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F6b

September 7, 2011

TO: Coastal Commissioners and Interested Parties

FROM: Alison Dettmer, Deputy Director
Tom Luster, Environmental Scientist

SUBJECT: Addendum to Staff Report E-11-018 – Class B and C Waste Storage Facility at Humboldt Bay Power Plant, adjacent to Humboldt Bay south of Eureka, Humboldt County (Pacific Gas & Electric Company)

This addendum includes revisions to the above-referenced staff report. The proposed revisions herein do not change staff's recommendation that the Commission ***conditionally approve*** the proposed project.

REVISIONS TO STAFF REPORT

Staff recommends modifying the staff report as shown below in **bold underline** text:

Page 6, Special Condition 1:

> "**Future Availability of Alternative Storage Location: The Permittee shall notify the Executive Director when another suitable facility agrees to store the Class B and C waste from the Humboldt Bay Power Plant.** Within three months of acceptance by another facility of the Class B and C waste stored at the Storage Facility, the Permittee shall submit a coastal development permit application to the Coastal Commission for removal of the waste and Storage Facility. **Within one year of acceptance by another facility of the Class B and C waste, the Permitted shall remove and transport the waste to the accepting facility. The Executive Director may extend these deadlines upon written request by the Permitted and for good cause.**"

Page 30, first bulleted paragraph:

- **"Offsite alternatives:** As noted in Section 4.2 above, PG&E has established that there are currently no offsite alternative locations available to store this waste material. There are several offsite facilities that have been built to store Class B and C wastes, but at this time, none are available for wastes generated in California. PG&E anticipates that it will at some point reach an agreement with the recently constructed facility in Texas to allow storage, but it is uncertain as to when, if ever, such an agreement would be reached.

Additionally, while PG&E has a Class B and C waste storage facility at its Diablo Canyon power plant, that facility's license limits storage to wastes generated at Diablo Canyon, which is a standard NRC requirement for these types of storage facilities at individual power plants. It is also infeasible to construct this storage facility elsewhere offsite – for example, elsewhere in Humboldt County or in California – due in part to the security measures required, which for this facility, will largely be provided through the presence of the adjacent spent fuel storage facility at the Humboldt Bay Power Plant site. Therefore, for purposes of the Commission's review, there are no feasible offsite alternatives that would achieve the project objectives without violating at least one Chapter 3 policy."

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STAFF REPORT
COASTAL DEVELOPMENT APPLICATION

APPLICATION FILE NO.:	**E-11-018**
APPLICANT:	**Pacific Gas & Electric Company**
PROJECT LOCATION:	Humboldt Bay Power Plant, adjacent to Humboldt Bay near King Salmon, Humboldt County.
PROJECT DESCRIPTION:	Construct and operate a "Class B and C Waste" Storage Facility to store low-level radioactive waste from the Humboldt Bay Power Plant.
SUBSTANTIVE FILE DOCUMENTS:	See Appendix A
EXHIBIT 1:	Map of Project Location
EXHIBIT 2:	Site Plan and Facility Layout
EXHIBIT 3:	Memo from Commission geologist regarding PG&E's Humboldt Bay Power Plant Independent Spent Fuel Storage Installation for CDP #E-05-001
EXHIBIT 4:	Relevant Special Conditions of CDP #E-05-001 for PG&E's Humboldt ISFSI

EXECUTIVE SUMMARY

Pacific Gas & Electric Company (PG&E) proposes to construct a facility to store low-level radioactive waste generated at the Humboldt Bay Power Plant (HBPP). The proposed facility would be located at the HBPP site, which is just east of the community of King Salmon along the Humboldt Bay shoreline. PG&E recently constructed a new power plant adjacent to the HBPP

and is now demolishing and decommissioning the older plant, which includes two gas-fired electrical generating units and one nuclear generating unit. The low-level radioactive wastes to be stored at the proposed facility are being generated through the decommissioning process.

The proposed Storage Facility would be located adjacent to PG&E's Independent Spent Fuel Storage Facility (ISFSI), which the Commission approved in 2005. The ISFSI is used to store the HBPP nuclear unit's spent fuel and "Greater Than Class C" waste, both of which are considered high-level radioactive waste and require secure storage for thousands of years to prevent harm to humans and the environment. The currently proposed Storage Facility would contain "Class B and C" wastes, which have much lower levels of radioactivity than those stored in the ISFSI, but still require long-term storage to maintain the wastes' stability and to prevent exposure to the environment.

> **Note:** Because federal law pre-empts the state from imposing requirements related to nuclear safety or radiation hazards, this report evaluates only those issues necessary to determine conformity to the policies of the Coastal Act and does not impose requirements on aspects of the facility pre-empted by federal law.

Key Issues: Significant issues related to the proposed project's conformity to Coastal Act policies include:

- Perpetual presence of the Storage Facility: There are currently no available offsite locations for PG&E to store these wastes. PG&E anticipates that an offsite facility might be available sometime in the next several years, but it needs to have a facility available more quickly in order to complete its HBPP decommissioning by 2015, which is the end date of its license from the Nuclear Regulatory Commission (NRC). In recognition that an offsite facility might eventually be available, **Special Condition 1** would require PG&E to submit a CDP application for removal of the Storage Facility.

  However, because there are currently no alternative storage locations and because it is unclear when or whether other sites might be available, the recommended Findings herein are based on the presumption that the wastes will remain at the HBPP site in perpetuity. The Commission used a similar approach in its 2005 approval of HBPP's ISFSI – that is, because there were no alternative locations available to store the power plant's spent fuel, the Commission presumed the ISFSI would remain on site in perpetuity.

- Geologic Hazards: The Findings herein evaluate how geologic hazards associated with the site and the area could affect the proposed Storage Facility over a very long time period. As noted above, federal law preempts local or state governments from imposing conditions related to radiological hazards; these Findings therefore address only those Coastal Act geologic hazard policy issues related to the proposed Storage Facility's structural stability, the stability of nearby landforms, and the potential for coastal erosion to affect the proposed project.

The Commission staff geologist generally concurs with most of PG&E's analyses of the project site's geologic characteristics, which have also been recognized as adequate for the proposed project by the NRC. Staff is recommending through **Special Conditions 2 and 3** that the site's slope stability and rate of shoreline erosion be monitored to provide necessary assurance that site conditions remain suitable for the facility. These Special Conditions are consistent with conditions the Commission imposed as part of its approval of the ISFSI. However, even with these Special Conditions, staff has determined that the proposed development of the Storage Facility at this location does not conform to Coastal Act policies regarding geologic hazards, as it would be located at a site subject to potential slope failure, surface fault rupture, tsunami runup, and coastal erosion. These inconsistencies result in conflicts with other Coastal Act policies that must be resolved through application of Coastal Act Section 30007.5, as described below.

- Visual: The Storage Facility would be on a visually prominent blufftop near the shoreline of Humboldt Bay. The storage vault would be below grade, but lighting and other structures would be visible from nearby public areas. **Special Condition 4** would require PG&E to use neutral tones on all visible structures and direct lighting inward and downward to the extent allowed by NRC requirements; however, even with this Special Condition, the project would not conform to the Coastal Act's visual resources policy. This inconsistency results in a conflict with other Coastal Act policies that must be resolved through application of Coastal Act Section 30007.5, as described below.

- Public Access: The Storage Facility would be located between the first public road and Humboldt Bay, about 200 feet from the Humboldt Bay shoreline. However, for several reasons, this proposed development does not require the provision of additional public access because: first, the immediate project location is a hazardous industrial facility not suited to public access; second, an existing coastal trail protected through requirements of a previous coastal development permit provides sufficient access in the vicinity of this development; and third, other adequate public shoreline access exists nearby. The existing coastal trail is protected pursuant to CDP #E-05-001 for PG&E's ISFSI, which required PG&E to file a deed restriction over a trail along the length of shoreline along the HBPP site.

- Conflict Resolution: The project, as proposed, is inconsistent with Coastal Act Sections 30253(1)-(2) and 30251. However, denying the Storage Facility or modifying it to resolve these inconsistencies would result in nonconformity to other Coastal Act policies, specifically Sections 30230, 30231, and 30240 related to marine resources, water quality, and environmentally sensitive habitat areas. The Commission must therefore apply Sections 30007.5 and 30200(b), which allow the Commission to approve projects involving these conflicts in a manner that, on balance, is most protective of significant coastal resources. Staff recommends the Commission determine the benefits to marine resources, water quality, and environmentally sensitive habitat areas outweigh the project's nonconformity to Coastal Act policies regarding geologic risks and visual resources.

Staff recommends that the Commission **approve** the proposed project, as conditioned.

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1.0 STAFF RECOMMENDATION

Motion:

> *I move that the Commission **approve** Coastal Development Permit E-11-018 subject to conditions set forth in the staff recommendation specified below.*

Staff recommends a **YES** vote. Passage of this motion will result in approval of the permit as conditioned and adoption of the following resolution and findings. The motion passes only by affirmative vote of a majority of Commissioners present.

Resolution:

> *The Commission hereby **approves** the Coastal Development Permit for the proposed project and adopts the findings set forth below on grounds that the development as conditioned will be in conformity with the policies of Chapter 3 of the Coastal Act. Approval of the permit complies with the California Environmental Quality Act because either 1) feasible mitigation measures and/or alternatives have been incorporated to substantially lessen any significant adverse effects of the development on the environment, or 2) there are no further feasible mitigation measures or alternatives that would substantially lessen any significant adverse impacts of the development on the environment.*

2.0 STANDARD CONDITIONS

1) **Notice of Receipt and Acknowledgment**: This permit is not valid until a copy of the permit is signed by the Permittee or authorized agent, acknowledging receipt of the permit and the acceptance of the terms and conditions, is returned to the Commission office.

2) **Expiration**: Construction activities for the proposed project must be initiated within two years of issuance of this permit. This permit will expire two years from the date on which the Commission approved the proposed project if development has not begun. Construction of the development shall be pursued in a diligent manner and completed in a reasonable period of time. Application for extension of the permit must be made at least six months prior to the expiration date.

3) **Interpretation**: Any questions of intent or interpretation of any condition will be resolved by the Executive Director of the Commission (hereinafter, "Executive Director") or the Commission.

4) **Assignment**: The permit may be assigned to any qualified person, provided the assignee files with the Commission an affidavit accepting all terms and conditions of the permit.

5) **Terms and Conditions Run with the Land**: These terms and conditions shall be perpetual, and it is the intention of the Commission and the Permittee to bind all future owners and possessors of the subject property to the terms and conditions.

3.0 SPECIAL CONDITIONS

1) **Future Availability of Alternative Storage Location:** Within three months of acceptance by another facility of the Class B and C waste stored at the Storage Facility, the Permittee shall submit a coastal development permit application to the Coastal Commission for removal of the waste and Storage Facility.

2) **Monitoring Bluff Slopes**:

   a) Baseline: Prior to starting construction, the Permittee shall survey the bluff slopes around the approved development to establish the location of the bluff edge and shall set permanent monuments sufficiently far back from the bluff edge to allow their use during future surveys. To fulfill this requirement, the Permittee may use the baseline or most recent monitoring report submitted pursuant to Special Condition 1 of CDP #E-05-001 for the Permittee's adjacent Independent Spent Fuel Storage Installation (ISFSI).

   b) Monitoring and Reporting: Thereafter, and no less than every five years, the Permittee shall monitor those bluff slopes for sliding, ground movement, or other motion. Monitoring shall be done using the measures and monitoring devices described in the *Safety Analysis Report* for the above-referenced ISFSI submitted as part of CDP #E-05-001. No later than June 30 of each subsequent fifth year, the Permittee shall submit a report, prepared by a licensed Civil Engineering Geologist, to the Executive Director describing the results of the monitoring. If during any five-year period, monitoring shows any horizontal or vertical movement of the bluff slope or edge of two feet or greater, monitoring and reporting shall then be done on an annual basis, with the report described above being submitted no later than June 30 of each year. If during five consecutive annual monitoring periods, movement of the bluff slope and edge totals less than two feet, monitoring and reporting may return to a five-year period. The Permittee shall notify County staff and the Executive Director immediately in the event of slope failure or movement that may indicate imminent slope failure. If monitoring results for any reporting period indicate slope movement that may require additional measures to protect the development, the Permittee shall submit a coastal development permit application or request for an amendment to this permit. The Permittee may comply with these monitoring and reporting requirements by incorporating them into the reports required pursuant to Special Condition 1 of CDP #E-05-001.

3) **Monitoring Shoreline Erosion**:

   a) Baseline: Prior to starting construction, the Permittee shall survey the shoreline adjacent to the site of the approved development to establish the location of the existing riprap and the lower toe of the bluff. To fulfill this requirement, the Permittee may use the baseline or most recent monitoring report submitted pursuant to Special Condition 2 of CDP #E-05-001 for the Permittee's adjacent Independent Spent Fuel Storage Installation (ISFSI).

b) Monitoring and Reporting: Thereafter, and no less than every five years, the Permittee shall conduct surveys of the shoreline and lower toe of the bluff of the Storage Facility site. Surveys shall be conducted by a licensed Surveyor or Civil Engineer. Each survey shall be performed in the early spring when the beach level is lowest and the lower bluff face is most exposed, or as close to that time as is feasible. Each survey shall record the position of the lower toe of the bluff using conventional survey techniques (total station, rod and level, plane table, etc.), differential Global Positioning System (GPS), photogrammetry (with current ortho-rectified aerial photographs), by ground Light Detection and Ranging (LIDAR), or other comparable technique. Survey techniques used shall be consistent throughout the survey period or shall allow consistent comparison of yearly data. Survey measurements shall be accurate within 0.5' horizontal and 1.0' vertical.

The Permittee shall report the results of each survey to the Executive Director by June 30 of every fifth year. Each report shall include narrative and mapped analysis of the survey data, a determination of the average retreat rate for the full survey area, identification of any locations where the bluff change rate is more than two standard deviations from the average. Bluff change shall be calculated at 50' intervals (or smaller) to determine the average retreat, standard deviation and to identify areas of outlier retreat rates.

If monitoring results for any survey indicate the development may be threatened by coastal erosion in less than five years, the Permittee shall submit within sixty days of the annual survey report a coastal development permit application or request for an amendment to this permit to relocate the approved development or other project components as needed.

The Permittee may comply with these monitoring and reporting requirements by incorporating them into the reports required pursuant to Special Condition 2 of CDP #E-05-001.

4) Visual Resources: All structures and fixtures of the approved development's blufftop site visible from public areas shall be painted or otherwise finished in neutral tones that minimize their visibility from those public areas. Lighting at the storage area shall be directed downward and inward to the extent allowed by Nuclear Regulatory Commission requirements.

4.0 FINDINGS AND DECLARATIONS

The Commission finds and declares as follows:

4.1 PROJECT PURPOSE AND DESCRIPTION

4.1.1 PROJECT PURPOSE

The primary purpose of the project is to construct and operate a Class B and C Waste Storage Facility (Storage Facility) at the site of the Humboldt Bay Power Plant (HBPP). The Storage Facility would be used to store low-level radioactive waste that is either already on site at the inactive HBPP nuclear generating unit, or is being generated through activities associated with the ongoing demolition and decommissioning of that unit. Constructing the proposed Storage Facility would allow the demolition and decommissioning of the power plant's nuclear unit to continue on schedule.

Type of waste storage: The "Class B and C wastes" to be stored in the proposed storage facility are regulated by the Nuclear Regulatory Commission. They are characterized as low-level wastes based on their relatively low concentrations of long-lived radionuclides and associated shorter-lived precursors, as well as the relatively low magnitude doses that could be expected from these materials.[1] Examples of these wastes include components from the power plant's reactor vessel, such as various stainless steel parts and ion exchange resins. Although these are considered low-level wastes, handling, transport, and storage of Class B and C wastes require protective measures to ensure their stability and to provide protection from exposure to the environment. Only wastes generated at HBPP would be stored at this facility.

Role of Storage Facility in HBPP decommissioning: The proposed Storage Facility plays a key role in PG&E's HBPP decommissioning schedule. As noted in Section 4.3 below, the NRC license for HBPP anticipates that decommissioning of the nuclear unit will be complete by 2015. To allow the ongoing decommissioning activities to continue, and to meet that schedule, PG&E will soon need suitable storage for HBPP's Class B and C wastes. Although there are several facilities in the U.S. capable of storing these types of wastes, none are currently available for storing the wastes from HBPP. PG&E anticipates that a recently opened facility in Texas may become available within the next few years and it is seeking the necessary approvals to transport and store these wastes there. Even if it constructs the proposed HBPP Storage Facility, PG&E expects to eventually ship these Class B and C wastes to another facility when one becomes

[1] As described in 10 CFR 61.55, the NRC categorizes low-level radioactive wastes as Class A, B, or C. Class A wastes are very low level and are not required to be segregated from other wastes for disposal. Class B wastes must be stored in a manner to ensure stability after disposal, and Class C wastes require additional measures to protect against release or intrusion. More detailed descriptions are available in the NRC's Regulatory Issue Summary 08-12 *Consideration for Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Material Licenses*, NRC Policy Issue SECY-08-0124 *Annual Review of the Need For Rulemaking and/or Regulatory Guidance on Low-Level Radioactive Waste Storage*; and EPRI's *Guideline for Operating an Interim On-Site Low-Level Radioactive Waste Storage Facility*.

available so that no regulated nuclear materials remain at the HBPP site and so that PG&E may surrender its NRC license. However, to address the uncertainty as to whether other facilities might be available within PG&E's decommissioning timeframe, PG&E has proposed the Storage Facility as a means to stay on its required decommissioning schedule.

Presence in perpetuity: Because there is no certainty as to if and when other facilities might be available, the Commission's Findings presume that the waste is to remain at this location for the foreseeable future. This approach is similar to that the Commission used in its review and approval of PG&E's Independent Spent Fuel Storage Installation (ISFSI), which is adjacent to the proposed Storage Facility site and which the Commission approved through CDP #E-05-001 in 2005. The ISFSI is used to store spent nuclear fuel and "Greater Than Class C" wastes generated at the HBPP, both of which are considered high-level radioactive waste. The Findings and Special Conditions herein are modeled on those the Commission approved for the ISFSI.

4.1.2 PROJECT DESCRIPTION

Background & History: The HBPP is located just south of Eureka along the shoreline of Humboldt Bay near the community of King Salmon (see Exhibit 1 – Map of Project Location). The power plant consists of two inactive natural gas-powered electrical generating units and an inactive nuclear generating unit. The gas-powered units were shut down in 2010 upon start-up of PG&E's new Humboldt Bay Generating Station, which is located adjacent to the HBPP.

The nuclear unit was built in the early 1960s and was shut down in July 1976, due to concerns about the facility's seismic safety. In 1983, PG&E determined it would not be cost-effective to perform the modifications necessary to re-start the unit and so then started the decommissioning process. In 1988, the NRC approved PG&E's plan to put the plant in "safe storage" (known as SAFSTOR) and issued PG&E a "possess-but-not-operate" license for nuclear materials in the power plant that expires in 2015. Over the past approximately twenty years, PG&E has taken a number of actions to prepare for decommissioning and to improve safety or environmental conditions at the facility. These include removing asbestos and other materials, demolishing various structures, and preparing the site for full demolition and decommissioning.

Main Project Elements: The Storage Facility would include a 30- by 60-foot concrete storage vault placed below grade about ten feet into the ground. The structure would hold up to ten steel liners containing the Class B and C wastes. The liners are designed to contain the wastes within the vault and to allow the wastes to be transported to another facility without having to remove them from the liners. The vault would be surrounded by a secured area of about 5,000 square feet with chain link fencing, perimeter lighting, and security monitors. Much of the Storage Facility would be within the outer security zone around the ISFSI, known as the "owner-controlled area". This area is regulated pursuant to 10 CFR 72.106, which establishes federal requirements for limiting an individual's exposure to radiation from the stored fuel and establishes various security measures (see additional discussion in Section 4.3 below).

Construction is expected to take about six months and would require 10 to 20 construction workers. Work would involve excavating up to about 3,000 cubic yards of soil from the site to about 15 feet below grade, constructing the in-ground concrete and steel vault, placing concrete and steel lids over the vault, backfilling around the structure with about 2,000 feet of soil, and installing the security fencing, lighting and monitoring equipment. Soil would be stockpiled on site, with excess material used as part of future site grading conducted during power plant demolition. Work would be conducted primarily during daylight hours.

Independent Spent Fuel Storage Installation (ISFSI): Adjacent to the proposed Storage Facility site is PG&E's recently constructed ISFSI, which contains spent fuel from the HBPP nuclear unit. Although known as "spent" fuel, it remains highly radioactive for thousands of years. Once removed from a power plant, spent fuel is stored in wet storage pools for at least five years to allow it to "cool" sufficiently to be placed in dry casks. It may then be moved to other forms of storage, such as that provided by an ISFSI. There are several types of ISFSI designs, with most being some type of storage cask secured in or on a thick concrete pad within a secured area. The storage casks are generally multi-layer containers made of concrete, steel, and other metals to contain most of the radioactivity being generated by the spent fuel. The NRC has licensed more than 30 ISFSIs at nuclear plants around the U.S.

Most of the HBPP ISFSI is below grade, which improves its response during seismic events (see the more detailed discussion of this issue in Section 4.4.1 of these Findings). Similar to its proposal for the Storage Facility, PG&E proposed constructing the ISFSI because there are no offsite facilities available to store spent nuclear fuel and PG&E needed the storage to allow decommissioning of the power plant complex.

Site Environmental Characteristics: The HBPP site covers about 143 acres along the shore of Humboldt Bay just east of the community of King Salmon (see Exhibit 2 – Site Plan & Facility Layout). The site consists largely of former coastal terrace prairie that has been substantially disturbed due to the long-term presence of the power plant. It extends along several hundred feet of shoreline, most of which includes riprap that has been placed to protect the power plant. Much of the site is adjacent to the open waters of Humboldt Bay and extensive areas of mudflats and tidal marsh.

The proposed Storage Facility would be located on an on-site coastal bluff known as Buhne Point, just northwest of the power plant. At its highest point, the bluff is about 60 feet above Humboldt Bay. The Storage Facility would be at about 36 to 40 feet elevation, which is about the highest remaining developable part of the bluff. The adjacent ISFSI occupies an area at about 44 feet elevation. In the past, much of the upper area of the bluff served as the location of oil tanks used by the power plant, which have since been removed. It is now the site of the aforementioned ISFSI, along with a service road, and some areas of disturbed habitat. The proposed Storage Facility would be located entirely on already developed or previously-disturbed sites just to the east of the ISFSI.

Project Decommissioning: If another facility becomes available for Class B and C waste storage, PG&E would likely propose to remove the waste from the Storage Facility, transport it to the alternative location, and decommission this Facility. Pursuant to **Special Condition 1**, should another facility accept the waste, PG&E would submit a coastal development permit application to remove the Storage Facility.

4.2 PROJECT ALTERNATIVES

As described below, there are currently no less environmentally damaging and feasible alternatives available to PG&E for Class B and C waste storage:

No Other Available Facilities: These types of wastes are generally stored either at centralized facilities that accept wastes from multiple sources or at facilities built at individual power plants to store wastes from just those power plants. There are three centralized facilities in the U.S. that accept Class B and C wastes – in Washington State, South Carolina, and Texas – but each operates under multi-state compacts that do not at this time allow for wastes generated in California. Recently approved legislation allows the facility in Texas to now accept "out-of-compact" wastes, and PG&E is working to secure the approvals needed to transport and store its HBPP Class B and C wastes at that facility. However, PG&E has not yet received the necessary approvals, and in response to the uncertainty about when or whether it will receive those approvals, it has proposed the onsite Storage Facility to ensure it can continue its scheduled HBPP demolition and decommissioning.

Regarding the facilities for individual power plants, there are a number of these types of facilities around the U.S., including one at PG&E's Diablo Canyon Power Plant. However, in most cases, including Diablo Canyon, the license for such facilities allows only wastes generated at the site's power plant to be stored within.

"No Project" Alternative: With the lack of other available facilities, PG&E could choose to not construct and operate its own Storage Facility at HBPP, and instead keep the wastes where they are until an offsite facility is able to take the wastes. While this is an available alternative, it would not allow for the scheduled decommissioning of the power plant, and, as described in Section 4.4.6 below, it is not a less environmentally damaging alternative due largely to the potential risks associated with keeping the wastes in the power plant at a lower elevation and less seismically-secure configuration than would be provided in the proposed Storage Facility. Although PG&E anticipates that it could receive the needed approvals for off-site storage sometime during the next few years, the uncertainty of when or whether this would occur requires an assumption that the "no project" alternative would result in the Class B and C wastes remaining in the inactive power plant for the foreseeable future.

Consequences: Without evidence of a feasible and available alternative for offsite storage, the Commission must presume that the proposed Storage Facility, if built, would remain in perpetuity. As noted above, this is similar to the Commission's approach approving PG&E's ISFSI, and the Findings herein are based largely on the Findings approved for that project (CDP #E-05-001). The Commission therefore presumes that the proposed Storage Facility will affect

coastal resources for the foreseeable future, and the Findings and Special Conditions herein are based on this presumption. Should an alternative become available and PG&E is able to store these wastes elsewhere, **Special Condition 1** requires that PG&E submit a CDP application for removal of the Storage Facility.

4.3 COASTAL COMMISSION JURISDICTION

Permit Jurisdiction: The project is entirely within the coastal zone and within the Commission's retained jurisdiction. The only necessary permit from local government is a building permit from Humboldt County, which PG&E will obtain prior to construction. Discharges during construction of the Storage Facility will likely require either a modification to the HBPP's NPDES permit or a Construction Stormwater Permit from the Regional Board. Once constructed, any stormwater discharges from the project area would be incorporated into the power plant's NPDES permit.

Federal permits and federal pre-emption: The Storage Facility would be subject to approval by the Nuclear Regulatory Commission. PG&E anticipates that the Facility would require an extension of its current "possess but not operate" license past the current expiration date in 2015.

The NRC has exclusive jurisdiction over radiological aspects of the proposal. The state is preempted from imposing upon operators of nuclear facilities any regulatory requirements concerning radiation hazards and nuclear safety. The state may, however, impose requirements related to other issues. The U.S. Supreme Court, in *Pacific Gas and Electric Company v. State Energy Commission, 461 U.S. 190, 103 S.Ct. 1713 (1983)*, held that the federal government has preempted the entire field of "radiological safety aspects involved in the construction and operation of a nuclear plant, but that the states retain their traditional responsibility in the field of regulating electrical utilities for determining questions of need, reliability, costs, and other related state concerns." The facility's current and proposed possession, handling, storage, and transportation of nuclear materials are therefore precluded from state regulation regarding radiation hazards and nuclear safety. The Coastal Commission findings herein address only those state concerns related to conformity to applicable policies of the Coastal Act, and do not evaluate or condition the proposed project with respect to nuclear safety or radiological issues.

4.4 CONFORMITY TO APPLICABLE POLICIES OF THE COASTAL ACT

4.4.1 GEOLOGIC HAZARDS

Coastal Act Section 30253 states, in relevant part:

> *New development shall:*
> *i. Minimize risks to life and property in areas of high geologic, flood, and fire hazard.*
> *ii. Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs…*

The proposed site is located near the Humboldt Bay shoreline, directly opposite the mouth of the Bay. The Storage Facility would be sited about two hundred feet west of the power plant on Buhne Point, a coastal bluff that rises about 60 feet above the Bay. The bluff consists largely of a marine terrace deposit known as the Hookton Formation, which is made up of poorly cemented sands and interbedded clays. The site is subject to several geologic hazards, including seismic activity, slope failure, tsunami runup, and coastal erosion, each of which is briefly summarized below. Exhibit 3 provides a Geotechnical Review Memorandum that describes the Commission staff geologist's review of the site's geologic hazards conducted for a previous project, the aforementioned ISFSI approved by the Commission in 2005 (CDP E-05-001). The memorandum also summarizes the staff geologist's recommendations regarding the proposed ISFSI's conformity to Coastal Act policies related to risks from those geologic hazards.

Site seismic characteristics: The site is at the southern end of the Cascadia Subduction Zone near a location known as the "Mendocino Triple Junction" where three crustal plates converge – the Pacific Plate to the south; the Gorda Plate and its extension, the Juan de Fuca Plate to the north; and, the North American Plate to the east. This area includes several active faults capable of substantial seismic movement, and has been subject to very large earthquakes of about magnitude 9.0 that occur roughly every 300 to 400 years and usually result in large tsunamis.[2] The last such earthquake occurred in 1700. Along with these very large quakes, the area has a history of earthquakes of greater than magnitude 5.0, with more than 120 earthquakes over that magnitude recorded within 100 miles of the proposed site and 10 over magnitude 7.0.

- ***Ground motion hazard:*** The area is also subject to seismic events that cause relatively high levels of ground shaking, which is another indicator of earthquake strength.[3] The

[2] An earthquake's magnitude is a measure of energy released by an earthquake, as expressed on a logarithmic scale measuring the horizontal displacement caused by an earthquake and detected on a seismograph. A magnitude 6 earthquake, for example, produces ten times the amount of ground shaking as a magnitude 5 earthquake.

[3] Ground shaking is a measure of the movement caused by the earthquake compared to the rate of acceleration caused by gravity. "Peak ground acceleration" (PGA) can be measured as a vertical or horizontal movement. For example, a PGA of 0.1 g means that the ground accelerated at one-tenth the rate of acceleration resulting from gravity (9.81 meters per second squared). PGA depends not only on the intensity or magnitude of an earthquake, but on the distance from the quake and on characteristics of the site – for example, ground acceleration will vary based on the depth and firmness of soil or bedrock at the site.

relationship between an earthquake's magnitude and its rate of ground shaking is not linear, however – for example, the two quakes that produced the largest recorded ground motions at the site (0.30 g and 0.55 g) were of magnitude 5.3 and 5.4, respectively, while a recent magnitude 7.2 quake in June 2005 produced ground motion of less than 0.1 g. HBPP has experienced six earthquakes with ground motion of greater than 0.10g. The effects of an earthquake on structures can also vary by the frequency (in cycles per second) of the seismic waves they generate, with shaking at high frequencies being generally more damaging to smaller, more rigid structures, and shaking at low frequency usually more damaging to larger or more flexible structures.

The area around the proposed Storage Facility includes several active faults or fault traces. The Buhne Point Fault surfaces a few hundred feet to the southwest of the proposed facility, the surface trace of the Discharge Canal Fault lies about four hundred feet to the northeast, and the Bay Entrance Fault is about 1500 feet to the west. The faults create a wedge that is uplifted during fault movements and that is largely responsible for the topography and elevation of Buhne Point. Less than two miles away is the surface trace of another fault underlying the site – the Little Salmon Fault – which is thought to rupture concurrently with the Cascadia Subduction Zone.

The Storage Facility is designed to withstand the "maximum credible earthquake" likely to occur at the site. This design earthquake is of magnitude 9.1, based on the probabilistic assessment PG&E conducted for the NRC to calculate the likelihood of this event during a 2000-year return period. This magnitude is roughly equivalent to the recent Tohoku earthquake in northern Japan and the Sumatra earthquake of December 2004. Such an earthquake at the HBPP location could result in a peak acceleration of almost 2.9 g, which is equivalent to the force near the upper limit of any earthquake anywhere in the world. In reviewing the proposed ISFSI in 2005, the Commission concurred with the staff geologist's determination that the overall assessment provided by PG&E provided a conservative design basis for the ISFSI, and it similarly concurs that this assessment provides a conservative design basis for the Storage Facility. The Commission therefore concludes that designing the Storage Facility to withstand this rate of ground shaking is consistent with Coastal Act section 30253(1) with respect to the ground motion hazard.

- ***Liquefaction:*** Liquefaction can occur during ground shaking when loosely consolidated soils are saturated with water. However, liquefaction is not likely at the Storage Facility site, as the soils there – generally dense and stiff clays and sand – are a type generally not subject to liquefaction. Additionally, Standard Penetration Tests conducted on the similar soils at the adjacent ISFSI site showed that they were unlikely to be subject to liquefaction.[4] As a result, the Commission concurs with the conclusion of both the staff geologist and PG&E that liquefaction will not occur in these soils.

[4] Standard Penetration Tests involve striking a sampling tube with a standard weight hammer to determine how many blows it takes to drive the tube 12 inches into the soil. Generally, where the soils take 30 blows or more, liquefaction never occurs, and where soils take between 20 and 30 blows, liquefaction is very rare. Most of the tests conducted at the site resulted in counts above 30, with the rest above 20 and spatially isolated from one another.

- ***Slope stability:*** The proposed Storage Facility site is surrounded by the sloped sides of Buhne Point. The bluffs to the north and west are relatively steep, and the slopes to the east and south are relatively gentle. To ensure slope stability for most coastal developments, a safety factor of at least 1.5 over the life of the proposed project is considered necessary. For the ISFSI, PG&E assessed slope stability under static conditions and determined the factor of safety to be 2.69 for the north side of the site (the coastal bluff) and 4.94 for the southern slope. The Storage Facility would be located about 75 feet further from the steeper slopes than the ISFSI. While these safety factors would be adequate for a development with a standard 50-75 year operating life, this level of stability cannot be assured for a project expected to be on site in perpetuity, particularly as coastal erosion impinges on the site.

  Additionally, the slope stability analyses for the ISFSI indicated yield accelerations—the level of ground shaking needed to instigate landslides—to be 0.69g for the coastal bluff and 0.66g for the southern slope. Since the levels of ground shaking calculated for the design basis earthquake are higher than these slope stability levels, it is likely that the slopes will fail during such an earthquake. The expected amount of displacement from a 0.69g event ranges from 0.2 to 0.5 feet, which is far in excess of the approximately two-inch displacement (50 mm) usually considered acceptable for new construction, though PG&E has indicated that the design of the Storage Facility can accommodate this amount of displacement. With the expected slope failure during the design basis earthquake, however, the Commission finds that the proposed development is ***not*** consistent with the requirement of Coastal Act Section 30253(1) to minimize risk with respect to slope stability.

- ***Surface fault rupture:*** As mentioned above, several active faults underlie or are near the site. The Little Salmon Fault, the Bay Entrance Fault and the Buhne Point fault all dip to the northeast and underlie the site at various depths. The surface trace of the Buhne Point fault lies a few hundred feet southwest of the Storage Facility site, and the surface trace of the Discharge Canal fault lies less than 500 feet to the northeast. These two faults define a wedge, on which the Storage Facility site is located. Through movement on these faults, the wedge is gradually uplifted and tilted. Although trenches across the nearby ISFSI site encountered sand-filled fractures, none of them showed detectable offset and so are not considered active faults. PG&E believes that future deformation from displacement on the Little Salmon fault will be minor tilting with no differential displacements. The Commission's staff geologist agrees that this is likely, but additionally believes it is possible that one or both of these faults could shift position and that future fault movement could occur at the Storage Facility site. PG&E notes that the Storage Facility would not be located over a known surface fault; however, it is quite common for faults to rupture along traces offset from previous ruptures, defining a "fault zone" rather than a single fault plane. This is the case for these two faults, although the zone of fracturing does not appear to be more than a few tens of feet wide. It is also possible that a future movement along these faults could result in a different style of faulting. PG&E has additionally provided documentation showing that large, massive structures (such as ammunition bunkers, bank vaults, and the like) have performed well in previous earthquakes in Taiwan, Turkey, and Nicaragua. Although these anecdotal observations are encouraging, there also are many examples of quite large, massive buildings being damaged by surface faulting. Given the proximity of the

proposed Storage Facility to these active faults, and due to the Facility's presumed perpetual presence at this site, the Commission concurs with the staff geologist's position that the development could be subject to fault rupture during its expected operating life. Accordingly, the Commission finds the proposed Storage Facility is ***not*** consistent with the requirement of Coastal Act Section 30253(1) to minimize risk with respect to surface fault rupture.

- ***Tsunami:*** The proposed Storage Facility would be located about 36 to 40 feet above Humboldt Bay and about 200 feet from the Bay shoreline. Given the history of tsunamis in the area and the characteristics of the site, the Storage Facility is expected to be subject to tsunami hazards. The site is at high risk for a tsunami generated from local submarine landslides, a distant earthquake, or a major Cascadia Subduction Zone earthquake. Because the site is directly opposite the mouth of Humboldt Bay, it could readily be subject to both direct and indirect tsunami wave energy from such events.

  The surrounding region is the most studied area of North America's west coast with respect to tsunami hazards. Many of the relevant studies were summarized in the *Safety Analysis Report* (SAR) prepared by the Nuclear Regulatory Commission in conjunction with its licensing of the ISFSI (see NRC Docket No. 72-77). Based on nearby site characteristics, the SAR concludes that the tsunami generated by the last major Cascadian Subduction Zone earthquake in 1700 reached an elevation of about 38 feet on Humboldt Bay's North Spit, just opposite the HBPP. Its estimates of the maximum runup for other nearby "paleotsunamis" along the open coast vary from about 26 to 33 feet at Del Norte County's Lagoon Creek, about 70 miles distant, and from 66 to 69 feet in Orick, about 50 miles north of HBPP. At the entrance to Humboldt Bay, the SAR cites maximum runup estimates ranging from 16 to 33 feet (above Mean Lower Low Water, or MLLW). Most models predict that the tsunami height would decrease upon entering the bay, with maximum runup at the power plant of between 3 and 23 feet above MLLW. However, these estimates do not take into account tide stage, storm surge, or future sea level rise.

  As part of its previous proposal for siting the nearby ISFSI, PG&E assessed how the site was likely to be affected by tsunamis. It determined that the maximum tsunami runup resulting from a Cascadian Subduction Zone earthquake during Mean Higher High Water (MHHW) would be from about 23 to 38 feet. Because the ISFSI site is at about 44 feet, and because it is below grade, PG&E concluded that the ISFSI would not be inundated and would not be damaged by debris carried by the tsunami. The Storage Facility would similarly be largely below grade, but would be at a slightly lower elevation, about 36 to 40 feet, and within the predicted range of tsunami runup.

  For several reasons, when considering the ISFSI, the Commission did not concur with PG&E's conclusions regarding the effects of tsunamis, and it similarly concludes that the Storage Facility will not be safe from tsunami hazards either during the relatively short-term or in perpetuity. First, similarities between the expected Cascadian Subduction Zone earthquakes, the December 2004 Sumatran earthquake, and the March 2011 Tohoku earthquake raise doubts as to the validity of the expected tsunami runup height at the site.

The Sumatran quake resulted in tsunami runups of as much as 130 feet, which is about three times higher than the runup predicted at HBPP, and the mechanisms for the earthquakes and the generation of tsunamis in each area are similar. The more recent March 2011 Tohoku earthquake in northern Japan, which was of similar magnitude to the Sumatra quake and was a subduction-type earthquake, did not have as high a tsunami runup as the Sumatra quake, but the runup was still higher than had been predicted. Additionally, the proposed 38-foot runup level for the ISFSI site was based only on the height above Mean Higher High Water. It does not include the height increase customarily added to the prediction to account for the tsunami occurring during a 100-year storm surge. This would put the runup at an even higher level, and above the 36- to 40-foot elevation of the Storage Facility. Further, both the ISFSI and the Storage Facility sites are on a peninsula made up of poorly consolidated soils that during a tsunami would be subject to wave energy from both incoming and retreating waves, which could result in substantial erosion and damage.

In its review of the ISFSI, the Commission requested PG&E evaluate the longer-term potential for tsunami events, based largely on the expectation that the ISFSI would remain in perpetuity. As noted above, because there are no currently available alternative sites for the proposed Storage Facility, the Commission must assume, for purposes of its review, the perpetual presence of the Facility at the site. PG&E applied the rate of tectonic uplift at Buhne Point (estimated at about 1.3 feet per 100 years) to several scenarios for anticipated rates of sea level rise over geologic time. The analyses found that during the next several thousand years, overtopping of the site would be likely, though increased glaciation expected over the subsequent 10,000 years would result in lower sea levels, exposing the site to fewer risks associated with sea level rise or tsunamis. However, based on the above, the site is expected to be subject to tsunami-related risks. The Commission therefore finds that the siting of the Storage Facility is ***not*** consistent with the requirement of Section 30253(1) to minimize risks associated with tsunamis and tsunami runup.

- ***Coastal Erosion:*** Coastal Act Section 30253(2) requires, in part, that new development not require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs. The Storage Facility would be located adjacent to a shoreline area where historic coastal erosion rates have been among the highest in the state. This has been due in part to its location across from the mouth of Humboldt Bay and the jetties built to maintain the Bay entrance, but which also act to direct wave energy towards the site.

  As part of its shoreline erosion assessment done for the ISFSI, PG&E identified a substantial long-term shoreline retreat adjacent to the HBPP site. PG&E's assessment showed that the shoreline retreated between about 1250 and 1500 feet between 1858 and 2000, although the retreat rate during this period was highly variable. For example, the retreat rate averaged 24 to 35 feet per year between 1858 and 1870, averaged 4 to 9 feet per year between 1870 and 1942, and averaged 44 to 65 feet per year between 1942 and 1959. Since 1952, however, the HBPP site has been protected by a riprap revetment built to protect the power plant, which has essentially halted retreat of the shoreline. The bluff above the revetment has continued to retreat, though, at a rate of roughly one to four inches per year. It will likely continue to retreat until it attains a stable slope angle.

The slope stability analyses done for the ISFSI and which the Commission is applying to the proposed Storage Facility is based on the current configuration of the bluff. Even with the relatively modest rate of bluff retreat predicted with the revetment in place, the slope stability static factor of safety is lower, and its expected seismic displacement higher, than the calculations presented by PG&E. The site is protected from coastal erosion primarily by a revetment that has required extensive maintenance in the past, and will only remain safe in the future with continued maintenance and, perhaps, expansion of the coastal armoring.

Further, with predicted sea level rise, overtopping of the existing revetment and erosion of the upper bluff by direct wave attack is likely within the next several hundred years. Accordingly, it is likely that ensuring the Storage Facility's stability will require construction of some type of upper bluff shoreline protection device. To better assess the rate of erosion of both the bluff and the shoreline, and to provide adequate time to plan for, design, and implement any necessary shoreline protection, **Special Conditions 2 and 3** would require PG&E to monitor erosion and to report to the Executive Director when erosion would cause a threat to the ISFSI's stability. These Special Conditions are based on similar conditions from the coastal development permit the Commission approved for the ISFSI (see Exhibit 4 – Relevant Special Conditions of CDP E-05-001). A key difference of the Special Conditions for the Storage Facility is that they allow PG&E to use the baselines established for the ISFSI as being suitable for the Storage Facility.

Even with these conditions, however, the proposed development would not be adequately protected from coastal erosion and is likely to require future shoreline protection. The Commission therefore finds that the siting of the Storage Facility is ***not*** consistent with the requirement of Section 30253(1) to minimize risks associated with coastal erosion and to avoid the need for shoreline protective devices.

Conclusion: The site and the proposed Storage Facility are likely to be subject to significant geologic hazards. Although PG&E believes that the Storage Facility design is adequate to withstand these hazards, the Commission finds that siting the Facility at this location does not fully conform to the requirement of Section 30253(1) that new development minimize risks to life and property, specifically the risks associated with slope failure, surface fault rupture, tsunamis, and coastal erosion.

Even with the existing revetment and with **Special Conditions 2 and 3**, the combination of bluff erosion and of sea level rise over the next several decades will likely require construction of additional shoreline protection on the bluff to protect the Storage Facility, and the Commission finds the Storage Facility would be inconsistent with the requirement of Section 30253(2) that new development not require shoreline protective structures during its anticipated operating life.

However, although siting the facility at this location results in inconsistencies with Sections 30253(1) and (2), to deny the proposed project or to modify it to remove these inconsistencies would result in effects on coastal resources that conflict with other Chapter 3 policies. The Commission must resolve these inconsistencies by applying Coastal Act Section 30007.5, as is described below in Section 4.5.6 of this report.

4.4.2 VISUAL RESOURCES

Coastal Act Section 30251 states, in relevant part:

> *The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas…*

The Storage Facility would be located near the top of a coastal bluff about 150 feet from the shoreline of Humboldt Bay. Much of the structure would be constructed below grade and would not be visible from nearby public areas or coastal waters; however, it would include a new fence and associated lighting and security equipment, all located near the top of a visually prominent coastal bluff. These project elements are necessary parts of the Storage Facility's safety and security measures pursuant to NRC requirements.

Although these project elements are similar to those currently in place at the adjacent ISFSI, they would represent an increase of adverse visual effects into an area visible from the adjacent shoreline, from parts of the nearby community of King Salmon, and from other nearby public viewpoints. These areas are valued in part for their views of the Bay, for wildlife and bird watching, and for other activities done in part in appreciation of the scenic qualities of Humboldt Bay. Additionally, the adverse visual effects of this Facility would increase with time due in part to their increased prominence as the nearby power plant is demolished and decommissioned and due to the expected presence of the Facility at this site in perpetuity.

To reduce the project's impacts on visual resources, **Special Condition 4** requires PG&E to use neutral tones on all the Storage Facility's visible structures and would require PG&E to direct all necessary lighting downward and inward to the extent allowed by NRC security requirements. Even with this Special Condition, however, the Storage Facility's location on a visually prominent bluff results in increased lighting and structures that would interrupt views to and along the scenic coastal waters and shoreline of Humboldt Bay.

Conclusion: The Commission therefore finds the project would be inconsistent with the requirement of Section 30251 that development be sited and designed to protect views to and along the ocean and scenic coastal areas. Additionally, although siting the Storage Facility at this location results in an inconsistency with Section 30251, to deny the proposed project or to modify it to remove this inconsistency would result in effects on coastal resources that conflict with other Coastal Act policies, including Sections 30230 & 30231 (marine resources and water quality), and 30240 (environmentally sensitive habitat areas). There are no measures available that would allow full consistency with Section 30251 and the other applicable Coastal Act policies. The Commission must therefore resolve this conflict by applying Coastal Act Sections 30007.5 and 30200(b), which is discussed below in Section 4.5.6 of this report.

4.4.3 MARINE RESOURCES AND WATER QUALITY

Coastal Act Section 30230 states:

> *Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Coastal Act Section 30231 states:

> *The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.*

The HBPP site is adjacent to Humboldt Bay and includes extensive areas of coastal wetland, mostly outside the developed footprint of the power plant and its associated infrastructure. The Storage Facility would be built about 200 feet from Humboldt Bay and would involve excavation, grading, and soil stockpiling, along with placement of new structures. The location is covered by impervious surfaces developed as part of the power plant. The HPBB is currently subject to an NPDES permit issued by the North Coast Regional Water Quality Control Board. The permit includes conditions related to allowable volumes and types of non-radiological discharges from the various facilities on the site and other measures meant to prevent adverse impacts to coastal waters.[5]

Construction of the Storage Facility would be subject to additional review and possible permitting by the North Coast Regional Water Quality Board for conformity to requirements of a Construction Stormwater Permit and/or incorporation into other HBPP NPDES permits. Project-related discharges are subject to Best Management Practices to avoid and minimize adverse effects to nearby waterbodies. The project would take place within an area already subject to NPDES Best Management Practices and other water quality control measures. Ongoing operation of the Storage Facility would result in relatively minor changes to the drainage patterns and stormwater runoff from the site. The HBPP NPDES permit would likely be modified to

[5] As noted previously, storage and use of hazardous radioactive materials, including the spent fuel, is subject to the requirements of the NRC. State and local governments are pre-empted by federal law from regulating activities related to nuclear safety and radiological hazards. Similarly, the design elements of the Storage Facility related to nuclear safety and radiological hazards are subject solely to requirements imposed by the federal government.

incorporate any Storage Facility-related discharges. With these Best Management Practices and water quality measures in place, normal Storage Facility operations are not expected to adversely affect marine resources or coastal water quality, and as they are a part of the overall power plant decommissioning, may result in improvements to water quality.

Conclusion: Based on the above, the Commission finds that the project, as conditioned, conforms to the policies of Coastal Act Sections 30230 and 30231.

4.4.4 ENVIRONMENTALLY SENSITIVE HABITAT AREAS (ESHA)

Coastal Act Section 30240(b) states:

> *Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.*

Much of the HBPP site is former coastal prairie terrace, although the power plant's presence during the past nearly fifty years has resulted in significant areas of development, impervious surfaces, and other site disturbances. However, much of the area surrounding the HBPP includes mixed uplands and coastal wetlands, and the waters and shoreline of Humboldt Bay.

The Storage Facility would be built on a previously disturbed site at the power plant. PG&E's biological surveys conducted at HBPP over the past several years have identified a number of areas of habitat near the plant that could be suitable for sensitive species. For example, habitat at or near the site is considered suitable for several special-status fish species, including Chinook salmon, coho salmon, steelhead, coastal cutthroat trout, and tidewater goby, and several freshwater aquatic species, including northern red-legged frog, foothill yellow-legged frog, tailed frog, southern torrent salamander, and the northwestern pond turtle. None of these species have been observed at the proposed Storage Facility site, however, and its construction and operation are not expected to adversely affect the species or the habitat listed above.

Indirect impacts to the nearby environmentally sensitive habitat areas due to runoff and noise are not expected to cause adverse impacts. Runoff would be controlled through Best Management Practices required as part of the power plant's NPDES permits, and noise levels during construction are expected to be similar to levels already emanating from the operating power plant site. Soil removed during construction would be stored at a previously disturbed area near the power plant, accessible by an existing road. These soils would be graded and revegetated to reduce impacts due to sedimentation and runoff.

Conclusion: Based on the above, the Commission finds that the project conforms to the policies of Coastal Act Section 30240(b).

4.4.5 PUBLIC ACCESS AND RECREATION

Coastal Act Section 30210 states:

> *In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse.*

Coastal Act Section 30211 states:

> *Development shall not interfere with the public's right of access to the sea where acquired through use or legislative authorization, including, but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.*

Coastal Act Section 30212(a) states:

> *Public access from the nearest public roadway to the shoreline and along the coast shall be provided in new development projects except where: (1) It is inconsistent with public safety, military security needs, or the protection of fragile coastal resources, (2) Adequate access exists nearby, or, (3) Agriculture would be adversely affected. Dedicated accessway shall not be required to be opened to public use until a public agency or private association agrees to accept responsibility for maintenance and liability of the accessway.*

Coastal Act Section 30214 states:

> *(a) The public access policies of this article shall be implemented in a manner that takes into account the need to regulate the time, place, and manner of public access depending on the facts and circumstances in each case including, but not limited to, the following:*
> *(1) Topographic and geologic site characteristics.*
> *(2) The capacity of the site to sustain use and at what level of intensity.*
> *(3) The appropriateness of limiting public access to the right to pass and repass depending on such factors as the fragility of the natural resources in the area and the proximity of the access area to adjacent residential uses.*
> *(4) The need to provide for the management of access areas so as to protect the privacy of adjacent property owners and to protect the aesthetic values of the area by providing for the collection of litter.*
>
> *(b) It is the intent of the Legislature that the public access policies of this article be carried out in a reasonable manner that considers the equities and that balances the rights of the individual property owner with the public's constitutional right of access pursuant to Section 4 of Article X of the California Constitution. Nothing in this section or any amendment thereto shall be construed as a limitation on the rights guaranteed to the public under Section 4 of Article X of the California Constitution.*

(c) In carrying out the public access policies of this article, the commission and any other responsible public agency shall consider and encourage the utilization of innovative access management techniques, including, but not limited to, agreements with private organizations which would minimize management costs and encourage the use of volunteer programs.

Coastal Act Section 30221 states:

Oceanfront land suitable for recreational use shall be protected for recreational use and development unless present and foreseeable future demand for public or commercial recreational activities that could be accommodated on the property is already adequately provided for in the area.

Coastal Act Section 30234.5 states:

The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.

Coastal Act Section 30252 states:

The location and amount of new development should maintain and enhance public access to the coast by (1) facilitating the provision or extension of transit service, (2) providing commercial facilities within or adjoining residential development or in other areas that will minimize the use of coastal access roads, (3) providing nonautomobile circulation within the development, (4) providing adequate parking facilities or providing substitute means of serving the development with public transportation, (5) assuring the potential for public transit for high intensity uses such as high-rise office buildings, and by (6) assuring that the recreational needs of new residents will not overload nearby coastal recreation areas by correlating the amount of development with local park acquisition and development plans with the provision of onsite recreational facilities to serve the new development.

The Coastal Act's public access policies generally require that developments such as the proposed Storage Facility, located adjacent to the shoreline in an area with ongoing public use, not interfere with that use and provide access to the shoreline. In addition to these policies, and pursuant to state and federal law, public access established as part of a permit decision must generally be based on an appropriate nexus between the proposed project's effects on access and the measures taken to establish access – that is, there must be a credible relationship between any loss of access caused by the project and the measures required to replace or regain that access. Further, those measures must be roughly proportional to the effects of a project. As described below, however, this proposed project is not expected to cause additional effects on public access beyond those already occurring at the power plant site. The Commission's previous approval of the adjacent ISFSI addressed the types of public access effects that could result from the Storage Facility. These aspects of the project are detailed below.

Background and Existing Access: The Storage Facility would be within the 143-acre HBPP site about 200 feet from the Humboldt Bay shoreline. The HBPP site includes several hundred feet of shoreline, with public access provided along a path on top of the riprap placed to protect the power plant. This lateral accessway is used largely for low-intensity recreational uses, such as fishing, bird and wildlife watching, and scenic enjoyment of the Bay. A 2001 Humboldt Bay Trails Feasibility Study identified this accessway as an important link in the system of trails and public accessways around Humboldt Bay.[6] The accessway connects a trail in King Salmon to the west of the power plant site with a trail along the railroad to the north. It had existed as an informal trail for many years; however, based on the public access effects the Commission identified in its Findings for the previously-approved ISFSI (CDP #E-05-001), PG&E was required to protect the accessway through a deed restriction.

The ISFSI includes two NRC-required security zones – an innermost area of about 8000 square feet on the blufftop that is fenced and within which all public access is prohibited; and an outer "controlled area" that extends an additional 100 meters in all directions. The NRC requires that licensees have the ability to limit, but not necessary prohibit, access within this zone. The ISFSI controlled area extends off the PG&E site some distance into Humboldt Bay and includes about 500 feet of the shoreline accessway. As part of the ISFSI development, and to meet the above-referenced NRC requirements, PG&E installed two gates and fencing along the accessway. The gates remain open except during very limited times when required for security and safety reasons. They were closed, for example, when the spent fuel casks were being loaded into the ISFSI, and would be closed in the event of an ISFSI emergency or if the casks needed to be removed for maintenance; however, PG&E characterizes these latter two events as highly unlikely. Other than these very limited closures, providing continued public access to this area is consistent with required NRC safety and security measures.

In its approval of the ISFSI, the Commission required through a Special Condition that the lateral accessway along the PG&E site be protected through a deed restriction and that the protected access move with the shoreline (see Exhibit 4 – Relevant Special Conditions of CDP #E-05-001). This was based in part on the expected perpetual presence at the site of the ISFSI and its required security zones, as well as on expected site changes due to the inland movement of the shoreline resulting from coastal erosion and sea level rise. At some point, these changes would affect access due to placement of additional shoreline stabilization structures to protect the ISFSI or due to movement of the shoreline closer to the ISFSI and its inner security zone, which would result in public access being "squeezed out" of this stretch of shoreline. The ISFSI approval therefore resulted in a protected accessway along the length of shoreline adjacent to the HBPP.

No Additional Public Access Effects Due to the Storage Facility: For at least two reasons, the Storage Facility results in no additional limitations on public access. First, its security zones are smaller and do not require structures such as fences or gates across the existing public accessway. Second, both it and the ISFSI are presumed to exist at the site for the same amount of time – i.e., in perpetuity – so it does not cause a longer temporal effect on access. Because the

[6] See Redwood Community Action Agency, *Humboldt Bay Trails Feasibility Study*, prepared with funding by the California Coastal Conservancy, 2001.

accessway required of the ISFSI is to exist in perpetuity and is to move with the shoreline, any access effects resulting from the Storage Facility are already addressed through the Special Condition imposed as part of the Commission's ISFSI approval.

In addition, although the Storage Facility would be located between the nearest public roadway and the shoreline, the Commission is not requiring additional public access as it finds, pursuant to Coastal Act Section 30212(a), that adequate access exists nearby. This includes, for example, the lateral accessway discussed above, a beach and picnic area in nearby King Salmon, a boat launch at Field's Landing about a mile south of the site, and the Elk River Wildlife Area Viewpoint about a mile to the north.

Conclusion: Based on the discussion above, the Commission finds that the project conforms to the public access and recreation policies of the Coastal Act.

4.4.6 RESOLVING POLICY CONFLICTS

Coastal Act Section 30007.5 states:

> *The Legislature further finds and recognizes that conflicts may occur between one or more policies of the division. The Legislature therefore declares that in carrying out the provisions of this division such conflicts be resolved in a manner which on balance is the most protective of significant coastal resources. In this context, the Legislature declares that broader policies which, for example, serve to concentrate development in close proximity to urban and employment centers may be more protective, overall, than specific wildlife habitat and other similar resource policies.*

Coastal Act Section 30200(b) states:

> *Where the commission or any local government in implementing the provisions of this division identifies a conflict between the policies of this chapter, Section 30007.5 shall be utilized to resolve the conflict and the resolution of such conflicts shall be supported by appropriate findings setting forth the basis for the resolution of identified policy conflicts.*

As noted previously in these Findings, the proposed Storage Facility is inconsistent with Coastal Act Sections 30253(1)-(2) (geologic hazards) and Section 30251 (visual resources). However, as explained below, denying or modifying the proposed project to eliminate these inconsistencies would lead to nonconformity to other Coastal Act policies, namely Sections 30230, 30231 (marine biology and water quality), and 30240 (environmentally sensitive habitat areas).

Regarding its inconsistency with Section 30253(1)-(2), even though the Storage Facility's proposed location is the most suitable of the available on-site locations for reducing geologic risks, approving the Storage Facility at this location would not be fully consistent with the requirements of Section 30253(1) to minimize those risks. The Storage Facility would be located at a site subject to geologic risks associated with seismic activity, tsunami, surface rupture, and coastal erosion. Even with design measures to reduce the potential risks resulting

from these hazards, the Storage Facility's location does not minimize those risks and it is therefore inconsistent with Section 30253(1). Additionally, the Storage Facility's perpetual presence at this location would require construction of additional shoreline protection during the life of the project, which conflicts with the requirement of Section 30253(2) that new development not require protective structures that would substantially alter natural landforms along bluffs and cliffs. Regarding its inconsistency with Section 30251, the Storage Facility is proposed to be sited near the top of a coastal bluff, as this is the most suitable site for reducing risks from geologic hazards, though approving it at this location would not protect views to and along the ocean, which would make it inconsistent with that requirement of the Coastal Act's visual resource policy.

However, even with the above-identified nonconformity to Coastal Act policies, denying the Storage Facility on the basis of these inconsistencies would result in the continued presence of the Class B and C wastes in a less safe and less environmentally protective location – i.e., within an inactive power plant at a lower elevation where they would be subject to greater geologic risks than at the proposed Storage Facility location. Keeping the wastes at the power plant involves increased risk of release due to the site's geologic hazards, resulting in significant adverse impacts to marine biology, water quality, and environmentally sensitive habitat areas, which would be inconsistent with Coastal Act policies relevant to those coastal resources. In such a situation, when a proposed project is inconsistent with a Chapter 3 policy, and denial or modification of the project would be inconsistent with another policy, Section 30007.5 of the Coastal Act provides for resolution of such a policy conflict.

Applying Section 30007.5: As indicated previously, the standard of review for the Commission's decision on a coastal development permit in the Commission's retained jurisdiction is whether the proposed project is consistent with the Chapter 3 policies of the Coastal Act. In general, a proposal must be consistent with all relevant policies in order to be approved. If a proposal is inconsistent with one or more policies, it must normally be denied or conditioned to make it consistent with all relevant policies. However, the Legislature recognized through Sections 30007.5 and 30200(b) that conflicts can occur among those policies. It therefore declared that when the Commission identifies a conflict among the policies of Chapter 3, the conflict is to be resolved "in a manner which on balance is the most protective of significant coastal resources", pursuant to Coastal Act Section 30007.5.

Resolving conflicts through application of Section 30007.5 involves the following seven steps, each of which is explained in greater detail below, along with a description of how each applies to the proposed Storage Facility project:

1) The project, as proposed, is inconsistent with at least one Chapter 3 policy.
2) The project, if denied or modified to eliminate the inconsistency, would affect coastal resources in a manner inconsistent with at least one other Chapter 3 policy that affirmatively requires protection or enhancement of those resources.
3) The project, if approved, would be fully consistent with the policy that affirmatively mandates resource protection or enhancement.

4) The project, if approved, would result in tangible resource enhancement over existing conditions.
5) The benefits of the project are not independently required by some other body of law.
6) The benefits of the project must result from the main purpose of the project, rather than from an ancillary component appended to the project to "create a conflict".
7) There are no feasible alternatives that would achieve the objectives of the project without violating any Chapter 3 policies.

1) **The project, as proposed, is inconsistent with at least one Chapter 3 policy.** For the Commission to apply Section 30007.5, a proposed project must be inconsistent with an applicable Chapter 3 policy. In the case of this proposed Storage Facility, the inconsistency is with Sections 30253(1)-(2) and 30251.

2) **The project, if denied or modified to eliminate the inconsistency, would affect coastal resources in a manner inconsistent with at least one other Chapter 3 policy that affirmatively requires protection or enhancement of those resources.** A true conflict between Chapter 3 policies results from a proposed project which is inconsistent with one or more policies, and for which denial or modification of the project would be inconsistent with at least one other Chapter 3 policy. Further, the policy inconsistency that would be caused by denial or modification must be with a policy that affirmatively mandates protection or enhancement of certain coastal resources. Denial of the Storage Facility would be inconsistent with three policies of this type –Section 30230, which requires, in part, that "Marine resources shall be protected for such uses"; Section 30231, which requires, in part, that biological productivity "shall be maintained"; and Section 30240, which requires, in part, that environmentally sensitive habitat areas "shall be protected against any significant disruption of habitat values" *[emphasis added in each*]. In most cases, denying a proposed project will not cause adverse effects on coastal resources for which the Coastal Act mandates protection or enhancement, but will simply maintain the status quo. Where denial of a project, as with this Storage Facility, would result in such effects, a conflict between or among two or more Coastal Act policies is presented.

3) **The project, if approved, would be fully consistent with the policy that affirmatively mandates resource protection or enhancement.** For purposes of resolving these policy conflicts, if denial of a project would conflict with an affirmatively mandated Coastal Act policy, approval of the project would have to conform to that policy. For instance, if denial of a project is inconsistent with a Chapter 3 policy, the proposed project would then have to protect or enhance the resource values for which the applicable Coastal Act policy includes an affirmative mandate. If the Commission were to interpret this conflict resolution provision otherwise, then any proposal, no matter how inconsistent with Chapter 3, that offered a slight incremental improvement over existing conditions, could result in a conflict that would allow the use of Section 30007.5. The Commission concludes that the conflict resolution provisions were not intended to apply to such minor incremental improvements.

The Storage Facility is sited and designed to prevent release of wastes that would adversely affect the biological resources mentioned above. It is designed to withstand what is considered to the area's "maximum credible earthquake"; it would be constructed at a location not subject to liquefaction, it and it would be sited both below-grade and at the highest available elevation at the site and higher than the power plant, where it is expected to withstand most tsunami-related impacts. Therefore, the project, as proposed and conditioned, is fully consistent with Coastal Act Sections 30230, 30231, and 30240.

4) **The project, if approved, would result in tangible resource enhancement over existing conditions.** This aspect of the conflict between policies may be looked at from two perspectives – either approval of the project would result in improved conditions for a coastal resource subject to an affirmative mandate, or denial or modification of the project would result in continued degradation of that resource.

   Approval of the Storage Facility would result in removal of hazardous materials from the lower elevation power plant to a site and storage method less susceptible to expected events that would cause releases and environmental damage in violation of the Coastal Act's policies regarding marine resources, water quality, and ESHA. Approval would also result in overall significantly lower risks from geologic hazards than the current location of the Class B and C wastes. The Storage Facility's higher elevation makes it less susceptible to tsunamis, and it would be on a site not prone to liquefaction. The wastes stored in the Storage Facility would be in a more stable configuration for safety during seismic events. Further, constructing the Storage Facility would allow PG&E to continue the decommissioning process at the power plant, resulting in eventual removal of all hazardous materials from a location highly susceptible to those expected seismic events.

   Conversely, denial of the Storage Facility would result in the continued presence of the wastes in the lower elevation power plant and the continued higher risks associated with that facility's response to expected geologic events, including tsunamis and seismic movement. But for the Storage Facility, the Class B and C wastes would be expected to remain within the power plant for the foreseeable future. During that time, it is probable that any or all of several events could occur – e.g., a tsunami, an earthquake resulting in severe ground shaking and/or liquefaction, etc. – that would be of sufficient magnitude to release those wastes to the marine waters, wetlands, and sensitive habitat adjacent to the power plant, which would be inconsistent with Coastal Act policies established to protect marine life, water quality, and sensitive habitat areas. Further, and as described below, there are no on- or off-site alternatives that would increase the protections provided by the proposed Storage Facility. Approval of the Storage Facility would therefore result in tangible resource enhancements over existing conditions.

5) **The benefits of the project are not independently required by some other body of law.** The benefits that would cause denial of the project to be inconsistent with a Chapter 3 policy cannot be those that the project proponent is already being required to provide pursuant to another agency's directive under another body of law. In other words, if the benefits would be provided regardless of the Commission's action on the proposed project, the project

proponent cannot seek approval of an otherwise-unapprovable project on the basis that the project would produce those benefits. In essence, the project proponent does not get credit for resource enhancements that it is already being compelled to provide.

In the case of this Storage Facility, PG&E is proposing the project primarily to allow continued decommissioning of the HBPP nuclear unit and associated facilities. While PG&E must obtain approvals for the Storage Facility from both the Coastal Commission and the NRC, this type of storage system is not being mandated by the NRC or any other regulatory body. In fact, rather than build the Storage Facility and gain the benefits it would provide, PG&E could instead maintain the wastes in their current location and either extend the decommissioning process or wait for a suitable facility to be available elsewhere.

6) **The benefits of the project must result from the main purpose of the project, rather than from an ancillary component appended to the project to "create a conflict".** A project's benefits to coastal resources must be integral to the project purpose. If a project is inconsistent with a Chapter 3 policy, and the main elements of the project do not result in the cessation of ongoing degradation of a resource the Commission is charged with enhancing, the project proponent cannot "create a conflict" by adding to the project an independent component to remedy the resource degradation. The benefits of a project must be inherent in the purpose of the project. If this provision were otherwise, project proponents could regularly "create conflicts" and then request that the Commission use Section 30007.5 to approve otherwise unapprovable projects. The balancing provisions of the Coastal Act could not have been intended to foster such an artificial and easily manipulated process, and were not designed to barter amenities in exchange for project approval.

   The Storage Facility is designed to provide a more stable location and method of storage than that currently provided by the inactive and lower elevation power plant. The project as proposed by PG&E consists of measures necessary to ensure long-term storage of the Class B and C wastes in a secure environment. These benefits are a result of the Storage Facility's basic design elements, which include storage containers and a vault specifically designed to store these types of waste in a more secure below-grade structure. The "essence" of the Storage Facility is that the wastes would be moved out of a facility that is at a lower elevation and is highly susceptible to the geologic events described above, and into a more stable facility less subject to those events and the risks associated with those events.

7) **There are no feasible alternatives that would achieve the objectives of the project without violating any Chapter 3 policies.** Finally, a project does not present a conflict among Chapter 3 policies if at least one feasible alternative would meet the project's objectives without violating any Chapter 3 policy. Thus, an alternatives analysis is a condition precedent to invocation of the balancing approach. If there are alternatives available that are consistent with all of the relevant Chapter 3 policies, then the proposed project does not create a true conflict among those policies. However, as discussed below, there are no feasible alternatives that would provide Chapter 3 consistency.

- **Offsite alternatives:** As noted in Section 4.2 above, PG&E has established that there are currently no offsite alternative locations available to store this waste material. There are several offsite facilities that have been built to store Class B and C wastes, but at this time, none are available for wastes generated in California. PG&E anticipates that it will at some point reach an agreement with the recently constructed facility in Texas to allow storage, but it is uncertain as to when, if ever, such an agreement would be reached. Therefore, for purposes of the Commission's review, there are no feasible offsite alternatives that would achieve the project objectives without violating at least one Chapter 3 policy.

- **"No Project" alternative:** Similarly, the "no project" alternative does not prevent conflict among Chapter 3 policies. As noted above, without the Storage Facility, the waste would remain in place within the HBPP, which is sited at a location subject to higher geologic risks and greater potential for adverse biological impacts than are present at the Storage Facility location. Additionally, keeping the waste where it is, while currently consistent with federal requirements for nuclear safety, would prevent PG&E from completing the planned demolition and decommissioning of the HBPP, as required pursuant to PG&E's "possess but not operate" NRC license.

- **Onsite alternatives:** There are also no onsite alternatives that would provide consistency with all relevant Chapter 3 policies. For several reasons, the project as proposed would be at the onsite location most suited for the waste storage – it is near the highest available elevation at the HBPP site, thereby reducing tsunami-associated risks; it is on the site's strongest soils and substrates, thereby reducing risks from ground shaking and liquefaction; and it is set back from the bluff edge, thereby reducing risks to the facility from coastal erosion and additionally reducing the facility's visual impacts. The Storage Facility location is also adjacent to the existing ISFSI, whose continual monitoring and security needs for the foreseeable future will likely reduce potential risks associated with release of materials from the Storage Facility.

Therefore, not only would denial of the proposed project result in a development inconsistent with Chapter 3 policies, there are no alternatives to the proposed project that would be fully consistent with applicable Chapter 3 policies.

Existence of a Conflict Between Chapter 3 Policies: Based on the above, the Commission finds that the proposed project presents a conflict between Sections 30253(1)-(2) and 30251, on the one hand, and Sections 30230, 30231, and 30240, on the other, that must be resolved through application of Section 30007.5, as described below:

Conflict Resolution: After establishing a conflict among Coastal Act policies, Section 30007.5 requires the Commission to resolve the conflict in a manner that is on balance most protective of coastal resources. As noted previously, the project would reduce but not minimize risks due to geologic hazards, it would eventually require shoreline protection during its anticipated operating life, and it would result in adverse visual impacts, thus making it inconsistent with Coastal Act Sections 30253(1)-(2) and 30251. However, denying

the project because of its inconsistency with these policies would result in significant adverse effects on biological resources due to the greater geologic risks associated with the existing storage area.

In sum, the Commission finds that while the Storage Facility would cause adverse visual impacts, would not minimize risks due to geologic hazards, and would eventually require a shoreline protection structure, it would also be sited at a location that is superior to the current location of the Class B and C wastes, thus reducing the risks associated with those geologic hazards and, for that reason, increasing protection of coastal biological resources. The Special Conditions in Section 3 of this report are necessary to ensure the Storage Facility's adverse impacts are minimized and its benefits are fully realized. Therefore, the Commission finds that approval of the proposed project notwithstanding its inconsistencies with several Coastal Act policies is "most protective of coastal resources" for purposes of the conflict resolution provisions of Coastal Act Section 30007.5.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

Section 13096 of the Commission's administrative regulations requires Commission approval of coastal development permit applications to be supported by a finding showing the application, as modified by any conditions of approval, to be consistent with any applicable requirements of the California Environmental Quality Act (CEQA). Section 21080.5(d)(2)(A) of CEQA prohibits approval of a proposed development if there are feasible alternatives or feasible mitigation measures available that would substantially lessen any significant impacts that the activity may have on the environment. As discussed above, the proposed project has been conditioned to be found consistent with the policies of the Coastal Act. Mitigation measures that will minimize or avoid all significant adverse environmental impacts have been required. As conditioned, there are no feasible alternatives or feasible mitigation measures available, beyond those required, that would substantially lessen any significant adverse impact that the activity would have on the environment. Therefore, the Commission finds that the proposed project, as conditioned to mitigate the identified impacts, can be found consistent with the requirements of CEQA.

APPENDIX A: SUBSTANTIVE FILE DOCUMENTS

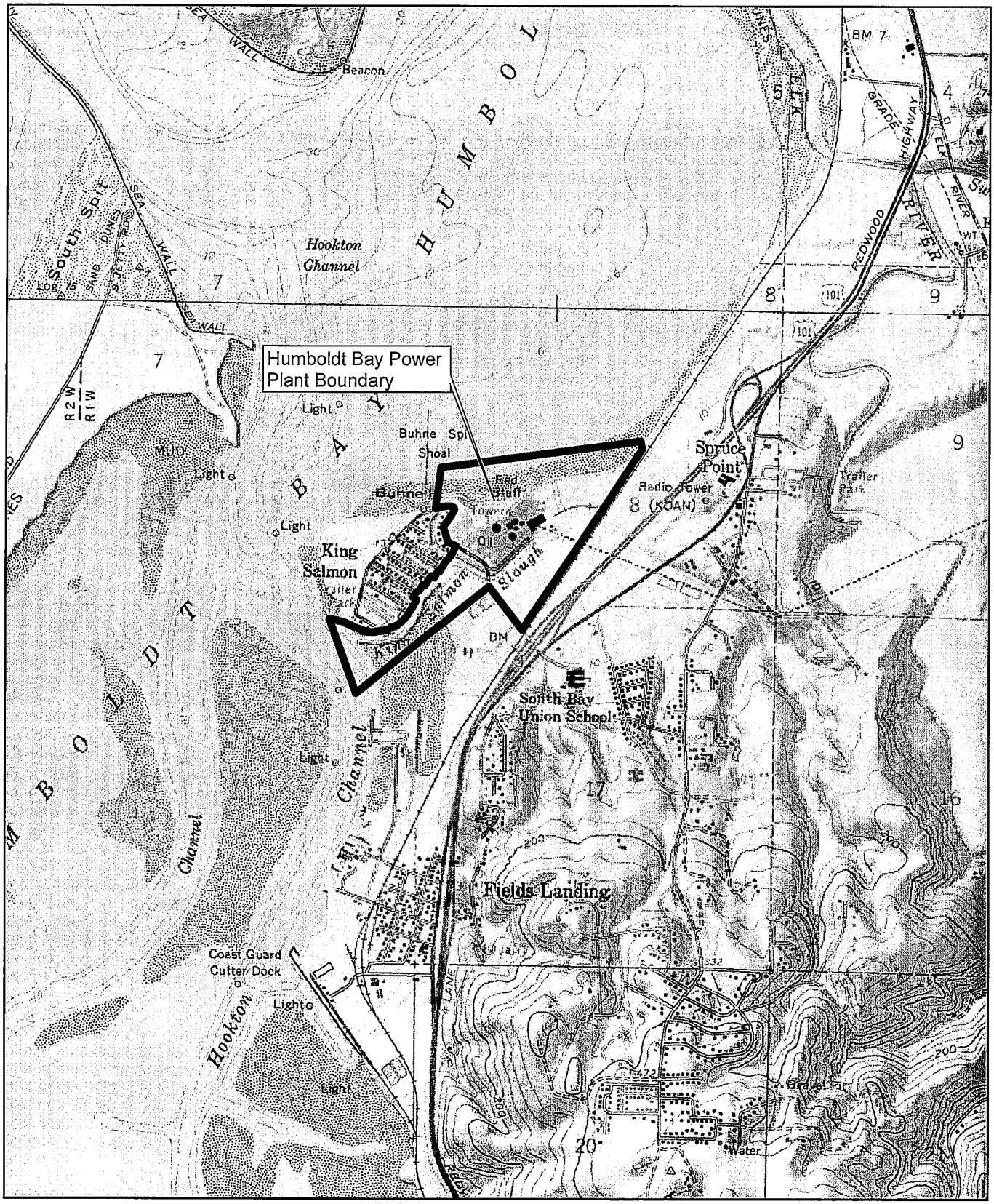
Johnsson, Mark J. (Coastal Commission Staff Geologist). *The Tohoku Earthquake of March 11, 2011: A Preliminary Report on Implications for Coastal California*, March 24, 2011.

Nuclear Regulatory Commission. *Fact Sheet on Decommissioning Nuclear Power Plants*, Feb 11, 2004 (accessed via http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/decommissioning.html)

Pacific Gas & Electric Company. *Safety Analysis Report, Environmental Report, and Emergency Plan*, from application to Nuclear Regulatory Commission for 10 CFR 72 ISFSI License, 2003.

_____. *Humboldt Bay Independent Spent Fuel Storage Installation Emergency Plan*. October 2004.

_____. Coastal Development Permit Application for CDP #E-05-001, Humboldt Bay Independent Spent Fuel Storage Facility (ISFSI), approved by Coastal Commission September 15, 2005.



LEGEND

Humboldt Bay Power Plant Boundary

N

0 1,000 2,000
Feet

FIGURE 1
VICINITY MAP

CLASS B AND C WASTE STORAGE PROJECT
PG&E HUMBOLDT BAY POWER PLANT, EUREKA, CALIFORNIA

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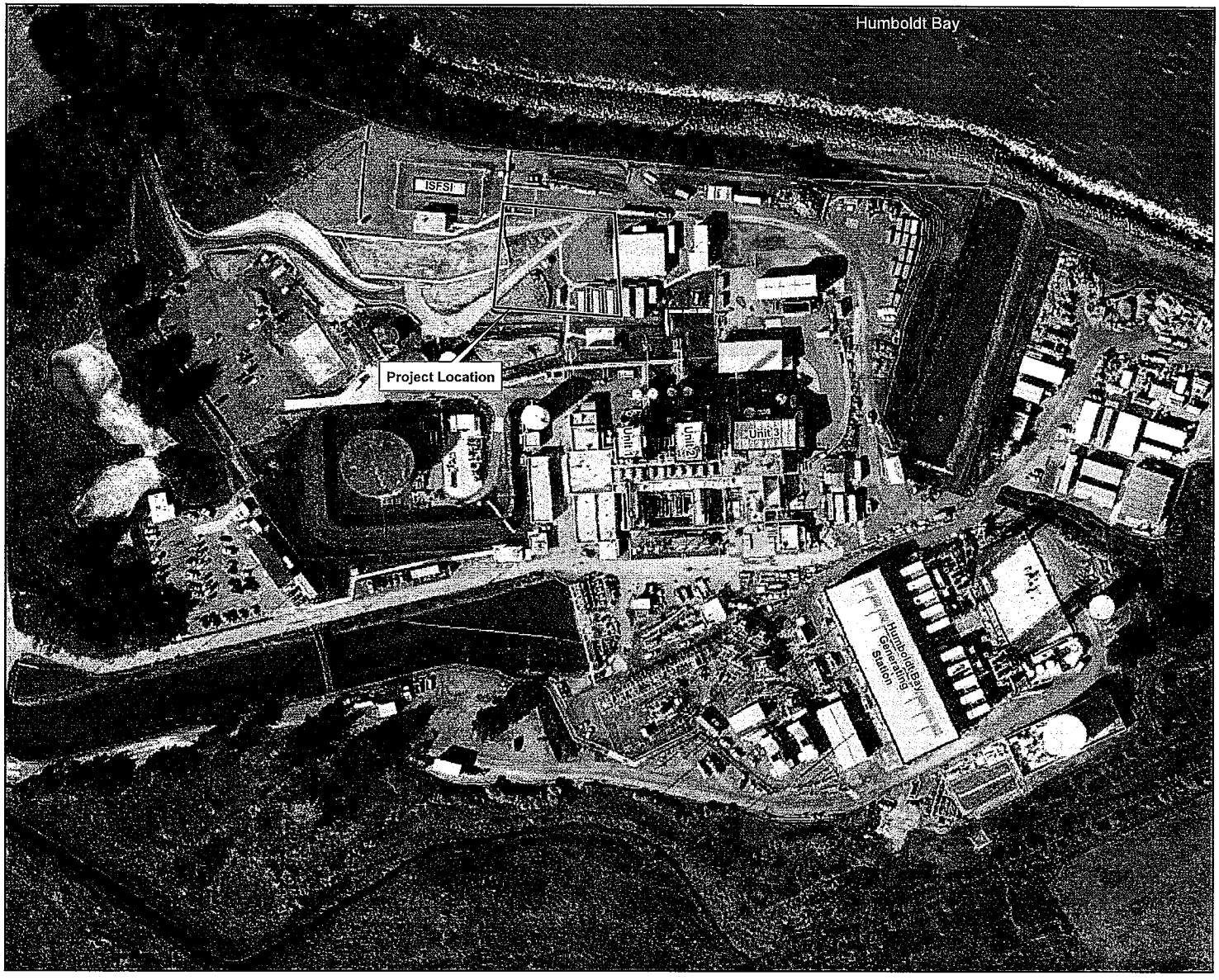
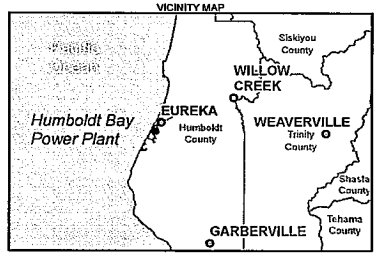
CH2MHILL





LEGEND

- Project Location and Potential Area of Disturbance
- Existing Site Feature
- Temporary Trailer, to Be Relocated

N

0 75 150
Feet

FIGURE 2
PROJECT LOCATION
CLASS B AND C WASTE STORAGE PROJECT
PG&E HUMBOLDT BAY POWER PLANT, EUREKA, CALIFORNIA

CH2MHILL.

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E-11-018
EXHIBIT 2

CALIFORNIA COASTAL COMMISSION
45 FREMONT, SUITE 2000
SAN FRANCISCO, CA 94105- 2219
VOICE AND TDD (415) 904- 5200
FAX (415) 904- 5400

12 August 2005

GEOTECHNICAL REVIEW MEMORANDUM

To: Tom Luster, Coastal Program Analyst
From: Mark Johnsson, Staff Geologist
Re: E-05-001 (Pacific Gas and Electric Company, Humboldt Bay Power Plant Independent Spent Fuel Storage Installation)

In regard to the above referenced Coastal Development Permit Application, I have reviewed the following documents submitted by the applicant to the Nuclear Regulatory Commission in support of their license from that Commission:

1) Pacific Gas and Electric Company, 2004, "Humboldt Bay Independent Spent Fuel Storage Installation Environmental Report" dated October 2004.
2) Pacific Gas and Electric Company, 2004, "Humboldt Bay Independent Spent Fuel Storage Installation Safety Analysis Report" dated October 2004.

After reviewing these documents, I had several remaining concerns regarding the potential for coastal erosion at the site. In addition, because the Commission previously has determined that there is no reasonable expectation that a Federal spent nuclear fuel repository will ever be licensed to receive wastes from commercial nuclear power plants (see appeal A-3-SLO-04-035, Pacific Gas and Electric Company, Diablo Canyon Power Plant Independent Spent Fuel Storage Installation, December 2004), I asked the applicant to consider the effects of geologic hazards at the site on the proposed development over perpetuity, rather than over the 50-year design life cited by the applicant. These applicant addressed these questions with the following documents.

3) Pacific Gas and Electric Company 2004, "Assessment of erosion at Buhne Hill, Humboldt Bay ISFSI", 32 p. report dated 10 September 2004 and signed by W. D. Page (CEG 1432).
4) Pacific Gas and Electric Company 2005, "Implications of long-term global warming and tectonic displacements at Buhne Hill, Humboldt County, California", 86 p. report dated 18 July 2005 and signed by W. D. Page (CEG 1432).

During the review of this application a major earthquake occurred in the vicinity of the proposed development. The applicant prepared the following report on the earthquake and its effects on the existing infrastructure at the Humboldt Bay Power Plant:

5) Pacific Gas and Electric Company 2005, "Report on the M7.2 Offshore Northern California earthquake of June 14, 2005", 9 p. report dated and signed by M. McLaren, S. Nishenko, N. van der Elst and M. Stanton.

To help address the tsunami hazard at the site, the applicant submitted the following documents, which I also have reviewed:

6) Abramson, H., 1998, Evidence for tsunamis and earthquakes during the last 3500 years from Lagoon Creek, a coastal freshwater marsh, Northern California [Masters thesis]: Arcata, California, Humboldt State University.
7) Anonymous, 1981, E.A. White, The Union.
8) Gardner, H.W., Lindberg (CEG 1895), D.N., Bickner, F.R., and Manhart, G.L., 1999, Final report of seismic study phase 3 at College of the Redwoods Eureka Campus: Eureka, California, LACO Associates, p. 24.
9) Garrison-Laney, C.E., 1998, Diatom evidence for tsunami inundation from Lagoon Creek, a coastal freshwater pond, Del Norte County, California [Masters thesis]: Arcata, California, Humboldt State University.
10) Kroeber, A.L., 1976, Yurok Myths: Berkeley, California, University of California Press, 488 p.
11) Kroeber, A.L., and Gifford, E.W., 1949, World Renewal: A cult system of native northwest California: Anthropologic Records, v. 13, p. 1-155.
12) LACO Associates, 1999, Site evaluation for the Child Development Center, fault rupture hazard, Phase C Investigation, College of the Redwoods, 7351 Tompkins Hill Road, Eureka California: Eureka, California, LACO Associates, p. 15.
13) Leroy, T.H., 1999, Holocene sand dune stratigraphy and paleoseismicity of the north and south spits of Humboldt Bay, northern California [Masters thesis]: Arcata, California, Humboldt State University.
14) Patton, J.R., 2004, Late Holocene coseismic subsidence and coincident tsunamis, southern Cascadia Subduction Zone, Hookton Slough, Wigi (Humboldt Bay), California [Masters thesis]: Arcata, California, Humboldt State University.
15) Waterman, T.T., 1920, Yurok Geography: University of California Publications in American Archeology and Ethnology, v. 16, p. 177-314.
16) Witter, R.C., Patton, J.R., Carver, G.A., Kelsey, H.M., Garrison-Laney, C., Koehler, R.D., and Hemphill-Haley, E., 2002, Upper-plate earthquakes on the western Little Salmon Fault and contemporaneous subsidence of southern Humboldt Bay over the past 3,600 years, northwestern California, U.S. Geological Survey National Earthquake Hazards Reduction Program, p. 19.

I also have made use of a number of other references from the scientific literature on the Cascadia Subduction Zone, its seismic potential, and potential consequences of a major earthquake in the zone. These include:

Atwater, B.F., Stuiver, M., and Yamaguchi, D.A., 1991, Radiocarbon test of earthquake magnitude at the Cascadia subduction zone: Nature, v. 353, p. 156-158.

Clague, J.J., 1997, Evidence for large earthquakes at the Cascadia subduction zone: Review of Geophysics, v. 35, p. 439–460.

Gulick, S.P.S., and Meltzer, A.S., 2002, Effect of the northward-migrating Mendocino triple junction on the Eel River forearc basin, California: Structural evolution: Geological Society of America Bulletin, v. 114, p. 1505-1519.

Gulick, S.P.S., Meltzer, A.S., and Clarke, S.H., Jr., 2002, Effect of the northward-migrating Mendocino triple junction on the Eel River forearc basin, California: Stratigraphic development: Geological Society of America Bulletin, v. 114, p. 178-191.

Leonard, L.J., Hyndman, R.D., and Mazzotti, S., 2004, Coseismic subsidence in the 1700 great Cascadia earthquake: Coastal estimates versus elastic dislocation models: Geological Society of America Bulletin, v. 116, p. 655-670.

Peterson, C.D., Barnett, E.T., Briggs, G.G., Carver, G.A., Clague, J.J., and Darienzo, M.E., 1997, Estimate of coastal subsidence from great earthquakes in the Cascadia subduction zone, Vancouver Island, B.C., Washington, Oregon, and northernmost California: Portland, Oregon, Oregon Department of Geology and Mineral Industries, p. 44.

Polenz, M., and Kelsey, H.M., 1999, Development of a Late Quaternary marine terraced landscape during on-going tectonic contraction, Crescent City coastal plain, California: Quaternary Research, v. 52, p. 217-228.
Stewart, R.J., and Brandon, M.T., 2004, Detrital zircon fission-track ages for the "Hoh Formation": Implications for late Cenozoic evolution of the Cascadia subduction wedge: Geological Society of America Bulletin, v. 116, p. 60-75.
Toppozada, T., Borchardt, G., Hayden, W., and Petersen, M., 1995, Planning scenario in Humboldt and Del Norte Counties, California, for a great earthquake on the Cascadia Subduction Zone: Sacramento, California, California Division of Mines and Geology Special Publication 115, 151 p.
Witter, R.C., Kelsey, H.M., and Hemphill-Haley, E., 2003, Great Cascadia earthquakes and tsunamis of the past 6700 years, Coquille River estuary, southern coastal Oregon: Geological Society of America Bulletin, v. 115, p. 1289-1306.

I have visited the site on three occasions over the past two years. On each of these visits, I examined the site itself and the current facilities. In addition, in March 2004 I participated, together with members of the Nuclear Regulatory Commission, in a field trip to examine rock units and the trace of the Little Salmon Fault in the Humboldt Bay area. The applicant's geotechnical team also prepared a two-day field for me in May 2005 to examine the sites of tsunami investigations in the Humboldt and Del Norte County area. I have had numerous meetings and conversations with Lloyd Cluff, director of the Geoscience Department at PG&E, and with members of his staff including Drs. William Page, Joseph Sun, Marcia McLaren, AND Norm Abrahamson.

This memo will not be a point-by-point review of each of the documents cited above. Instead, after briefly describing the geologic and tectonic setting, I will summarize the geologic hazards at the site and indicate whether, in my opinion, the development can be found consistent with section 30253 of the Coastal Act, that states, in part:

> New development shall:
>
> (1) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.
>
> (2) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.
>
> …

Geologic and Tectonic Setting

The Humboldt Bay Power Plant lies on the eastern shore of Humboldt Bay, directly opposite the inlet between North and South Spits. The proposed site for the ISFSI is near the top of Buhne Point, a hill that rises some 60 feet above the bay. The point is made up of the Hookton Formation, a marine terrace deposit approximately 80,000 years old that consists of poorly cemented sands and interbedded clays.

The site lies near the southern end of the Cascadia Subduction Zone, marking the junction of the North America plate and the Gorda Plate to the west. The Gorda Plate, and its northern extension, the Juan de Fuca Plate are being thrust beneath the North America Plate as the latter moves relatively westward. This movement is manifested in periodic very large earthquakes—best estimated at about magnitude 9.0 with a recurrence interval of about 300-400 years. These earthquakes usually result in large tsunamis, and it is in fact deposits left from tsunamis that has been most useful in identifying past Cascadia Subduction Zone earthquakes. The last such earthquake occurred in the year 1700, and resulted in a tsunami that was recorded in historical Japanese documents of the era.

The Little Salmon Fault is a thrust fault likely originating at the Gorda/North America plate interface at depth along the Cascadia Subduction Zone, and continuing to the surface of the North America Plate. The fault passes within two miles of the ISFSI site. This fault is thought to rupture concurrently with the Cascadia Subduction Zone.

Two other active faults lie even closer to the ISFSI site, and also likely rupture concurrently with the Cascadia Subduction Zone. The Buhne Point Fault is a thrust fault dipping to the northeast that directly underlies the ISFSI site and reaches the surface some 300 feet southwest of the site. The Discharge Canal Fault is a high angle fault with a surface trace approximately 500 feet northeast of the ISFSI site. Together these two faults define a wedge, containing the ISFSI site, that is uplifted during fault movement. It is this uplift that is responsible for the topographic high that is Buhne Point. Despite extensive trenching across the ISFSI site, no signs of faulting within this wedge have been detected.

Ground Shaking

Historical Seismicity:

The Humboldt Bay region is an area of high seismic activity. There have been over 120 recorded earthquakes greater than magnitude 5 within 100 miles of the ISFSI site, including 10 that have exceeded magnitude 7. Most of these earthquakes have occurred in the offshore region within and along the southern margin of the Gorda plate and on the Mendocino fault zone at its southern margin. Only one of these earthquakes occurred on the actual interface of the Gorda and North American plates (The M 7.2 1992 Petrolia earthquake); most of the others have occurred on the overriding North America plate.

Six earthquakes have produced ground motions >10%g at the Humboldt Bay Power Plant. Two moderate earthquakes, ML 5.3 in 1975 and ML 5.4 in 1994, produced relatively large ground motions of 0.30g and 0.55g, respectively, the largest ground motions recorded at the site to date.

In June 2005 there was a magnitude 7.2 earthquake in the middle of the Gorda Plate, approximately 60 miles offshore, approximately 50 miles from the proposed ISFSI site. This was a strike-slip event in a fault on the North America Plate, above the Gorda Plate descending in the Cascadia Subduction Zone. Despite the large magnitude of this quake, ground shaking at the ISFSI site was less than 0.1 g, and the tsunami that was generated was measured in inches and only detectable by careful examination of tide gages.

Ground Shaking in Future Earthquakes

An earthquake of a given magnitude will produce different levels of ground shaking at different locations, depending on the distance of the location from the earthquake hypocenter, the nature of the soil or rock between the location and the earthquake, and soil and rock conditions at the site. The level of shaking is expressed by a term called "intensity", and is quantified by the Modified Mercalli Index, whereby intensities ranging from I (not felt) through XII (near total destruction) are assigned based on the level of damage sustained by human structures. Better quantification of the level of shaking also is possible; and the standard measure is peak ground acceleration (PGA), usually expressed as a fraction of the acceleration due to gravity (9.81 m/s$_2$, or 1.0 g). Other measures, such as peak ground velocity, also may be used but these are more rarely tabulated. Peak ground acceleration is typically measured in horizontal and vertical directions. It can be expressed deterministically ("a given earthquake can be expected to produce a peak horizontal ground accelerations at the site of *X* g"), or probabilistically ("given the seismic environment at the site, there is a 10% chance that a peak ground acceleration of *X* g will be exceeded in 50 years"). The current trend is to express seismic risk in probabilistic terms.

Peak ground accelerations depend not only on the intensity of the causative earthquake and the distance of the site from the hypocenter of the earthquake, but also on site characteristics. Most important is the depth and firmness of the soil and/or bedrock underlying the site. All of these parameters are evaluated in producing a seismic shaking hazard assessment of a site. In evaluating the response of structures to ground shaking, the frequency (cycles per second) of that shaking is important—higher frequency shaking is more damaging to smaller, more rigid structures, whereas lower frequency shaking is more damaging to larger, or more flexible structures. The proposed ISFSI facility fits into the latter category. Different ground acceleration values apply to seismic waves with different frequencies or periods. Thus, an earthquake with a peak ground acceleration of 0.7 g may have a peak "spectral acceleration" (SA) of 1.1 g for waves of 0.3 second period, but only 0.5 g for waves with periods of 1 second. A typical earthquake produces seismic waves with many different periods, and a plot of spectral accelerations for an earthquake shows the ground accelerations for waves of all periods.

The applicant has assessed the ground shaking that would occur at the site using a probabilistic seismic hazard analysis. The probabilistic analysis assumed a 2000 year return period; a lesser standard than the 10,000 year return event required for nuclear power plants. This is allowable because of a rule change made by the Nuclear Regulatory Commission in 2003, lowering the design standard for ISFSI's to a 2000 year return event. At the time this rule change was proposed, Commission staff provided comments to the Nuclear Regulatory commission objecting to the reduction in standards largely because the choice of a lower standard was arbitrary. A copy of this comment letter is attached to this memo.

Part of developing a probabilistic seismic hazard assessment is identifying the maximum earthquake likely on any faults that could provide ground shaking at the site. The applicant has modeled this "maximum credible earthquake" as the simultaneous rupture of the entire length of the Cascadia Subduction Zone (some 600 miles long) coupled with the rupture of the Little Salmon Fault. Because of the size and locations of these faults a very large earthquake is assumed—up to a magnitude 9.1. This is roughly equivalent to the 26 December 2004 Sumatran

earthquake, and near the upper bound of any earthquake likely anywhere on Earth. The seismic potential of this area is as large as any spot on Earth.

In order to assess the ground shaking at the site, the seismic energy is propagated from the presumed epicenter to the site, accounting for directivity effects and attenuation of energy that occurs through distance. The soil characteristics of the site are then used to judge any amplification effects. The final probabilistic seismic hazard assessment resulted in a seismic spectra peaking at nearly 2.9g at a period of 0.25 seconds. At the longer periods most important for influencing large structures such as the ISFSI, spectral accelerations were still over 1g. These values of ground shaking were then used to derive design criteria for the construction of the ISFSI.

These very high ground accelerations would seem to provide a conservative design basis for the ISFSI. Although I do object to the use of the 2000 year return period in the calculation of the probabilistic seismic hazard assessment, the analysis is so dominated by the M9.1 Cascadia event that it is essentially such an event that is being modeled. It is therefore my opinion that the ground shaking possible at the site has been adequately characterized, and designing to this standard will result in a project that is consistent with Coastal Act section 30253 with respect to the ground motion hazard.

Liquefaction

Liquefaction of soils can occur during strong ground shaking if soils are water saturated and consist of loosely consolidated, well sorted sands. At the ISFSI site the water table lies at about six feet above sea level, or some 35 feet below ground level. In addition, there may be temporary perched ground water on clay layers within the Hookton. A relatively shallow ground water table coupled with the subterranean nature of the ISFSI indicates that liquefaction is a concern.

Borings at the site show that the top 23 ft of soils consists of clayey sands and clays, followed by very dense sands and silty sands to depth of 50 to 53 ft. Very stiff to hard sandy silts/silts and very dense sand extend from 50 ft to below 400 ft. A standard means of testing for the liquefiability of soils is to perform a Standard Penetration Test, in which the number of blows it takes a hammer of standard weight to drive a standard sampling tube a distance of 12 inches. Empirically, it is found that for soils with blow counts of more than about 30, liquefication never occurs, and it is indeed rare in soils with blow counts between 20 and 30. The results of various Standard Penetrometer Tests in borings at the ISFSI site indicated that nearly all blowcounts are above 30. The few blowcounts that are below 30 are typically above 20 (dense) and are spatially isolated. From these data the applicant concludes, and I concur, that liquefaction will not occur in these soils.

Slope Stability

The applicant assessed slope stability under static conditions by calculating the factor of safety against sliding, using soil strength parameters measured at the site. They found that the factor of

safety at the ISFSI location was 2.69 with regard to the western slope (the coastal bluff) , and 4.94 with respect to the more gentle eastern slope towards the plant. These values are far in excess of the industry standard for new development of 1.5. As discussed under "coastal erosion," however, this level of stability cannot be assured in perpetuity if coastal erosion impinges on the site.

The slope stability analyses indicated yield accelerations—the level of ground shaking needed to instigate landslides—to be 0.69g and 0.66g for the coastal bluff and the eastern slope, respectively. Since these levels of ground shaking are less than the design basis earthquake, it is likely that the slopes will fail during such an earthquake. The amount of displacements of the slide masses was calculated using a Newmark sliding block approach to be about one foot during the design basis earthquake. This is far in excess of the 50 mm usually considered acceptable for new construction, but the applicant has indicated that the design of the ISFSI can accommodate this amount of displacement. Accordingly, it is my opinion that overall global stability of the slopes adjacent to the site is sufficient that the ISFSI will not be subject to landslide hazards unless the slope configurations change as a result of coastal erosion.

Surface Fault Rupture

Several active faults underlie the site. The Little Salmon Fault, The Bay Entrance Fault and the Buhne Point fault all dip to the northeast and underlie the site at various depths. The surface trace of the Buhne Point fault lies only about 300 feet south of the ISFSI site, and the surface trace of the Discharge Canal fault lies about 500 feet to the north. These two faults define a wedge, on which the ISFSI site is located. Through movement on these faults, the wedge is gradually uplifted and tilted. Although trenches across the site did encounter sand-filled fractures, none of them showed detectable offset and so are not considered active faults. The applicant believes that future deformation from displacement on the Little Salmon fault will be minor tilting with no differential displacements. I agree that this is likely, but I believe that it is certainly possible that one or both of these faults will shift position and that future fault movement could occur at the ISFSI site. It is quite common for faults to rupture along traces offset from previous ruptures, defining a "fault zone" rather than a single fault plane. This is, in fact, the case for these two faults as well, although the zone of fracturing does not appear to be more than a few tens of feet wide. Further, it is possible that a future movement along these faults could result in a different style of faulting. Given the proximity of the ISFSI to these active faults, I do not feel that it can be assured over perpetuity that the ISFSI will not be subjected to fault rupture.

The applicant has shown evidence that large, massive structures (including ammunition bunkers, bank vaults, and buildings with massive foundations) have performed well in previous earthquakes in Taiwan, Turkey, and Nicaragua. Although these anecdotal observations are encouraging, there also are many examples of quite large, massive buildings being damaged by surface faulting. Accordingly, I cannot find that the site will be safe from fault rupture hazard.

Tsunami

The applicant has sponsored extensive study of ancient tsunami deposits in Humboldt and Del Norte Counties; studies that have demonstrated repeated inundation by tsunamis during Cascadia Subduction Zone earthquakes. Most of these deposits were discovered in sheltered locations at relatively low elevation and give very little information regarding the maximum elevation to which tsunamis can run up. One exception is that tsunami deposits were not found behind North Spit, suggesting that the line of dunes, here about 40 feet high, is sufficient to protect that part of the bay from direct tsunami influence. In addition, Yurok oral legends tell of the tsunami of 1700, and indicate that the maximum run-up was just to the lower portion of a village site at Orick, which lies at 40 feet elevation, In addition, the applicant has modeled the tsunami height expected from a Cascadia Subduction Zone earthquake, and also arrived at estimated runup heights of 30 to 40 feet on the open coast. The tsunami would be partly attenuated as it entered Humboldt Bay, and the modeled runup elevation at the ISFSI site is 21 to 36 feet. Even at Mean Higher High Water, the modeled runup is only 23 to 38 feet. Accordingly, the applicant concludes that the ISFSI site, at an elevation of 44 feet, would not be inundated. Further, the ISFSI site is below ground level and not subject to damage by missiles carried by the tsunami. Finally, the ISFSI would be unaffected by inundation.

There are three reasons, however, that I cannot conclude that the site will be safe from a Cascadia Subduction Zone tsunami hazards in perpetuity. First, and perhaps most significant, is the comparison between the expected runups at this site and the observed runups of as much as 130 feet that occurred in Indonesia as a result of the 26 December 2004 Sumatran Earthquake. As indicated above, both the earthquake mechanism and the mechanism of tsunami generation for that earthquake is very similar to that expected for a Cascadia Subduction Zone earthquake and it is unclear why the near-source tsunami runups would be so different for the two earthquakes. Second, it is customary when assessing tsunami inundation to model the tsunami at not only high tide, but also with a storm surge (usually a 100-year storm) as well. If a Cascadia Subduction Zone tsunami were to hit during a period of high storm surge, the ISFSI site may well be damaged. Finally, the ISFSI site comprises a peninsula-like terrace that is underlain by poorly consolidated sands, silts, and clays. During a tsunami, this peninsula would be attacked from two directions. Erosion resulting from both incoming and retreating waves could, in my opinion, compromise the integrity of the ISFSI site.

Because it is anticipated that the ISFSI will occupy the site in perpetuity, I asked the applicant to address what role sea level rise might have on the site. They prepared an analysis superimposing the tectonic uplift of Buhne Hill (estimated at about 1.3 feet per 100 years) on sea level ruse under several scenarios for time periods of 100, 1000, 10,000 and 100,000 years. Their analysis of sea level rise, although necessarily poorly constrained, indicates that overtopping of the ISFSI by sea level rise in the next several thousand years is possible. Under such conditions, overtopping by a tsunami is likely. Sometime between 1000 and 10,000 years, however, it is likely, based on our understanding of driving forces of glacial cycles, that the Earth will enter another glacial period. The resulting spread of polar ice will lock up large amounts of water, resulting in a lowering of sea level. Given continued uplift of Buhne Hill, the ISFSI site actually will become safer from such effects as tsunamis and coastal erosion.

Coastal Erosion

The subject site, like a long stretch of Humboldt Bay to the north, is armored by a rip-rap revetment. In the vicinity of the power plant, the revetment dates to 1952, when rip-rap was first placed to protect Unit 1. The rip rap was enlarged and modified in 1956-7, to protect Unit 2. After suffering storm damage in the 1980's, the revetment was repaired in 1989. This rip-rap has been very effective in protecting the site from coastal erosion. For some perspective in how erosion might effect the site if the revetment is not maintained at the site, the applicant examined historic shoreline retreat in reference (3)

The applicant assessed historic shoreline retreat by reviewing 16 aerial photographs and maps (U.S. Coast Guard Charts and USGS maps) spanning the time interval 1852 to 2000. Eight of these were deemed to be of sufficient accuracy and scale to provide estimates of the shoreline position. From 1858 until 2000 total shoreline retreat has amounted to 1248 to 1485 feet. Prior to construction of the jetties at the mouth of Humboldt Bay, South Spit overlapped North Spit and, at least for the early 19th century, Buhne Hill was not exposed to attack by ocean waves. With the construction of the jetties, erosion was rapid. Between 1858 and 1870, the shoreline retreated at a rate of 24-35 feet. Between 1870 and 1942 the rate of retreat was 4 to 9 feet, but between 1942 and 1959 the bluff retreated at an average rate of 44 to 65 feet per year. The actual rate was somewhat higher than this, because the revetment was at least partially in place by 1952.

Since the construction of the revetment, the bluff above the revetment has continued to retreat, but at a much lower rate (estimated at 1-4 inches per year). Much of this retreat has been by shallow landslides, and the bluff has been flattening through time. The bluff will continue to retreat, at least until a stable slope is attained., at which time one would expect the rate of bluff retreat to slow further or stop.

What is clear from this analysis, however, is that in the absence of shoreline protection, coastal erosion will threaten the ISFSI on a decadal time span. The slope stability analyses assume the current configuration of the bluff. Even with modest bluff retreat, such as is predicted even in the presence of the current revetment, the static factor of safety and the expected seismic displacement will be lower and higher, respectively, than the calculations presented above. This site has experienced one of the highest coastal erosion rates documented in the state, is only protected from that erosion by a revetment that has required extensive maintenance in the past, and will only remain safe in the future with continued maintenance and, perhaps, expansion of the coastal armoring.

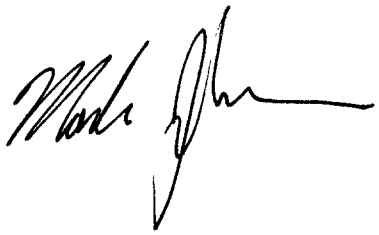
Further, given future sea level rise discussed in reference (4), overtopping of the existing revetment and erosion of the upper bluff by direct wave attack is likely within the next several hundred years. Accordingly, it seems likely that stability of the ISFSI will require the construction of some type of upper bluff shoreline protection device, in clear violation of Section 30253 of the Coastal Act.

Summary

The applicant is to be commended in presenting a candid analysis of the geologic hazards at the site. They have demonstrated that the site is likely to be subjected to severe ground shaking, slope failures, tsunami, and coastal erosion. In addition, I believe that the site may be subject to surface fault rupture hazard as well. The applicant believes that all of these hazards can be mitigated for. On the other hand, the tsunami, surface fault rupture hazard, and coastal erosion hazard at this site, coupled with an essentially infinite design life, lead me to believe that it is not possible to assure that the proposed development will not be significantly affected by these geologic hazards, as required by section 30253 of the Coastal Act.

I hope that this review is helpful. Please contact me with any questions or concerns.

Sincerely,



Mark Johnsson, Ph.D., CEG, CHG
Staff Geologist

E-11-018, Exhibit 4 –

Relevant Special Conditions of CDP #E-05-001 for Humboldt Bay Power Plant Independent Spent Fuel Storage Installation (ISFSI)

Special Condition 1 – Monitoring Bluff Slopes: "Prior to starting construction, the Permittee shall survey the bluff slopes adjacent to the ISFSI structure to establish the location of the bluff edge and shall set permanent monuments sufficiently far back from the bluff edge to allow their use during future surveys. Thereafter, and no less than every five years, the Permittee shall monitor those bluff slopes for sliding, ground movement, or other motion. Monitoring shall be done using the measures and monitoring devices described in the project's *Safety Analysis Report*. No later than June 30 of each subsequent fifth year, the Permittee shall submit a report, prepared by a licensed Civil Engineering Geologist, to the Executive Director describing the results of the monitoring. If during any five-year period, monitoring shows any horizontal or vertical movement of the bluff slope or edge of two feet or greater, monitoring and reporting shall then be done on an annual basis, with the report described above being submitted no later than June 30 of each year. If during five consecutive annual monitoring periods, movement of the bluff slope and edge totals less than two feet, monitoring and reporting may return to a five-year period. The Permittee shall notify County staff and the Executive Director immediately in the event of slope failure or movement that may indicate imminent slope failure. If monitoring results for any reporting period indicate slope movement that may require additional measures to protect the development, the Permittee shall submit a coastal development permit application or request for an amendment to this permit."

Special Condition 2 – Monitoring Shoreline Erosion: "Prior to starting construction, the Permittee shall survey the shoreline of the ISFSI site to establish the location of the existing riprap and the lower toe of the bluff. Thereafter, and no less than every five years, the Permittee shall conduct surveys of the shoreline and lower toe of the bluff of the ISFSI site. Surveys shall be conducted by a licensed Surveyor or Civil Engineer. Each survey shall be performed in the early spring when the beach level is lowest and the lower bluff face is most exposed, or as close to that time as is feasible. Each survey shall record the position of the lower toe of the bluff using conventional survey techniques (total station, rod and level, plane table, etc.), differential Global Positioning System (GPS), photogrammetry (with current ortho-rectified aerial photographs), by ground Light Detection and Ranging (LIDAR), or other comparable technique. Survey techniques used shall be consistent throughout the survey period or shall allow consistent comparison of yearly data. Survey measurements shall be accurate within 0.5' horizontal and 1.0' vertical.

The Permittee shall report the results of each survey to the Executive Director by June 30 of every fifth year. Each report shall include narrative and mapped analysis of the survey data, a determination of the average retreat rate for the full survey area, identification of any locations where the bluff change rate is more than two standard deviations from the average. Bluff change shall be calculated at 50' intervals (or smaller) to determine the average retreat, standard deviation and to identify areas of outlier retreat rates.

If monitoring results for any survey indicate the development may be threatened by coastal erosion in less than five years, the Permittee shall submit within sixty days of the annual survey report a coastal development permit application or request for an amendment to this permit to relocate the ISFSI or other project components as needed."

Special Condition 5 – Public Access: "a) Deed Restriction: ***Prior to issuance of the coastal development permit***, the applicant shall submit to the Executive Director for review and approval documentation demonstrating that the applicant has executed and recorded against the parcel(s) governed by this permit a deed restriction, in a form and content acceptable to the Executive Director: (1) indicating that pursuant to this permit, the California Coastal Commission has authorized development on the subject property subject to terms and conditions that restrict the use and enjoyment of that property; and, (2) imposing the Special Conditions of this permit as covenants, conditions and restrictions on the use and enjoyment of the Property. The deed restriction shall include a legal description of the entire parcel or parcels governed by this permit. The deed restriction shall also indicate that, in the event of an extinguishment or termination of the deed restriction for any reason, the terms and conditions of this permit shall continue to restrict the use and enjoyment of the subject property so long as either this permit or the development it authorizes, or any part, modification, or amendment thereof, remains in existence on or with respect to the subject property.

The deed restriction shall establish an accessway based on the existing public use trail and shall extend along the shoreline from the western end of the power plant site near King Salmon to the rail line on the northern end of the power plant site. The accessway shall be no less than twenty feet wide at any point as measured landward from the Ordinary High Water Mark (OHWM). The deed restriction shall also reflect that this accessway will move with the shoreline; that is, the minimum dimensions of the accessway shall be maintained as the OHWM moves due to short- or long-term events such as coastal erosion, sea level rise, or other phenomena.

b) Access Plan: Prior to starting project construction, the Permittee shall submit an access plan subject to Executive Director review and approval. The plan shall, at minimum, include the following:

- A legal description of the accessway as recorded on the property deed.
- A description of improvements that will be made to ensure public access is safely maintained. The improvements shall include, at minimum:
  - Measures that will be taken to maintain the accessway in a safe and usable condition to ensure safe pedestrian use (e.g., providing a level walking surface, regular inspections of accessway conditions, placing garbage receptacles on or near the trail, etc.).
  - Signs at both ends of the accessway that describe the access available and the conditions related to the adjacent ISFSI that may affect access. The design and placement of signs should be consistent with those developed as part of the Humboldt Bay Trails Feasibility Study.
  - A schedule to complete installation of the initial improvements described in the plan. These improvements shall be installed concurrent with construction of the ISFSI and shall be completed within 30 days of the storage casks being moved into the ISFSI storage area.

c) Changes to Access: If any change to the safety or security measures associated with the ISFSI results in a change to, or limitation on, public access to the shoreline, PG&E shall file a complete application to amend this permit. The application for an amendment shall describe the nature of the change and its effect on public access, and shall include proposed measures that would provide at least an equivalent amount of shoreline access on or near the project site."