 316(a), the RWQCB and the SWRCB can issue a variance to these specific plan objectives. Duke Energy (Thomas 2000) has requested a variance for the 20^{o} F limitation. This allows Duke Energy to discharge at greater temperature relative to receiving water ambient levels as long as the discharge levels "…will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water."
RWQCB staff (Thomas 2000) feel that the studies being conducted now by Duke Energy will suffice in this determination and should not require additional time beyond that necessary for completing and analyzing the survey information. Therefore, the thermal limit for the discharge will be based upon potential biological impacts. For a discussion of biological impacts, please see the Biological Resources section of this FSA.

From a water quality perspective, staff is supportive of the thermal limits identified in the proposed NPDES permit. Staff is, however, concerned that Duke may exceed other specific objectives of the Thermal Plan, such as the discharge not resulting in temperature increases exceeding 4^{o} F at the shoreline over 50 percent of the tidal cycle. Since whether the project will exceed this provision of the thermal plan is unclear, staff has identified a proposed condition of certification that will develop, with the RWQCB, and in consultation with other agencies and the project owner, a limited monitoring program to determine the degree of project compliance with the Thermal Plan.

As discussed above, Duke Energy (2000a) provides a discussion of alternative design and operational factors to minimize thermal impacts. Staff has concluded that there are alternatives to of the existing discharge structure for Units 6 & 7. ~~is not best technology available~~ that would reduce the thermal plume. However, since staff has not ~~failed to~~ identified~~y~~ any significant water quality impacts associated with the thermal plume, and the project may comply with the Thermal Plan, staff is not recommending modifications to the thermal discharge system. Mitigation of the proposed project failing to meet thermal plan requirements should include consideration of modifying the existing discharge structure to a multiport facility that would lessen thermal effects.

Also as discussed above, staff has evaluated there are several alternatives to Duke's (2000c) proposed modification to the existing Units 1-5 cooling water intake structure to comply with Clean Water Act Section 316(b) best technology available requirements. Given that impingement is not considered to be substantial and that Duke has offered an off-site mitigation package to address entrainment impacts, staff concludes that Duke's proposal meets best technology available.there are alternative mitigation measures to reduce the impact of entrainment and impingement, staff has not made a final decision whether the proposed project meets BTA. Please see the **Biological Resources** section for further discussion of this issue.

CONCLUSIONS AND RECOMMENDATIONS

Staff recommends approval of the proposed MLPPP for the technical area of Soil and Water Resources. Although staff has concerns about the project's compliance with certain provisions of the Thermal Plan, a proposed condition of certification would ensure determination of the project's compliance with these requirements. In addition, staff concludes that the proposed project will compliancey with the best technology provisions of Section 316(b) of the Clean Water Act. has not been resolved. Please refer to the Biological Resources Section of this testimony.

CONDITIONS OF CERTIFICATION

SOILS&WATER-1: Prior to the initiation of any earth moving activities, the project owner shall submit the CBO approved propsed erosion control and sediment control plan to the CBO and the Energy Commission CPM for concurrent review and approval. The project owner shall implement the approved erosion and sediment control plan.

Verification: The project owner shall submit the proposedfinal erosion and sediment control plan for review and shall be approvaled by the designated CBO and be submitted to the Energy Commission CPM 360 days prior to the initiation of any earth moving activities. The Energy Commission CPM shall coordinate comments on the proposed plan with the designated CBO and with other interested agencies including the Coastal Commission.

SOIL&WATER-2: The project owner shall submit the final, approved National Pollutant Discharge Elimination System Permit from the Central Coast Regional Water Quality Control Board governing the discharge of the project's once through cooling water to the Energy Commission. The project owner shall comply with all provisions of the National Pollutant Discharge Elimination System Permit. The project owner shall notify the Energy Commission CPM of any proposed changes to this permit or waste discharge requirements for Class I Surface Water Impoundments (Order 99-132), including any application for permit renewal.

Verification: Within 30 days following receipt of a final, approved National Pollutant Discharge Elimination System Permit from the Central Coast Regional Water

Quality Control Board, the project owner shall submit to the Energy Commission CPM a copy of the permit. The project owner shall submit to the Energy Commission CPM in the annual compliance report a copy of the annual monitoring report submitted to the Central Coast Regional Water Quality Control Board for NPDES No. CA006254 (Order 00-41) ~~and for Waste Discharge Requirements for Class I Wastewater Surface Impoundments (Order No. 99-132).~~ The project owner shall notify the Energy Commission CPM in writing of any changes to and/or renewal of this ~~either~~ permit.

SOIL&WATER-3: If necessary, the project owner shall update the waste discharge requirements (Order 99-132) for Class I Surface Water Impoundments from the Central Coast Regional Water Quality Control Board and Hazardous Waste Facility Permit from the Department of Toxic Substances Control (EPA ID No. CAT 080011653) to reflect discharge from the new combined cycle units. For the life of the project, the project owner shall notify the Energy Commission CPM of any proposed changes to these permits, including any application for permit renewal.

Verification: 60 days prior to commercial operation, the project owner shall submit to the Energy Commission CPM a copy of the revised permits allowing discharge from the new combined cycle units. If changes to these permits are not necessary to allow discharge of waste streams from the new combined cycle units, the project owner shall notify the Energy Commission CPM in writing of the fact. The project owner shall submit to the Energy Commission CPM in the annual compliance report a copy of the annual monitoring report submitted to the Central Coast Regional Water Quality Control Board for Waste Discharge Requirements for Class I Wastewater Surface Impoundments (Order No. 99-132). The project owner shall notify the Energy Commission CPM in writing of any changes to and/or renewal of this permit or the Hazardous Waste Facility Permit from the Department of Toxic Substances Control.

SOIL&WATER-~~3~~4: The project owner shall characterize the extent and influence of the thermal plume under the varying conditions experienced at the discharge. A technical advisory committee shall be established by CEC Water and Biological Resources staff and Central Coast Regional Water Quality Control Board staff with representatives of California Department of Fish and Game, California Coastal Commission, Regional Water Quality Control Board, Energy Commission, and the project owner. The study objectives, sample design, metrics and methods (protocols) will be developed by the technical advisory committee. The goal of the study is to provide a detailed, three-dimensional characterization of the thermal plume and project compliance with applicable permit requirements. The study protocols will be developed and put into a study plan within twelve months of the certification. The project owner will commence the thermal plume characterization and monitoring study within one month of the start of operation of the new power plant. All units (1&2 and 6&7) should be in operation during the study (worst case). The project owner will prepare the study plan and conduct the data collection. The project owner shall prepare a draft report of the study results that is scientific in style and includes methods, analysis, results, and conclusions, within six months from the end of data gathering and submit it to the CEC CPM. The other agencies shall be included in the review, as they desire. A final report shall be completed within nine months of the end of data collection.

Verification: The project owner will submit a draft study plan (based on technical advisory committee direction) to the CEC CPM within nine months of certification for review and approval. Within twelve months of certification, an approved final study plan will be provided to the CPM. This study plan will be prepared by the project owner as guided by the technical advisory committee established by CEC Water Resources staff and CEC CPM in consultation with the agencies. The CPM will ensure that the monitoring studies are conducted according to the study plan.

The project owner will submit a draft report that discusses the results of the thermal plume characterization and monitoring, that is a scientific style report including methods, analysis, results, and conclusions within six months of the end of field sampling, and they will submit an approved final report within nine months from the end of field sampling. The CPM will ensure that a study results draft report is submitted within six months of the completion of the field sampling, and that a final report is completed within nine months from the completion of the field sampling.

~~Within 30 days following certification the CPM shall ensure that a technical advisory committee has been established and is progressing toward the creation of the study plan. Within 30 days following the start of operation of new units 1&2 of the Moss Landing Power Plant, the thermal plume characterization and monitoring efforts will commence.~~

If the project owner has not complied with any aspect of this condition, the CPM will notify the project owner of making this determination.

SOIL&WATER-5 No earth disturbing activities for construction of the proposed project shall occur until the site has been successfully remediated by PG&E. If the site has not been remediated, no earth moving activities shall occur until the Energy Commission has approved a plan submitted by the project owner. This plan shall identify measures that will be undertaken to ensure that contaminated soil and/or surface or groundwater disturbed during construction activities will not degrade adjacent water resources and associated aquatic habitats.

Verification: The project owner shall submit a letter, at least 60 days prior to the start of construction, from the Department of Toxic Substances Control indicating that the site has been successfully remediated by PG&E. If the site has not been remediated, the project owner shall submit a plan for approval to the Energy CPM. This plan will identify measures that will be undertaken to ensure that contaminated soil and/or surface or groundwater disturbed during construction activities will not degrade adjacent water resources and associated aquatic habitats. The Energy Commission CPM shall coordinate review of this plan with the Department of Toxic Substances

Control, Regional Water Quality Control Board, the Department of Fish & Game and the Coastal Commission. No earth moving activities associated with construction of the proposed project will occur until the proposed project has been approved by the Energy Commission CPM.

REFERENCES

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SWRCB (State Water Resources Control Board) 1998. "Review of the California Thermal Plan (Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California), Initial Staff Report, State Water Quality Control Board, July 1998.

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Hoffman 1999. Letter to R. Briggs, Regional Water Quality Control Board, Central Coast Region, from Wayne Hoffman, Duke Energy-North America, September 28, 1999: plant is currently regulate by NPDES permit CA0006254 issued to PG&E and adopted by the Regional Board on February 10, 1995. In this letter, Duke informed Briggs that they had notified the Board of the change in ownership and were requesting a two-year extension of the current permit to allow for the new plant to be incorporated.