
CALIFORNIA COASTAL COMMISSION

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W13b

November 13, 2012

TO: Coastal Commissioners and Interested Parties [Go to the original staff report.](#)

FROM: Alison Dettmer, Deputy Director
Tom Luster, Staff Environmental Scientist
Cassidy Teufel, Environmental Scientist [See correspondence received.](#)

SUBJECT: Addendum to Staff Report for CDP Application E-12-005 and Consistency
Certification CC-027-12, Pacific Gas & Electric Company [See additional correspondence received.](#)

[See further additional correspondence received.](#)

This addendum provides revisions to the November 2, 2012 staff report on Pacific Gas Electric's proposal to conduct high energy seismic survey operations in state and federal waters offshore of San Luis Obispo County between Cayucos and Point Sal and to temporarily install and operate an array of seismic monitoring devices onshore.

REVISIONS

SECTION II.F – OTHER AGENCY APPROVALS AND CONSULTATIONS

California State Lands Commission – page 16, beginning of first paragraph:

“At the beginning of the August 20, 2012 hearing, CSLC staff presented a revised version of the three area environmentally preferred alternative identified in the EIR which limited active survey activities to only the months of November and December and provided for a second year of survey activities if PG&E failed to complete its proposed work in the two month window provided in 2012. PG&E noted its acceptance of this temporally and spatially limited project at the beginning of the hearing. At that hearing, and after taking additional public comment, the CSLC approved a geophysical survey permit for the revised project and required that **PG&E committed to fund** an independent third party review process ~~be initiated~~ to evaluate the survey design and data acquisition methodology proposed by PG&E.”

SECTION II.G – MARINE RESOURCES [Note: change heading to Marine Biological Resources?]

Introduction – page 18, first paragraph:

“Seismic surveys are among the very loudest anthropogenic underwater sound sources (Richardson et al. 1995). The proposed conduct of high-energy seismic surveys has the potential to adversely affect marine resources and the biological productivity of coastal waters by potentially causing the disturbance, injury, and loss of marine organisms.”

Marine Mammals – page 20, second full paragraph:

“The project EIR includes a comprehensive discussion of the specific types of adverse impacts to marine mammals that may potentially result from the high-energy sound levels associated with the proposed survey. These impacts include masking, behavioral disturbance, temporary hearing loss, permanent hearing loss, and other physiological effects, including stranding and/or death. The discussion in the EIR draws heavily on a marine mammal technical report developed for the State Lands Commission by Wood et al. (2012) and included as Appendix H of the EIR (available on the Commission website at: <http://www.coastal.ca.gov/energy/seismic/mm-technical-report-EIR.pdf>). The Commission will be relying primarily on the methodology, analysis, and conclusions of this report and providing excerpts of key sections in this staff report. However, because PG&E substantially modified the project described in its CDP application and consistency certification after the development of this marine mammal technical report and certification of the EIR by the State Lands Commission, the Commission staff requested and received updates to the information provided in several of the tables included in the Wood et al. (2012) report, in order to evaluate the modified project. Information from these updated tables are referred to in the discussion below and provided for reference.”

Harbor porpoise – page 34, first full paragraph:

“To further illustrate the points raised above regarding the proposed conduct of active survey operations within the core habitat of the Morro Bay stock of harbor porpoise, Exhibit 6 includes a figure demonstrating the location of this core habitat area in relation to the proposed survey areas and a discussion of the genetic and geographic isolation of this stock from the 2011 U.S. Pacific Marine Mammal Stock Assessments developed by NMFS. This figure supports the assessment of Wood et al. (2012) and NMFS that the proposed project will have significant adverse effects on the Morro Bay stock of harbor porpoise. Marine mammal aerial surveys carried out in the project area on October 2, 2012, the results of which are also included in Exhibit 6, further support these conclusions and demonstrate that harbor porpoise are likely to be present within close proximity of the proposed active survey activities. The survey would effectively close about half of the harbor porpoise core habitat area, and porpoises within that area seeking refuge from the survey would likely either move into the remaining core habitat, thereby increasing competition, or move to more marginal habitat areas.”

Fish and Invertebrate Eggs and Larvae – page 44, first full paragraph:

“PG&E’s analysis concluded that survey tracks totaling 1,608 miles in length would result in roughly 65 billion gallons of seawater being within the 5.5 meter radius “zone of lethality” of the air guns. Based on the results of the 1997-99 DCPP entrainment sampling, the analysis additionally concluded that this volume of seawater would be expected to contain from 8.56 to 9.20 million fish larvae. Accordingly, with the assumed 100% mortality to larvae within this water volume, PG&E’s analysis concluded that the project was expected to cause the mortality of up to 9.2 million larval fish within the project area, along with an unknown number of fish eggs. However, the project evaluated in the September 25, 2012 report from PG&E was subsequently modified and reduced in size. ~~While Commission staff requested an updated evaluation from PG&E that reflects the currently proposed project, this information has not been provided. Commission staff therefore used the information PG&E submitted for the larger project, along with the percent reduction in the project length, to estimate a revised mortality figure. With the currently proposed project (as modified on October 1, 2012), the survey tracks total about 881 miles, or about 54% of the originally assessed 1,608 mile survey length. PG&E’s updated evaluation, provided on October 31, 2012, states that the currently proposed survey tracks would have the full array of air guns firing over a total length of about 576 miles for a total water volume in the “zone of lethality” of about 23 billion gallons (although this does not include operations during turns with only the mitigation air gun firing).~~ Assuming the larval densities are the same for both the previously evaluated and currently evaluated survey track lengths, the expected level of mortality would be about ~~54%~~36% of 9.2 million, or approximately ~~5.0~~3.3 million larvae.”

Fish and Invertebrate Eggs and Larvae – page 45, second full paragraph referring to “Appropriateness of Data Used”:

“Modifying the assessment to include additional data with the 1997-99 nearshore data (i.e., no more than a mile from shore) could provide a better representation of the types and expected abundance of larval species that would be affected by the project. One source of additional data may be the California Cooperative Oceanic Fisheries Investigations program (CalCOFI). CalCOFI has several sampling stations in federal waters offshore of Point San Luis near the proposed project area that could provide more appropriate data on representative larval fish species and density in the project area, which extends up to about 17 miles offshore. It is not clear, however, whether CalCOFI has conducted sampling at these nearby sites during the fall season. If fall sampling data are available, Commission staff recommends that it be incorporated into the analysis. Given the seasonal variability in larval fish diversity and abundance in the water column, offshore samples from spring and summer seasons may not accurately represent the species types and numbers present during the proposed survey period; however, PG&E could review those spring/summer sampling data to determine the degree of correlation to the DCPP sampling data, which may allow partial inclusion of the offshore CalCOFI data to improve the analysis.”

Fish and Invertebrate Eggs and Larvae – page 45, last paragraph, continuing to page 46:

“Appropriateness of Approach Used: PG&E’s analysis used the ~~entire volume~~ **upper 100 meters** of water within the survey area as the basis for the expected project impacts. By doing so, the analysis substantially underestimated the proportional mortality that would result from the survey, and thereby discounted the significance of the survey’s potential effects. The analysis assumed that larval mortality would be limited to areas within 5.5 meters of air guns that would be towed at a depth of about 10 meters; therefore, the area of the water column within which larvae would be subject to mortality would be no more than about the uppermost 16 to 20 meters. However, rather than use this upper part of the water column as the source water area, the analysis based its proportional mortality calculations on the ~~entire water column~~ **upper 100 meters of water** within the survey area, ~~including areas with depths of greater than 400 meters~~. By including these substantial volumes of water within which plankton are not likely to be affected, the analysis significantly underestimated the proportional effects on the various species. **Further, any diurnal differences in the composition of the plankton community – i.e., detecting species that emerge from or descend to deeper waters during the day or night – are already included in the data, since samples were taken over 24-hour periods. It is therefore not necessary to include the deeper parts of the water column in the analysis.**

Conducting the analysis using just the top 20 meters of the water column as the source water area would substantially increase the expected proportional mortality of the survey – that is, the larvae affected by the survey would represent a larger proportion of the total larval population in the top 20 meters of the survey area than the total population living in the entire ~~400+~~ **100** meter depths of the water column. Even though larval densities are generally higher in the upper water column than the lower, recalculating the source water area using just the top 20 meters is likely to significantly increase the proportional mortality and the overall effect of the survey on the planktonic community. ~~We note, too that even though there are diurnal differences in the larval composition, this characteristic is already reflected in both the DCPP and CalCOFI data, since those samples are taken during 24-hour periods.~~

While modifying PG&E’s analysis to address the above concerns would likely improve the impact assessment, there would remain a substantial degree of uncertainty. The estimates of expected plankton mortality due to in-water sound are based on a limited number of studies, most of which were done in other areas and on species not present in the survey area. **For example, available studies discuss effects on local northern anchovies and Dungeness crab, but also Atlantic cod and species offshore of Nova Scotia and Norway or in the Black Sea. As noted in the project’s Environmental Assessment (see Appendix E, page 3 of Addendum 1, “Responses to Issues Raised During a November 2, 2011 Meeting with Fishers at Port San Luis”, PG&E states: “There are a number of other gray literature studies of the effects of sound on developing eggs and larvae; none provide conclusive evidence on this topic that is germane to most Pacific Coast species. Indeed, one can conclude that there is a total dearth of material on this topic and it is an area of research that needs rigorous experimental evaluation. In summary, the few studies on the effects on eggs, larvae, and fry are insufficient to reach any conclusions with respect to the way sound would affect survival.”**

Fish and Invertebrate Eggs and Larvae – page 46, beginning of last paragraph:

“Based on the data used by PG&E and the assessment provided, it is likely that the survey would result in mortality to about ~~five~~3.2 million fish and invertebrate larvae in the project area and an unknown number of fish eggs.”

Conclusion of Marine Biological Resources – page 50, beginning of third paragraph:

“The Commission finds that, for the reasons discussed above, the proposed project would result in adverse impacts to marine resources and the biological productivity of coastal waters. These adverse effects include behavioral harassment and potentially injurious physiological effect on large numbers of marine mammals; the loss of fish and invertebrate eggs and larvae; the injury, disturbance, and loss of adult fish and invertebrates; and damage to marine protected areas.”

SECTION II.H – COMMERCIAL FISHING

Effects on Area Fish and Invertebrates – page 56, first full paragraph on “Short-Term Effects”:

“Another associated short-term adverse effect is ~~an increase a decrease~~ in “catch per unit effort” or CPUE. The effect described above – i.e., the reduced likelihood of catching species that show “alarm” or “startle” responses to the air gun sounds – can lead to the need for a greater level of effort required to catch a given number of fish. ~~Increased~~Decreased CPUE can show up in a number of ways that affect the economic vitality of the local fishing community – increased fuel consumption needed to cover a larger fishing area, inefficiencies associated with fishing in a less familiar area, cumulative effects of having more fishing boats share a smaller overall fishing area, etc. The effects of ~~increased~~decreased CPUE are similar in at least one way to those described above regarding overall reductions in catch – i.e., they are difficult to measure precisely – but they differ in that the ~~increased~~ effects of decreased CPUE effects would be felt over a larger area and by more of the fishing community than those directly affected by the catch reductions.”

Effects on Area Fish and Invertebrates – page 56, third full paragraph, continuing to page 57:

“Long-term Effects: The most likely long-term effects to area fishing interests are those associated with mortality and injury of adult and larval fish and invertebrates, as well as eggs of those organisms, as previously discussed in Section ~~xx~~II.G of these Findings. However, because of the many environmental and population variables that go into determining survivorship, population dynamics, community structure, and other similar ecosystem characteristics, it is not possible to determine with precision the extent of these effects.

Losses of adult fish are likely to be relatively low, since they would need to be relatively close to the air guns (i.e., within several dozen feet) to experience death or injury. However, a loss of adults in some species could result in reduced catch rates in the area for as many as several seasons – for example, because rockfish generally grow relatively slowly to adulthood, losses of adult rockfish could require some time for replacement populations to develop. Regarding larvae and eggs, the losses are expected to be in the range of about 53.2 million, as discussed in Section G above. The EIR notes that several factors are likely to reduce the potential effects resulting from these losses – for example, this total represents a relatively small proportion of larvae within the survey area and within the region, and the survey would occur outside the area’s peak larval concentrations in the spring and summer. ~~Commission staff requested that PG&E calculate the expected effects of these larval losses on adult populations; however, that information has not yet been provided.~~ **PG&E expects this level of loss to have an insignificant effect on the area’s adult fish population, though, as noted above, there are few studies to support this predicted level of mortality or to identify other adverse sublethal effects that may affect eventual adult populations.** In general, however, losses of these organisms are likely to reduce to some degree the numbers of certain species that would otherwise be available to the fishing community.”

Commercial Fishing Mitigation – page 58, beginning of first paragraph:

“Regarding impacts such as lost catch opportunities, possible lost fishing gear, and others, Commission staff requested that PG&E develop and submit a Fishing Mitigation Plan outlining the steps PG&E would take to address adverse impacts to commercial and recreational fishing operations, including the ~~loss and/or damage of fishing gear due to contact or entanglement with the proposed geophone array and~~ reduction or displacement of fishing activities or catch during and after survey operations.”

Commercial Fishing Mitigation – page 59, starting at first full paragraph:

“Commission staff then requested PG&E provide additional detailed information, including a proposed compensation amount, and develop a claims process specifically applicable to possible damages resulting from the proposed survey. Staff recommended that PG&E develop a process similar to the Joint Oil/Fisheries Liaison Office (JOFLO), which has been used successfully since 1983 to manage claims from fishing interests for damages associated with offshore oil and gas production in California. The JOFLO process includes several key characteristics that result in a successful mitigation strategy to address damages to fishing interests. JOFLO provides an independent liaison office to ~~review claims~~, to assist fishing interests in meeting filing requirements, and to provide mediation when necessary to settle claims. It also includes guidelines for claims and a standardized claims process. and benefits from having an established Further, claims managed through JOFLO benefit from contingency funds administered by the National Marine Fisheries Service, the Bureau of Ocean Energy Management (BOEM), and the County of Santa Barbara that are adequate to address valid damage claims from the fishing community. Although JOFLO was established as a means to provide long-term mitigation, Commission staff believes it serves as an appropriate model on which to base mitigation needed for PG&E’s relatively short-term survey.

On October 5, 2012, PG&E submitted additional information about its proposed plan, which included the following:

- PG&E noted that its proposed base compensation amount was still being negotiated with local fishing interests. PG&E has proposed providing an initial lump sum that would be disbursed among affected commercial fishing interests in a manner still to be determined.
- PG&E again proposed to use its existing claims process to address claims beyond the initial base compensation amount, and again proposed the same mediation process as described in its September 5, 2012 proposal to settle any disputed claims.
- PG&E proposed to retain the JOFLO Liason Office to assist parties in filing claims and to serve as an ombudsman, though it did not propose to incorporate other aspects of the JOFLO process into its claims process.

This most recent proposal, however, still lacks the information and certainty needed to ensure effective mitigation for potential impacts to the fishing community. For example, PG&E's proposal to partially retain JOFLO is apparently not an available option, as JOFLO is available to its members only (though PG&E could obtain JOFLO's services by becoming a member). The Commission believes that a more robust mitigation plan based on the JOFLO model would likely provide the necessary level of mitigation; however, absent some basic information about the level of compensation PG&E would provide, the process and basis for making damage claims and resolving those claims, and concurrence from the affected fishing interests about this approach, the Commission finds that there is insufficient information to find the currently proposed compensation plan is adequate to protect fisheries or is consistent with Coastal Act Section 30234.5."

Commercial Fishing Conclusion – page 60, first paragraph:

"The project would result in significant short-term impacts to both commercial and recreational fishing from preclusion of fishing efforts in the project area during the proposed survey and from behavioral reactions of targeted fish and invertebrate species that would reduce catch per unit effort both during and after the project. In addition, the anticipated injury and mortality to fish and fish larvae that would result from the proposed project activities has the potential to cause both short and long term adverse impacts to commercial and recreational fishing. For these reasons, the Commission finds the proposed project as currently proposed to be inconsistent with the commercial and recreational fishing policy of the at Coastal Act, Section 30234.5. While a As noted above, the Commission believes a more complete Communications Plan and a more robust, comprehensive and detailed fishing mitigation plan based on the JOFLO model could be sufficient to ensure protection of commercial and recreational fishing activities, However, the Commission does not currently have a plan that is detailed enough for it to assess whether mitigation would be adequate to meet this Coastal Act policy Section 30234.5. If the proposed project were otherwise consistent with other Coastal Act policies, the Commission could ensure consistency with Section 30234.5 by requiring: (1) a more comprehensive Communications Plan identifying how PG&E would provide updated sound propagation information to the affected fishing community, how PG&E would update its database of parties interested in reviewing and commenting on the proposed

project, and including measures for providing timely information updates via social media; and (2) a more comprehensive Mitigation Plan based on the JOFLO model that specifies a baseline compensation amount to address expected impacts to the fishing community, includes clear guidance on the criteria and process used to submit and determine valid claims, and to resolve any claim-related disputes.”

SECTION II.I – ACCESS AND RECREATION

Restriction of Water-Oriented Recreation – page 61, third paragraph:

“At the request of Commission staff, PG&E submitted a map of the nearshore waters that would be expected to receive sound levels at or above 145 dB re 1 μ Pa of the received sound levels in nearshore waters that would be expected from the survey activities, based on sound propagation models. This map is included as Exhibit 7 and suggests that nearshore areas from Montana de Oro State Park to Cambria would be expected to experience received sound levels in excess of 160 dB re 1 μ Pa.”

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Staff:	C. Teufel-SF
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COMBINED CONSISTENCY CERTIFICATION AND COASTAL DEVELOPMENT PERMIT APPLICATION

See correspondence received.

Application No.:	E-12-005
Consistency Certification:	CC-027-12
Applicant:	Pacific Gas and Electric Company
Agents:	Padre Associates, Inc.; DB Neish & Associates
Location:	State and federal waters offshore of San Luis Obispo County.
Project Description:	Conduct high energy seismic survey operations in state and federal waters between Cayucos and Point Sal and temporarily install and operate an array of seismic activity monitoring devices onshore.
Staff Recommendation:	Denial/Objection

SUMMARY OF STAFF RECOMMENDATION

Pacific Gas and Electric Company (PG&E) has submitted a coastal development permit application and a consistency certification for the first phase of a potential two phase series of high-energy three-dimensional seismic imaging surveys (“seismic surveys”) employing acoustic pulse-generating air guns to study active faults offshore and adjacent to the Diablo Canyon Power Plant (DCPP). The survey would occur in state and federal waters offshore of San Luis Obispo County between Cambria and Pismo Beach.

The seismic surveys rely on the use of air guns to generate high energy acoustic pulses capable of passing through ocean waters and penetrating from six to nine miles into the seafloor.¹ The survey would be carried out by a 235-foot research vessel—the National Science Foundation’s *R/V Marcus G. Langseth*—towing two arrays consisting of 18 40- to 360-cubic-inch air guns with a combined total discharge volume of 3,300 cubic inches. The array would be towed at a depth of approximately 30 feet at a speed of 4 to 5 nautical miles per hour. The air gun array would generate an acoustic pulse of approximately 230 to 252 decibels at the source (dB re 1 μ Pa at one meter) every 11 to 20 seconds. The air gun array would be towed approximately 460 feet behind the research vessel. The research vessel would also make use of two shallow imaging devices, a multi-beam echosounder sonar device and a sub-bottom profiler.

In order for the acoustic pulses created by the air guns to generate sub-surface imagery, the *R/V Langseth* would tow four “streamers” – each one approximately 3.7 miles long and spaced 300-to 500-feet apart. Each “streamers” would be comprised of a cable supporting a series of seven hydrophones capable of detecting the air gun generated acoustic pulses after they penetrate into the each and reflect back to the surface. The rate and manner in which these reflected pulses are detected by the hydrophones allows computer generated images to be created of sub-surface geological formations. The proposed phase one geophysical survey would be carried out in a single survey area, known as “Box Four.” Box Four would cover approximately 130 square miles offshore of Morro Bay and be comprised of 880 miles of survey lines. PG&E proposes to conduct the survey between mid-November and the end of December 2012, with the period of active air gun operations limited to approximately 17 days (9.25 days of surveys + 2 contingency days + 5 days of equipment calibration and testing).

The key Coastal Act issue of concern is this project’s significant and unavoidable impacts to marine resources. Seismic surveys are among the very loudest anthropogenic underwater sound sources and can cause disturbance, injury, and loss of a large number of marine species due to air gun noise. Of particular concern are impacts to the harbor porpoise (Morro Bay stock), whose range is limited to the general project area, and the entire population of which is likely to be subject to behavioral harassment. The project would also adversely affect Marine Protected Areas, fish and other invertebrates, involving both physiological impacts as well as economic

¹ A more detailed discussion of how air gun technology works can be found at:
<http://www.dosits.org/technology/observingtheseafloor/airgun/>

impacts to commercial and recreational fishing by precluding fishing and potentially affecting fish behavior and biology. While PG&E proposes to fund a monitoring program and implement measures to minimize effects, including cessation of air gun use if marine mammals are near enough to the sound source to be subject to greater than behavioral effects, a number of limitations (including the proposed use of air guns at night time and in potentially high seas and windy conditions that would make it difficult to detect marine mammals) would cause these measures to be ineffective much of the time.

Thus, even with extensive monitoring, and implementation of measures to minimize impacts, the Commission staff believes this project would still result in significant disturbance, injury and loss of marine biological resources and is therefore inconsistent with the Coastal Act's marine resource protection policies (Sections 30230 and 30231). However, because the project is meant to extend the operational life of a coastal-dependent industrial facility, it qualifies for special consideration under the Coastal Act's coastal-dependent industrial² development "override" policy (Coastal Act Section 30260). Section 30260 provides that if a coastal-dependent industrial development such as the proposed survey is inconsistent with any Chapter 3 policy of the Coastal Act, the Commission may nonetheless approve such development if it finds that the proposal meets all three tests of that policy: (1) alternative locations are infeasible or more environmentally damaging; (2) to do otherwise would adversely affect the public welfare; and (3) adverse environmental effects are mitigated to the maximum extent feasible.

In applying the first test, staff assessed whether alternative survey locations or configurations could provide a feasible and less environmentally damaging way to obtain the expected seismic data. Under the Commission's CEQA obligations, staff additionally evaluated a reasonable range of alternatives that might avoid or reduce the project's significant adverse environmental effects. Because the survey's adverse effects are largely related to the extent and duration of survey activities, staff focused its assessment of alternatives on whether PG&E could obtain the necessary data using methods that would decrease the extent and/or duration of those activities. Alternatives considered included (1) using alternative equipment, such as seafloor geophones that would reduce the number or length of high-energy survey lines; (2) conducting more extensive analysis of the data collected during previous seismic surveys to either eliminate the need for the current survey or reduce its size or duration; (3) completing the evaluation of PG&E's 2011 and 2012 collection of 2D onshore seismic data and offshore low-energy 3D seismic data, and using those data to reduce and more precisely target areas that may need to be the focus of a future high-energy offshore survey; and (4) using alternative survey techniques – e.g., a different streamer configuration, marine vibroseis, etc. – that might reduce the extent and duration of impacts. Staff also evaluated "no project" and "no project at this time" alternatives in recognition of the ongoing data collection and analysis by PG&E, the Nuclear Regulatory Commission, and U.S. Geological Survey, which may also serve to more precisely target any future needed survey work.

² The Commission has previously determined that the DCPP is a coastal-dependent industrial facility because it requires seawater for cooling and therefore requires a site on or adjacent to the sea in order to function at all. The proposed seismic survey is meant to gather additional seismic data as part of PG&E's effort to re-license, and therefore extend the operation of, the DCPP.

In assessing these alternatives, staff determined that there was insufficient information available to the Commission at this time to conclude PG&E's proposed project is the least damaging feasible alternative, due largely to the need to complete ongoing data acquisition and analysis that may allow for a reduced survey or no survey and other deficiencies in available information. Regarding the use of alternative equipment, staff determined that PG&E has not provided sufficient information to show that additional geophones are infeasible or less environmentally damaging. Although PG&E stated that its evaluation showed additional geophones would not reduce the number or length of survey transects, PG&E did not provide that evaluation to staff. Regarding the additional analysis of previously-obtained data, while PG&E has conducted some re-assessment of those data, most of that re-assessment was done at least a decade ago and appears to have covered only part of the available data. Staff therefore believes additional analysis of the full set of available data using updated techniques may result in the opportunity for a smaller or shorter proposed survey.

Regarding the evaluation of the more recently-acquired data, staff notes that these data were collected as part of a coordinated seismic characterization effort that includes the currently proposed survey. During the past few months, PG&E has already modified its proposed survey in response to evaluating some of this recently-acquired data, and staff believes the currently proposed survey could be further reduced based on completing the full analysis of the recent data. Regarding the use of alternative survey techniques, the proposed project is subject to an investigation funded by the CPUC to independently evaluate the feasibility of alternative streamer and vessel configurations for conducting the survey. This independent review, which has not yet been completed, may lead to further reductions of the proposed survey extent or duration. However, without the results of this review, staff believes the Commission does not have sufficient information to determine whether the currently proposed survey is the least environmentally damaging alternative. Finally, regarding the "no project" or "no project at this time" alternatives, it appears premature to conduct the currently proposed survey during the fall of 2012, as other ongoing data collection and analysis efforts by PG&E, the NRC, and USGS are likely to provide even better seismic characterization of the DCPP area in the near future and thereby potentially reduce the need, extent, or duration of the proposed survey.

Based on the above, staff recommends the Commission find that the proposed project does not meet the first test of Section 30260, since there is insufficient information to determine that alternative locations are infeasible or more environmentally damaging. Because applying Section 30260 requires that a proposed project meet all three tests in order to be approved, if the project fails to meet the first test there is no need for the Commission to apply the two remaining tests.

Staff therefore recommends the Commission **deny** the permit application and **object** to the consistency certification.

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APPENDICES

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EXHIBITS

[Exhibit 1 – Project Locations](#)

[Exhibit 2 – Proposed Onshore Seismic Monitoring Array Location](#)

[Exhibit 3 – Onshore Seismic Monitoring Device](#)

[Exhibit 4 – Bathymetry Map](#)

[Exhibit 5 – Survey Vessel, Air Gun Array, and Streamer Configuration](#)

[Exhibit 6 – Core Habitat Area of the Morro Bay Stock of Harbor Porpoise](#)

[Exhibit 7 – Expected Sound Propagation Distances](#)

[Exhibit 8 – Previous Seismic Surveys in the Project Area](#)

I. MOTION AND RESOLUTION

A. COASTAL DEVELOPMENT PERMIT APPLICATION

Motion:

I move that the Commission approve Coastal Development Permit E-12-005 subject to conditions set forth in the staff recommendation specified below.

Staff recommends a **NO** vote on the foregoing motion. Passage of this motion will result in denial of the permit application 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 denies the Coastal Development Permit for the proposed project and adopts the findings set forth below on grounds that there is insufficient evidence in the record to determine whether the development will be in conformity with the policies of Chapter 3 of the Coastal Act.

B. CONSISTENCY CERTIFICATION

Motion:

I move that the Commission concur with consistency certification CC-027-12 that the project described therein is fully consistent with the enforceable policies of the California Coastal Management Program.

Staff recommends a **NO** vote on the foregoing motion. Failure of this motion to pass will result in an objection to the certification and adoption of the following resolution and findings. An affirmative vote of a majority of the Commissioners present is required to pass the motion.

Resolution:

The Commission hereby objects to the consistency certification by the Pacific Gas and Electric Company finding that the consistency certification lacks information necessary to evaluate the project's consistency with the enforceable policies of the California Coastal Management Program.

II. FINDINGS AND DECLARATIONS

A. PROJECT DESCRIPTION

Pacific Gas and Electric Company (PG&E) is requesting authorization to perform the first phase of a potential multiple phase series of high-energy three-dimensional seismic imaging surveys employing acoustic pulse-generating air guns to study active faults offshore and adjacent to the Diablo Canyon Power Plant (DCPP). DCPP is a two-reactor nuclear power plant located near Avila Beach in San Luis Obispo County with an operating capacity of approximately 2200 MW. DCPP's two reactors have been in operation since 1985 and 1986, respectively, and are currently licensed by the Nuclear Regulatory Commission to continue until 2024 and 2025. If PG&E determines that an additional phase or phases of surveys is necessary, the first of these additional surveys would be scheduled for the fall of 2013 and would require additional review and approval by agencies including the California Coastal Commission (Commission), the California Department of Fish and Game, the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service. The coastal development permit application and consistency certification for the proposed project were modified by PG&E on October 1, 2012 to reflect the substantial project revisions and refinements that had occurred subsequent to the initial submittal of these documents to Commission staff.

Three-dimensional seismic imaging is a tool used by geologists and geophysicists to image subsurface geologic formations. On land, vibrations caused by specialized vehicles equipped with tools such as "vibroseis" or "accelerated weight drop" devices are used to send shock waves into the earth where they can bounce off underground rock layers and be detected and recorded by ultra-sensitive instruments at the surface.³ In water, sound waves produced by pneumatic devices called "air guns," or by other means, are used for a similar purpose. The timing and intensity of these reflections are used to map the location of subsurface structures such as folds and faults. Low-energy 3-D techniques are typically used to image features within roughly a mile of the earth surface while high-energy techniques can image features at depths of up to about ten miles. Sophisticated 3-D seismic surveys are based on a grid of closely spaced survey lines that create a high-definition three-dimensional picture of the subsurface geology. Interpretation of these data provides useful information that can help discern new geologic features and constrain uncertainties associated with known fault zones, including geometry (i.e., fault length, width, and dip), location, and fault activity or slip rate. The effectiveness of the 3-D survey is largely dependent on how well the subsurface geology can be imaged.

Based on geological studies conducted prior to and since construction of DCPP, several fault zones including the Hosgri, Los Osos, San Luis Bay, and the recently discovered Shoreline (which was discovered approximately 0.6 miles offshore Diablo Canyon in 2008) fault zones are known to be in the vicinity of DCPP. However, the specific geometries, lengths, and interconnections of these faults are not fully understood. Data gathered from the proposed survey would improve the characterizations of these fault zones and allow PG&E to refine

³ Such activities have been carried out extensively over the past several decades on land and have never been known to result in activation of faults or induction of seismic events. Similarly, the use of high-energy air gun arrays has also never been known to induce seismicity.

current estimates of the frequency and intensity of earthquakes that are likely to occur in the area surrounding DCPP. This information may also improve assessments of the potential seismic hazard and ground motion at DCPP.

The phase one survey proposed by PG&E would occur in state and federal waters offshore of San Luis Obispo County between Cayucos and Point Sal (as shown on [Exhibit 1](#)) and would require the temporary placement of 90 seismic monitoring devices along the Morro Bay sandspit ([Exhibit 2](#)). The proposed onshore monitoring devices would be approximately six inches high, five inches in diameter, and would be buried by hand approximately 12-inches into the sand above the mean high tide line. These devices would be in place for the duration of the proposed surveys, approximately 17 days.

The proposed seismic surveys rely on the use of air guns (pneumatic sound sources that use highly compressed air to create bubbles of pressurized air underwater⁴) to generate a high energy acoustic pulse capable of passing through ocean waters and penetrating from six to nine miles into the seafloor. The survey would be carried out by a 235-foot research vessel—the National Science Foundation’s *R/V Marcus G. Langseth*—towing two arrays consisting of 18 40- to 360-cubic-inch air guns with a combined total discharge volume of 3,300 cubic inches. The array would be towed at a depth of approximately 30 feet at a speed of 4 to 5 nautical miles per hour. The air gun array would generate an acoustic pulse of approximately 230 to 250 decibels at the source (dB re 1 µPa at one meter) every 11 to 20 seconds and would be towed approximately 460 feet behind the research vessel. The research vessel would also make use of a multi-beam echosounder sonar device and a sub-bottom profiler. These devices would be in use throughout the proposed survey and would discharge continuous sound pulses of 242 dB (re 1 µPa at one meter) and 204 dB (re 1 µPa at one meter), respectively.

The *R/V Langseth* would also tow four “streamers” – each one approximately 3.7 miles long and spaced 300- to 500-feet apart. The “streamers” would be comprised of cables and each one would support a series of seven hydrophones (devices that detect the acoustic pulses generated by the air gun array as they reflect back towards the surface from underground and transmit them back to the towing vessel for analysis). Each streamer would be towed at a depth of roughly 30 feet and constant depth and spacing between the streamers would be maintained through the use of specialized diverter devices. [Exhibit 5](#) provides a schematic diagram of the proposed air gun and hydrophone streamer configuration.

The proposed phase one geophysical survey would be conducted in a single section, called a survey “box.” As shown in [Exhibit 1](#), this box would be comprised of a series of adjacent survey tracks or transects positioned to provide complete coverage of the proposed geologic targets in the area. The proposed survey area, known as “Box Four,” would cover approximately 130 square miles and be comprised of 880 miles of survey lines. Given the size of the research vessel and length of the towed streamer array, the end of each transect line includes a wide turning radius. At the beginning of the survey, the *R/V Langseth* would begin moving along the first transect line while starting up a single small capacity air gun termed a “mitigation air gun.”

⁴ A more detailed discussion of how air gun technology works can be found at:
<http://www.dosits.org/technology/observingtheseafloor/airgun/>

At a given point, the larger capacity air gun arrays (composed of 18 active air guns each) would begin emitting acoustic pulses and would then “ramp-up,” starting at a low level and rising to full volume over a specified period. The acoustic pulses would continue as the vessel proceeds along a pre-established transect. Near the end of each transect, the full air gun arrays would be turned off and the vessel would make a turn in order to continue the next track parallel to the previous track. Given the large turning radius of the vessel, turns are anticipated to last between two and three hours. During these turns, the vessel would continue firing the mitigation air gun, generating pulses of 212 decibels, until the turn is complete and the full arrays are initiated once more. PG&E proposes to conduct the survey – including mobilization and demobilization – over an approximately 33-day period between mid-November and the end of December 2012. The proposed period of active air gun operations and surveying would be limited to approximately 17 days during this period. These 17 days would include two contingency days to address the possibility of needing to repeat sections of the survey and a five day period of limited air gun operations carried out in order to test the equipment and confirm and verify the sound propagation modeling used to estimate sound exposure levels and distances. Maintenance and operational delays (such as those caused by weather, equipment failures, or marine mammal shutdowns) would increase the number of active survey days beyond 17. During the most recent operation of the proposed survey vessel off the coast of Oregon in July 2012, mechanical and equipment failures and operational interruptions occurred with a fairly high frequency. However, information provided by the vessel operator, the National Science Foundation, subsequent to reporting of this information suggests that such occurrences are not typical.

B. BACKGROUND

This project can be traced back to Assembly Bill 1632 (also known as AB 1632 and codified as Pub. Resources Code, Section 25303). Among the provisions of AB 1632 is the requirement (Subpart (8)(A) of PRC Section 25303) that the California Energy Commission (CEC), as part of its energy forecasting and assessment activities, carry out a:

compilation and assessment of existing scientific studies that have been performed by persons or entities with expertise and qualifications in the subject of the studies to determine the potential vulnerability to a major disruption due to aging or a major seismic event of large baseload generation facilities, of 1,700 megawatts or greater.

This assessment was required to include an analysis of the impact of a major disruption on public safety, the economy, and the reliability of the State’s electrical generation and transmission system. AB 1632 therefore does not explicitly mandate geophysical surveys or require the current proposed project to be completed. Instead, AB 1632 requires that the effects upon the State’s electric supplies of a seismic event at the Diablo Canyon Power Plant (DCPP) and San Onofre Nuclear Generating Station (SONGS) be evaluated by the CEC.

In response to this requirement, the CEC released a report which found that an extended shutdown at either DCPP or SONGS would have major economic, environmental, and system reliability implications, and recommended that PG&E and Southern California Edison update the seismic hazard assessments of the nuclear facilities they operate. The CEC report also recommended that PG&E use “3D geophysical seismic reflection mapping and other advanced techniques” to supplement previous and ongoing seismic research programs. In response to the

CEC report's recommendations, the California Public Utilities Commission (CPUC) directed PG&E to complete 3D seismic studies and submit the results as part of the CPUC's review of the Nuclear Regulatory Commission (NRC) license renewal applications for the DCPP (although the current operating licenses for DCPP's generators would not expire for over 12 years and the NRC has determined that it will not issue final decisions regarding renewal until the issue of spent fuel storage is resolved, PG&E has initiated the license renewal process). Neither the CEC report nor the CPUC specified if the 3D seismic reflection mapping efforts they recommended should make use of high-energy sound sources, low-energy sound sources, or both. However, the CPUC supports the proposed project and convened an independent group of technical experts, called the Independent Peer Review Panel (IPRP), to review, evaluate, and report on the seismic study plans developed by PG&E in response to the CPUC directive. As noted in IPRP Report No. 3:

PG&E is planning 2-D and 3-D seismic studies and analyses at its Diablo Canyon Power Plant. PG&E plans to perform these studies for on-shore and off-shore areas by using enhanced 2-D and 3-D seismic reflection mapping and other advanced geophysical techniques to explore fault zones in the vicinity of DCPP, as recommended by the CEC AB 1632 Report.

Additional detail regarding these and other relevant actions and a timeline is provided in Appendix E at the end of this report.

Independent Peer Review Panel

As noted by State Senator Sam Blakeslee, author of AB 1632, in his 2012 testimony to the CPUC:

In January 2010, PG&E applied to the Commission [CPUC] for funding to perform additional seismic studies per the AB 1632 report. In August 2010, the Commission issued a decision (D.10-08-003) granting \$16.73 million for the studies. However, as a condition of the approval, the Commission convened the IPRP and invited the Energy Commission, California Geologic Survey, the California Coastal Commission and the California Seismic Safety Commission to participate on the panel. The panel was convened to "conduct a peer review of the studies including independently reviewing and commenting on the study plan and completed study findings." The purpose of the IPRP is consistent with provisions of AB 42⁵, which required the state's regulatory agencies to do more than simply accept PG&E's proposal, but to actively participate in the design of the studies to ensure that the concerns raised by the Energy Commission in the AB 1632 Report, and reaffirmed by the Commission, are addressed by the studies undertaken by PG&E. Per the Commission's own decision, the IPRP is tasked with providing comments on the design of the study.

The IPRP, after several organizational meetings, first met formally in January 2012 and has had several formal public meetings since, with the latest meeting occurring in October 2012. These meetings have included discussions of the scope, targets, and objectives of the seismic survey program proposed by PG&E as well as presentations of information by PG&E in response to

⁵ AB 42 was vetoed by Governor Schwarzenegger.

specific questions and requests for clarification by the IPRP. The IPRP and its informal predecessor group have developed four reports describing the status of its review and summarizing particular issues that it has identified. These reports were released on September 30, 2010, September 7, 2011, April 6, 2012, and September 25, 2012. As described in these reports, much of the discussion and review effort by the IPRP has been directed at the proposed “seismic targets” identified by PG&E and the potential usefulness of the information expected to be gained from the surveys on the seismic hazard evaluation for the Diablo Canyon Power Plant. In addition, as noted in IPRP Report No. 3 from April 6, 2012:

The IPRP’s discussions of the high energy off-shore seismic surveys in January and February 2012 also focused on the need for detailed review of PG&E’s proposed data acquisition and data processing techniques. The IPRP recognizes that the success of these surveys depends on the interaction and quality of data acquisition and data processing. The IPRP has therefore asked PG&E for a copy of their Request For Proposal (RFP) including the RFP for the high-energy off-shore seismic surveys, so that the IPRP can fully understand: 1) how the survey geologic targets have been characterized to potential bidders, and 2) how the specific parameters of the proposed survey acquisition and processing techniques were chosen. The IPRP received copies of the RFPs for the high energy off-shore seismic surveys on March 2, 2012. These RFPs provided needed information on the study approach and major parameters of the seismic studies. However, the members and staff of the IPRP do not have the expertise to review the techniques used in acquiring and processing the data from the high energy off-shore seismic surveys. These techniques are most commonly used by seismic exploration contractors working for the oil industry. The IPRP has suggested that CPUC consider an additional contract to review this aspect of the seismic studies for DCPP.

While the IPRP identified, in its April 6, 2012 and September 25, 2012 reports, the importance of a thorough review of PG&E’s proposed data acquisition and processing plan and the need for additional expertise on the IPRP to carry out this review, this need has not yet been met and this review has not yet been carried out.

IPRP report number 4, dated September 25, 2012, notes that some of its concerns had been addressed, but the lack of independent review of the proposed data acquisition and processing component of PG&E’s offshore survey plan continued to be a key piece of information that the IPRP found to be missing. It is also important to note that the IPRP only recently reviewed and commented on the October 1, 2012 revised project design proposed by PG&E in the CDP application and consistency certification currently before the Commission. These comments were provided to the Commission in a letter from the IPRP dated October 25, 2012 and include the following summary of the IPRP’s review of PG&E’s modified project proposal:

The IPRP finds that PG&E has responded to the questions directed to them and has shown that the initial phase of the proposed high energy survey includes an area where important information regarding the geometry and intersections of several faults may be imaged. The IPRP reached consensus that a 3D high energy seismic survey of Box 4 could provide valuable information about the faults that pose the greatest seismic hazard to Diablo Canyon Nuclear Power Plant.

The IPRP did not reach consensus on whether PG&E has demonstrated that the survey currently planned is optimally designed to provide the highest quality data. The IPRP membership, with one exception, support the proposed testing as designed. IPRP member Bruce Gibson has expressed general concerns regarding the overall survey planning and data processing approach selected by PG&E, and has not received responses that demonstrate to him that the planned survey is state-of-the-art. In the proposal before the Coastal Commission, Dr. Gibson is specifically concerned that, 1) data quality over the most important targets (SE quadrant of Box 4) will be low, and 2) the data collected by the shore-based array will not provide an adequate image of the targeted features.

The remainder of the IPRP members acknowledge Dr. Gibson's concerns, but believe that the currently planned survey is appropriate to provide preliminary answers to the primary questions it is designed to answer. The opportunity for additional review of survey design between surveys in 2012 and 2013, whether by an [Independent Technical Reviewer] hired by PG&E, or by contracted experts and the IPRP, give the IPRP greater confidence that high energy seismic surveys will yield valuable data to understand the seismic hazards at Diablo Canyon.

The consensus position of the IPRP expressed in its previous two reports regarding the importance of additional expert review of PG&E's proposed data acquisition and processing methodology therefore appears to have changed somewhat. This change appears to be at least partially in response to an offer of PG&E noted above and further described in the letter to the Commission from the IPRP - PG&E has offered to hire an additional expert, an Independent Technical Reviewer (ITR), as part of its internal Geoscience Department to provide input regarding the adequacy of the proposed data acquisition and processing methodology. However, as noted by the IPRP:

The independent review of survey planning, acquisition, and data processing has been a concern of the IPRP as discussed in IPRP Reports No. 3 and 4. Because of these concerns, the IPRP has discussed hiring additional technical experts who would have a similar charge as the ITR assigned by PG&E. The IPRP notes that the level of independence of the ITR is of paramount importance to the quality of the technical review and public acceptance of survey results.

Based on this discussion, it appears that while the IPRP still supports the independent third party review of the proposed data acquisition and processing methodology, most of its members do not feel that this review needs to be carried out prior to the initiation of survey activities.

Nuclear Regulatory Commission - 10 CFR 50.54(f) Letter

In response to the previous year's earthquake and tsunami related nuclear facility disaster in Japan, the Nuclear Regulatory Commission (NRC) issued a March 12, 2012 letter to the holders of nuclear reactor operating licenses, including PG&E. This letter was also in response to Section 402 of the Consolidated Appropriations Act, Public Law 112-074, which stated that the "Nuclear Regulatory Commission shall require reactor licensees to re-evaluate the seismic, tsunami, flooding, and other external hazards at their sites against current applicable Commission requirements and guidance for such licensees as expeditiously as possible..." This letter (known

as the 50.54(f) letter for the section of the NRC regulations which authorized it) requires PG&E and the other nuclear facility licensees:

to provide further information to support the evaluation of the NRC staff recommendations for the Near-Term Task Force (NTTF) review of the accident at the Fukushima Dai-ichi nuclear facility. The review will enable the staff to determine whether the nuclear plant licenses under your responsibility should be modified, suspended, or revoked.

The NRC staff recommendations referred to in this letter include one requesting licensees to “reevaluate the seismic and flooding hazards at their sites using updated seismic and flooding hazard information and present-day regulatory guidance and methodologies and, if necessary... perform a risk evaluation.”

As noted by PG&E:

To comply with this NRC Order, PG&E is proposing to carry out the seismic survey to better characterize the seismic sources and associated ground motions of the area surrounding Diablo Canyon. Conducting this study will reduce the level of uncertainty associated with the models being used, thereby increasing the integrity of the assessment and reducing the overall "hazard level." The orders issued by the NRC provide a finite timeline in which to take information collected as part of the study and feed it into the NRC re-evaluation process, otherwise the data will be of limited use and will not be available for the review under the 50.54F orders. By March 11th 2015, all operators need to have all seismic sources and related ground motions evaluated by the NRC Senior Seismic Hazard Advisory Committee (SSHAC) [study process]. In order to meet this timeline, the seismic survey needs to be completed this Fall. After the data is collected, processing will be completed by December 2013 for use in the SSHAC process, which can take as long as a year or more from start to finish.

In reviewing the proposed project, Commission staff consulted with staff of the NRC regarding the requirements of the 50.54(f) letter, the submittal deadline for information provided in response to this letter, and the relationship between the proposed project and the NRC requirement for updated information. In email and phone conversations between Commission and NRC staff in September and October 2012, the NRC clarified that it is in no way requiring that PG&E carry out the proposed high-energy 3D seismic surveys. The NRC also noted that the current SSHAC process was initiated by PG&E in 2011 and that it relies on a series of public workshops and groups of independent experts to review existing information, identify key data, and make recommendations on crucial data needs. As recently noted by the NRC on its website:

PG&E is now working with a team of independent experts to determine what should be included in its re-analysis for the NRC. The NRC doesn't yet know if that group will also recommend the high-energy offshore surveys, which cannot be done without state approval.

If the offshore surveys are done, the NRC expects PG&E will include that information in its earthquake re-analysis. If not, the NRC expects PG&E will nonetheless assemble enough updated information to complete its re-analysis by early 2015. The results of all this work will ensure Diablo Canyon remains ready to safely shut down after an earthquake.

History of Offshore Seismic Surveys in California

Please see Appendix B for a description of the Commission's review of previous offshore seismic survey projects.

C. CONSOLIDATED PERMIT

Coastal Act Section 30601.3 provides the Commission with the authority to act upon a consolidated permit for proposed projects that require a coastal development permit from both a local government with a certified local coastal program (LCP) and the Commission. This authority is triggered if the applicant, local government and Executive Director (or Commission) consent to consolidate the permit. For the proposed project, the temporary placement of 90 seismic monitoring devices on the Morro Bay sandspit, would take place within the jurisdiction of San Luis Obispo County under its certified Local Coastal Plan – San Luis Obispo County's LCP. On September 11, 2012, San Luis Obispo County, with the consent of the applicant and Executive Director, agreed to consolidate permit action for aspects of the proposed work that would be carried out in San Luis Obispo County's LCP jurisdiction with aspects that would be carried out within the Commission's retained jurisdiction, consistent with Coastal Act Section 30601.3.

D. COMBINED REVIEW

As discussed above, the offshore component of the proposed project would be located in both state and federal waters. As such, the Commission has authority to review this project under both the California Coastal Act and the federal Coastal Zone Management Act. PG&E has therefore submitted to the Commission both a coastal development permit application and a federal consistency certification. The review of these two submittals has been combined into this single staff report and recommendation.

E. NECESSARY INFORMATION

Section 930.63(c) of the federal consistency regulations (15 CFR Section 930.63(c)) requires that, if the Commission's objection is based on a lack of information, the Commission must identify the information necessary for it to assess the project's consistency with the CCMP. That section states:

A State agency objection may be based upon a determination that the applicant has failed, following a written State agency request, to supply the information required pursuant to § 930.58 or other information necessary for the State agency to determine consistency. If the State agency objects on the grounds of insufficient information, the objection shall describe the nature of the information requested and the necessity of having such information to determine the consistency of the activity with the management program. The objection may describe alternative measures (if they exist) which, if adopted by the applicant, may permit the proposed activity to be conducted in a manner consistent with the enforceable policies of the management program.

As described fully in Section N of this report, the Commission has determined that it does not have sufficient information to enable it to determine whether the project is consistent with Chapter 3 of the Coastal Act, because PG&E has not provided the information necessary for the Commission to determine whether there are feasible and less environmentally damaging project alternatives. In order to determine the project's consistency with the CCMP, the Commission has requested PG&E provide it with the necessary information identified in Section N of this report, which includes:

- Evaluation of whether placing additional seafloor geophones to collect data would allow the extent or duration of the proposed high energy survey to be reduced.
- Re-assessment using updated techniques of existing seismic data from the area to determine whether the extent or duration of the proposed survey might be reduced.
- Completion of currently-occurring seismic data collection and analysis to determine whether the survey could be reduced by focusing on a smaller or different target area.
- Evaluation of whether the use of alternative vessels or equipment could reduce the survey extent or duration.
- Incorporation of data and analyses from other ongoing seismic characterization programs (e.g., the Nuclear Regulatory Commission's Senior Seismic Hazard Analysis Committee, the U.S. Geological Survey, etc.) that would allow reduction or avoidance of survey activities.
- A third party review of proposed survey data acquisition and processing.

F. OTHER AGENCY APPROVALS AND CONSULTATIONS

San Luis Obispo County

During the preparation of this report, the Commission staff coordinated with San Luis Obispo County Planning staff to address any potential concerns the County might have regarding the proposed project.

California State Lands Commission

The proposed seismic survey requires from the California State Lands Commission (CSLC) a geophysical survey permit pursuant to Public Resources Code section 6826. The CSLC served as the “lead agency” for this project under the California Environmental Quality Act (CEQA). The original project description submitted by PG&E to the CSLC included proposed offshore surveys within an approximately 530 square nautical mile area over an 82 day period from September through December as well as substantial amounts of onshore survey work and the temporary placement of approximately 600 seismic monitoring devices on the seafloor. On March 16, 2012, the CSLC published a draft Environmental Impact Report (EIR) for public review and comment that concluded that the proposed project would result in significant unavoidable impacts in the areas of marine biological resources, commercial and recreational fishing, land use, recreation, air quality, and greenhouse gases. On August 14, 2012, following a public hearing, the CSLC certified the EIR, adopting as the environmentally preferred alternative a reduced project scope that would be limited to three of the four initially proposed survey areas. At the August 14 hearing, the CSLC requested additional information from PG&E and continued the hearing on the issuance of the geophysical survey permit until August 20, 2012.

At the beginning of the August 20, 2012 hearing, CSLC staff presented a revised version of the three area environmentally preferred alternative identified in the EIR which limited active survey activities to only the months of November and December and provided for a second year of survey activities if PG&E failed to complete its proposed work in the two month window provided in 2012. PG&E noted its acceptance of this temporally and spatially limited project at the beginning of the hearing. At that hearing, and after taking additional public comment, the CSLC approved a geophysical survey permit for the revised project and required that an independent third party review process be initiated to evaluate the survey design and data acquisition methodology proposed by PG&E. In addition, the CSLC adopted a “Statement of Overriding Considerations” to be included in the EIR which concludes that “the benefits of the information expected to be obtained by implementing the Project outweigh and override the expected significant effects.” Subsequent to the CSLC hearing, on August 30, 2012, PG&E further revised the project and limited it to only two of the four initially proposed survey areas. On October 1, 2012, PG&E again revised the project and limited it to only one of the four initially proposed survey areas. This revised project is the subject of this coastal development permit application and consistency certification.

The Commission staff coordinated closely with CSLC staff throughout their review process and during the development of the EIR and provided comments on the draft EIR.

California Department of Fish and Game/Fish and Game Commission

Four areas designated as state Marine Protected Areas (specifically, Cambria State Marine Conservation Area, White Rock State Marine Protected Area, Point Buchon State Marine Reserve, and Point Buchon State Marine Conservation Area) are located near or adjacent to the proposed survey area. PG&E estimates that received sound levels within these Marine Protected Areas (MPAs) would vary from approximately 120 dB to 180 dB. Public Resources Code Section 36710 lists the restrictions applied to State Marine Reserves and State Marine Conservation Areas and states that the California Department of Fish and Game (DFG) may permit research activities that would result in the “take” of marine life within both types of MPA. PG&E has requested a Scientific Collecting Permit to authorize the proposed seismic survey.

Although the authority of the Fish and Game Commission is largely restricted to the establishment of policy for DFG and does not extend to the issuance of Scientific Collecting Permits, the Fish and Game Commission can provide recommendations to DFG regarding the issuance of such permits. At a public informational hearing on September 24, 2012, DFG staff presented the Fish and Game Commission with a draft version of the Scientific Collecting Permit it is considering for the proposed project. The Fish and Game Commission discussed the issuance of the Scientific Collecting Permit and recommended that DFG not approve the issuance of the permit if the project would result in adverse impacts to the biological resources of a designated State Marine Reserve or State Marine Conservation Area.

Northern Chumash Tribal Council

During preparation of this report, the Commission staff solicited input from members of the Northern Chumash Tribal Council regarding their history in the project area, the cultural resources they have identified in the project area, and their concerns regarding potential adverse project-related impacts to these resources.

National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) has responsibilities over the proposed project under the Marine Mammal Protection Act (MMPA), the Magnuson-Stevens Fisheries Conservation and Management Act (MSA), the Endangered Species Act (ESA), and the Fish and Wildlife Coordination Act. PG&E has submitted an application to NMFS for Incidental Harassment Authorization (IHA) under the MMPA. This authorization would allow the non-intentional, non-injurious “take by harassment” of small numbers of marine mammals during the proposed project. To be eligible for such authorization under the MMPA, the proposed “take” must not cause physical injury or death of marine mammals, must have negligible impacts on the species and stocks, must “take” no more than small numbers of those species or stocks, and must not have an unmitigable adverse impact on the availability of the species or stocks for legitimate subsistence uses. Pursuant to Section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), any applicant for a required federal permit to conduct an activity affecting any land or water use or natural resource in the coastal zone must obtain the Commission’s concurrence in a certification to the permitting agency that the project will be conducted consistent with California’s approved coastal management program. The subject consistency certification (CC-027-12) will serve as Commission review of the project under the CZMA. Should the Commission concur with the consistency certification for the proposed project, NMFS would then be able to consider, and if appropriate, issue an Incidental Harassment Authorization to PG&E. NMFS published a preliminary Incidental Harassment Authorization for public review and comment in the Federal Register on September 19, 2012. The comment period for this document closed on October 15, 2012. Commission staff coordinated closely with NMFS staff and scientists regarding potential adverse impacts of the project on marine mammals.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service has responsibility over the proposed project under the Endangered Species Act and is carrying out a consultation with NOAA under Section 7 of the Endangered Species Act and is considering the issuance of Incidental Harassment Authorization for the harassment of southern sea otters in the project area as a result of proposed project activities. The draft version of this Incidental Harassment Authorization was posted in the federal register for a 30 day public comment period on September 26, 2012. In addition, Commission staff has been in coordination with U.S. Fish and Wildlife Service staff regarding potential adverse impacts of the project on the southern sea otter.

National Science Foundation

The National Science Foundation (NSF) owns and operates the proposed seismic survey vessel, the *R/V Langseth*. As the owner of the research vessel, the NSF needs to authorize the use of the vessel for this project and is therefore the lead agency under the National Environmental Quality Act (NEPA). NSF released a draft Environmental Assessment for the project under NEPA in June 2012.

G. MARINE RESOURCES

Section 30230 of the Coastal Act 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.

Section 30231 of the Coastal Act 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.

Seismic surveys are among the very loudest anthropogenic underwater sound sources (Richardson et al. 1995). The proposed conduct of high-energy seismic surveys has the potential to adversely affect marine resources and the biological productivity of coastal waters by potentially causing the disturbance, injury, and loss of marine organisms. Specifically, the generation of high-levels of underwater sound has the potential to injure and kill marine mammals, fish, and invertebrates; the towing of four approximately four-mile long cable streamers behind the research vessel has the potential to cause the entanglement of marine wildlife; and the movement of motorized project vessels to and through the project area has the potential to result in collisions with marine wildlife.

Underwater Sound

The generation of high-levels of underwater sound from each proposed 3,300 cubic inch seismic air gun array, as well as the sub-bottom profiler, multibeam echosounder, and 40 cubic inch single air-gun has the potential to disturb, injure and kill marine mammals, fish, and invertebrates.

Fundamentals of Underwater Sound

Four of the primary factors to consider when evaluating exposure to sound are the received sound intensity, pressure, frequency, and duration. Sound intensity is typically measured in decibels (dB). Most sound receivers are sensitive to sound pressure, which is measured in micropascals (μPa), as well as intensity. Received sound intensity, or dB level, is heavily influenced by the medium the sound is traveling through (for example, water vs. air) and the distance between the sound source and the receiver. For this reason, notations of sound intensity levels often include references to the distance from the sound source, and for underwater sound,

the typical convention when describing a sound source is to note its intensity level at a distance of one meter (most commonly, x dB re 1 µPa @ 1 meter (m)).

Differences in the movement and behavior of sound passing through air and water results in the use of different standard measurements for each medium. This means that underwater sound levels cannot be directly compared to sound levels in air, without a process of conversion and a consideration of the distance between the receiver and sound source (refer to Appendix C for a more detailed discussion of this conversion process).

For the equipment proposed to be used for this project, the source sound levels would be:

each 3,300 cubic inch air gun array:	252 dB re 1 µPa @ 1 m;
multibeam echosounder:	242 dB re 1 µPa @ 1 m;
sub-bottom profiler:	204 dB re 1 µPa @ 1 m;
single 40 cubic inch air gun:	212 dB re 1 µPa @ 1 m (approx).

An additional factor to consider when evaluating sound exposure is sound frequency (measured in Hz). While humans normally hear sounds ranging from 20 to 20,000 Hz, some animals including dolphins and porpoise, can detect ultrasonic frequencies (greater than 20,000 Hz) and others, including some baleen whales, can detect infrasonic sounds (less than 20 Hz). Sound frequencies for the equipment proposed to be used for this project would be:

air gun arrays:	0 Hz to 188 Hz (dominant frequencies)
multibeam echosounder:	1200 Hz (approximate)
sub-bottom profiler:	350 Hz.

The final important factor is duration – the period of exposure to a given sound level. This period of exposure can affect an individual's perception of (and physiological and behavioral response to) a given sound. Sound durations are usually divided into two categories – continuous and impulse sound. Each of the two 3,300 cubic inch air gun arrays would generate brief (0.1 second) pulses of sound every 11 to 20 seconds (the two arrays would trade off firing) along each of the proposed transect lines and would be characterized as an impulse sound source. While the single air gun would only be activated during vessel turns and would generate impulse sounds similar to those generated by the full arrays, the sub-bottom profiler and echosounder would be in use during both transects and turns. These devices would generate a new sound pulse every second or fraction of a second and are therefore considered continuous sound sources.

Please refer to Appendix C for a more detailed description of the acoustic process, the relevant measurements used to describe sound, and some of the key factors that affect exposure to sound.

Marine Mammals

A wide variety of marine mammals are known to be present in the project area either permanently or seasonally. As noted in the project EIR at least 22 species of cetaceans (whales and dolphins), six species of pinnipeds (seals, fur seals and sea lions), and one species of fissiped

(sea otter) are typically present along the central California coast. While the abundance of some of the whale species varies seasonally, many species including seals and sea lions, porpoise, sea otters, and dolphins, are year-round residents. Of the seasonal species, some such as gray whales (both eastern and western populations) are typically present during their predictable migration along the coast (moving southward in the late fall/winter and northward in the spring), while others such as blue whales, humpbacks and sperm whales are typically present during feeding aggregations in the summer months. However, marine mammal presence is difficult to predict and not all species and individuals follow these general trends. Predictions of marine mammal presence and density are typically based on average observations over many years and therefore may not reflect the actual behavior of all individuals within a species or the variation in abundance or occurrence that may occur in a single year or season. In other words, marine mammal species may be present in the project area even at times when they are not expected based on the average observations of previous years (e.g., PG&E's low-energy geophysical surveys carried out in the project area between December 2010 and February 2011 encountered 12 humpback whales, despite the fact that this species had not been predicted for this area during this period).

Many marine species, including marine mammals, rely on communication and sensing of their environment for a variety of critical life functions (traveling, finding mates or young, foraging, etc.). Although an animal may communicate and sense its environment in many ways and with a variety of different sensory organs, because seawater is relatively opaque to light and chemicals diffuse slowly in it, marine mammals have evolved to rely primarily on sound to sense their environment and communicate. Consequently, increased acoustic noise in the marine environment can have potentially serious implications for the basic life functions of marine mammals.

The project EIR includes a comprehensive discussion of the specific types of adverse impacts to marine mammals that may potentially result from the high-energy sound levels associated with the proposed survey. These impacts include masking, behavioral disturbance, temporary hearing loss, permanent hearing loss, and other physiological effects, including stranding and/or death. The discussion in the EIR draws heavily on a marine mammal technical report developed for the State Lands Commission by Wood et al. (2012) and included as Appendix H of the EIR (available on the Commission website at: <http://www.coastal.ca.gov/energy/seismic/mm-technical-report-EIR.pdf>). The Commission will be relying primarily on the methodology, analysis, and conclusions of this report and providing excerpts of key sections in this staff report. However, because PG&E substantially modified the project described in its CDP application and consistency certification after the development of this marine mammal technical report and certification of the EIR by the State Lands Commission, the Commission staff requested and received updates to the information provided in several of the tables included in the Wood et al. (2012) report, in order to evaluate the modified project. Information from these updated tables are referred to in the discussion below and provided for reference.

The basic process developed to evaluate the likelihood and magnitude of adverse impacts to marine mammals occurring as a result of the underwater sound involves: (1) dividing the impacts into two categories based on severity and level of harm – roughly, death, injury, or permanent hearing threshold shift (Level A) and disturbance causing disruption of behavioral

patterns or temporary hearing threshold shift (Level B); and (2) estimating the number of animals that would fall into each category based on the area of ocean exposed to sound levels associated with Level A and Level B impacts and the expected density of animals within those areas. The National Marine Fisheries Service (NMFS) has used this protocol for many years to evaluate and regulate underwater noise-generating activities under the Marine Mammal Protection Act (MMPA)⁶. While the particular impact threshold sound levels selected by NMFS have changed over the years, NMFS evaluations carried out recently have considered the Level A harassment exposure threshold for cetaceans to be 180 dB re 1 μ Pa (root mean square (rms), unweighted) (and 190 dB re 1 μ Pa (rms, unweighted) for pinnipeds), and the Level B threshold for all types of marine mammals to be 160 dB re 1 μ Pa (rms, unweighted).

The Commission believes the concept of separating Level A and Level B thresholds is a useful means of evaluating the potential impacts of underwater sound. However, the Commission has also disagreed with and expressed a number of concerns over NMFS' assumptions in the use of this approach over the past two decades – in particular over the assumptions used to establish the sound exposure thresholds for Level A and Level B impacts. Due to the paucity of data, the Commission has questioned: (1) the extrapolation of sound exposure research carried out on only a few select species to nearly all marine mammal species; (2) the extrapolation from conclusions based on studies carried out on animals in captive environments to use for animals in the wild; and (3) the use of a higher sound intensity threshold for pinnipeds than cetaceans. The Commission has also historically called for greater consideration of research carried out over the past decade that suggests that some marine mammal species and some individuals within populations have greater sensitivity to underwater sound and are more likely to be adversely affected by it.

As a result of these concerns, in case-by-case reviews, as well as its comments to the Marine Mammal Commission, the Commission has not agreed with the specific Level A and Level B impact thresholds applied by NMFS in the past; the Commission has found the use of lower, more conservative sound thresholds to be more appropriate for the evaluation of potential noise related impacts to marine mammals (e.g., in Navy consistency determinations CD-037-06 and CD-086-06). While NMFS currently uses lower sound thresholds that are closer to those that the Commission has supported in the past, its continued reliance on a “one size fits all” approach to estimating the number of animals and species that would be adversely affected by underwater sound may not reflect the current level of scientific understanding. Accordingly, the Commission believes that a second set of thresholds that more closely reflect the current state of science should also be considered.

In 2007, an expert panel was convened to summarize the current understanding of marine mammal hearing and behavioral and physiological responses to sound, and to propose new anthropogenic noise exposure thresholds for marine mammals. The work of this panel resulted in a scientific publication by Southall et al. (2007). In the five years since the work of this panel

⁶ The MMPA defines Level A harassment as harassment with the potential to injure a marine mammal or marine mammal stock in the wild, and Level B harassment as harassment with the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavior patterns including, but not limited to, migration, breathing, breeding, nursing, feeding, or sheltering.

was completed, several additional studies have become available that modify some of the conclusions reached by Southall et al. (2007). The development of the EIR for this project for CSLC provided an opportunity for the work of Southall et al. (2007) to be considered along with this more recent research and used to develop a more refined set of thresholds and approach to estimating impact levels. This new methodology was developed for the EIR by Wood et al. (2012) and includes some modifications to the approach described in Southall et al. (2007). To compare this new approach with the older NMFS approach, the EIR also included impact estimates that were derived using the NMFS thresholds.

As noted by Wood et al. (2012):

The Southall et al. (2007) noise exposure criteria, with some modifications based on more recent scientific data, are considered the current state-of-the-art standard in terms of marine mammal noise impacts. However, the more recent results must be considered and integrated as appropriate, in a current assessment of potential hearing and behavioral impacts. In the U.S., the NMFS has not undertaken a wholesale acceptance of the Southall et al. (2007) exposure criteria as a stated policy for all sound sources, although elements have been used in regulatory decision-making regarding military sonar (NOAA 2009a; 2009b). For impulse noise associated with seismic surveys, NMFS is currently using estimated thresholds derived earlier and incorporated into current regulations. For the CCCSIP Project EIR, we assess the potential impacts according to these current regulatory thresholds, as well as relative to a derivation of those proposed by Southall et al. (2007) that take into account some of the more recent scientific data ...

The thresholds developed by Wood et al. (2012) and discussed in the EIR represent a substantial advancement in the evaluation and estimation of noise impacts to marine mammals and are responsive to previous Commission concerns over the need for precautionary measures to address uncertainty. The Commission therefore finds the use of a dual-threshold approach using the Wood et al. (2012) methodology in combination with the NMFS thresholds to be appropriate for evaluating potential impacts to marine mammals from the project's proposed use of underwater sound. The marine mammal technical report developed by Wood et al. (2012) and included as Appendix H of the EIR provides a detailed discussion of the particular dual threshold approach developed for the EIR and its application (specifically, see Section 3.7 on pages 44-48).

The tables below provide Level A and Level B marine mammal impact estimates calculated by SMRU⁷ at the request of Commission staff using the Wood et al. (2012) approach developed for the EIR and based on the October 1, 2012 revised project submitted by PG&E. These estimates include three marine mammal density scenarios, referred to as "base," "upper," and "potential." These three scenarios have been included because marine mammal density is highly variable and difficult to accurately predict for short time periods (on the order of months) in an area the size of the project area. The available marine mammal density data for the project area most accurately predicts average densities over much larger areas and across multiple years.

⁷ SMRU is the consultant group comprised of the Wood et al. (2012) researchers.

Therefore, the “upper” and “potential” density scenarios were included to address potential sources of underestimation in the base density scenario with a more precautionary approach.

In addition, the table for potential Level B impacts also includes estimates developed by PG&E for the National Science Foundation’s June 2012 draft Environmental Assessment and the NMFS September 2012 proposed Incidental Harassment Authorization (IHA) for the project using the NMFS thresholds. PG&E did not develop estimates of Level A impacts because its application to NMFS for an IHA assumed that Level A impacts would not occur in association with the proposed project. PG&E took this approach based on the assumption that marine mammals would avoid the area exposed to sound levels at or above 180 dB, combined with the assumption that the use of marine mammal monitors and other impact avoidance measures, such as carrying out aerial surveys, would provide additional security if marine mammals did not avoid this area. In addition, under the Marine Mammal Protection Act, IHAs can only be used for relatively short-term activities that may incidentally harass marine mammals. The IHA process cannot be used where incidental take would likely result in serious injury or mortality to marine mammals (i.e., Level A impacts).

Level A Impacts

In its October 17, 2012 submittal of underwater sound impact estimates to Commission staff, SMRU provides the following introduction:

The following takes⁸ estimates were calculated for box 4 of the CCCSIP using the methods in Appendix H (Marine Mammal Technical Report) of the CCSIP Final Environmental Impact Report. The Level A and Level B takes for cetaceans and pinnipeds are reported in Tables 1 & 2 respectively. Otter takes are reported in Table 3. Given the planned survey timing (Nov 19 – Dec 15), it is considered that upper and potential take estimates are unlikely to occur for Blue whales, Humpback whales and Fin whales. These species are at reduced densities at this time and substantial turnover of animals is unlikely to occur over the time period November-December given typical migration timing/patterns. The grey whale migration will have just started by December 15 and we estimate that 160 animals will have migrated through the study area by that time (Malme et al. 1984; Rugh et al. 1999; Rugh et al. 2001). This represents 0.8% of the estimated population of 19,126.

We note that our Injury [Sound Exposure Level (SEL)] calculations (Level A) have a temporal component relating to the amount of track line shot and are thus sensitive to reductions in the number of boxes. In contrast, our Probabilistic rms (Level B) calculations are largely area based, with turnover corrections aiming to account for the length of the project. While the removal of box 1, 2 and 3 reduces the total area predicted to be ensonified, given the radii of the predicted disturbance zones (120 and 140 dB rms M-weighted), the relative reduction is small as a consequence, especially given the limits of harbor porpoise distribution offshore and coastally. NMFS Minimum estimates are also largely area based, whereas NMFS Maximum has a temporal component relating to the amount of track line shot.

⁸ Under the Marine Mammal Protection Act, adverse impacts (including harassment) to marine mammals are referred to as “take.”

Table 1 Proposed Project YEAR 1 (Box 4) Level A takes of special status species calculated using Injury SEL and NMFS rms thresholds under three density scenarios. Red cells highlight high magnitude (>100%), orange highlight medium magnitude (50-100%) and yellow low magnitude (10-50%), based on percentage of Residual Potential Biological Removal (PBR) [see footnote 7]. Endangered species are denoted in italics. Take estimates have been modified to take account of group-specific behavioral avoidance responses (range 90-99%) whereby animals avoid the area ensonified to the Level A threshold, as well as detection success of animals entering or within the exclusion zone using [Marine Mammal Observers] and [Passive Acoustic Monitors].

Species	Residual PBR	Marine Mammal Density Scenarios		
		Base	Upper	Potential
<i>Fin whale</i>	15	0.3	0.4	0.9
<i>Humpback whale</i>	7.7	0.1	0.2	1.2
<i>Blue whale</i>	2.1	0.1	0.2	0.5
Minke whale	2	0.0	0.0	0.0
Short-beaked common dolphin	3,376	2.7	4.1	5.1
Long-beaked common dolphin	151	0.1	0.2	0.3
Small beaked whale species	25	0.0	0.0	0.0
Harbor porpoise	15	2.9	6.5	6.5
Dall's porpoise	257	0.2	0.3	0.3
Pacific white-sided dolphin	178	0.3	0.4	0.5
Risso's dolphin	39	0.1	0.2	0.3
Northern right whale dolphin	43.2	0.1	0.2	0.2
Bottlenose dolphin – CA coastal	2.4	0.0	0.0	0.0
<i>Sperm whale</i>	1.5	0.0	0.0	0.0
Harbor seal	1,569	0.8	1.5	1.5
California sea lion	8,766	49.2	61.5	76.9
Southern sea otter	2,800	11.4 ⁹		
TOTAL		56.9	75.7	94.2

As indicated by the data in the table above, 13 of the 17 marine mammal species known to inhabit the project area are expected to experience harassment with the potential to result in direct physical injury as a result of the proposed project (Level A impacts). The other four species – minke whale, sperm whale, coastal bottlenose dolphins, and small beaked whale

⁹ SMRU provided this estimate of the number of sea otters that would be exposed to sound levels of at least 180 dB re: 1 µPa rms and approached to less than 100 meters by the project vessel.

species are not expected to experience Level A harassment due to the low anticipated densities of these animals in the project area during the proposed surveys. Under the highest of the three modeled density estimates, the number of animals that would be potentially injured in each species varies greatly, from 77 sea lions, 7 harbor porpoises, and 5 short-beaked common dolphins to between 0 and 1 for species such as the Dall's porpoise and northern right whale dolphin (the model used to generate these impact estimates relies heavily on marine mammal density data which includes tenths of animals so the impact estimates also include fractions). The Commission uses the highest density estimates to assess the potential impacts of the project due to the uncertainties inherent in the model and in order to analyze the full potential impact of the project. Under the highest density estimates, the underwater sound that would be generated by the proposed project has the potential to cause direct physical harm to approximately 94 individual marine mammals from 13 species.

In the table above, the residual “potential biological removal” level¹⁰ established by the National Marine Fisheries Service is included to provide a population scale context for the various Level A impact estimates. Essentially, the closer the estimated impact level for a particular species is to the potential biological removal (PBR) number, the more severe the impact would be expected to be on the overall population of that species. Among the 13 species for which potential Level A impacts are estimated, there is one – the Morro Bay stock of harbor porpoise – with estimated take levels (seven) that would reach nearly 50% of its residual PBR (15). Based on these estimates, therefore, the project could potentially threaten the long-term survival of the regional population of harbor porpoise by causing the loss of a high proportion of the animals that could be killed before the population falls below its estimated optimum population size. When considering the residual potential biological removal value included above – the adjusted number that takes into account other sources of human caused mortality that have already affected the stock this year – it is important to consider a series of eight harbor porpoise deaths that have occurred in the project area between late-September and late-October. These deaths are currently being evaluated by NMFS and if any of them are linked to human activities, the residual potential biological removal for harbor porpoise would need to be adjusted downward, thus further increasing the potential for the proposed project to cause this stock to fall below its optimum population size.

In addition, a review of the methodology and assumptions made by Wood et al. (2012) in the development of their impacts assessment model suggests that the Level A take estimates provided in Table 1 may be too low. As discussed by Wood et al. (2012) in the Acoustic Take Methodology Section (Section 3.9) of their report, one of the assumptions made in their model is that marine mammal observers would be used to enforce an exclusion zone around the project vessel in order to assure that the air guns are turned off if a marine mammal is observed close

¹⁰ Potential biological removal (PBR) is an estimate of the maximum number of animals that can be removed from a population from human-caused mortality without causing the population to fall below its optimum size. Each year, NMFS releases stock assessment reports for all regional marine mammal populations in the Pacific Ocean that includes calculations of the PBR for each of these populations based on the most recent available data. The residual PBRs used in Table 1 are from the NMFS U.S. Pacific Marine Mammal Stock Assessments for 2011 and are corrected to include the reported annual anthropogenic mortality estimate for each stock. Residual PBR is an adjusted number that takes into consideration the human-caused mortality to the population that has already occurred in a given year.

enough to the air guns to receive injurious sound levels. This precautionary measure is a standard practice for high-energy seismic surveys and has been proposed by PG&E as an “applicant proposed mitigation measure.” However, marine mammals can be difficult to observe at sea, suggesting that the effectiveness of marine mammal observers may vary. Wood et al. (2012) note this and elaborate that:

Marine Mammal Observers (MMOs) on the scout vessel and the survey vessel and initially on the aircraft would be used to monitor the exclusion zone. Passive acoustic monitoring (PAM) would also be in operation. A proportion of animals predicted to co-occur within the Level A radii should be detected, causing subsequent power down (or shut down) and reduction in the predicted take estimate.

The proportion of time MMOs are able to observe will vary over the survey. We have assumed a 12 h. visual monitoring day on average (Civil twilight starts at 6.38am, ends at 6.28pm on October 20th in the investigation area). Quantitative values for probability of detection if an animal is within the prescribed exclusion zone (an average of ~1km based on Greenridge and Jasco Applied Sciences models) are not available for most species, and where available, would depend upon sea conditions and visibility, among other factors. Estimates listed in Table 3.11 are qualitative estimates from experienced field biologists working on these species in many areas. Data was derived for an Environmental Assessment conducted in support of NMFS permit #14534 for biological and behavioral response studies in southern California. The estimates are based upon the size of the individual (the larger the animal, the more likely to detect), the size of the group (the larger the group, the more likely to detect), the frequency of surfacing, and the visibility of surface behavior. These estimates for the distance at which sensitive and hard-to-sight species (e.g., beaked whales) are detected also take monitoring for vocalizations into account. Daylight detection probabilities are considered maximums, taking into account the use of MMOs on two vessels and the proposed use of PAM (Table 3.11). Detection probabilities will likely decrease if the survey continues in poor weather, increasing Level A takes. (emphasis added)

In other words, Wood et al. (2012) used data derived from a discussion by experienced field biologists of the limitations of observing marine mammals at sea in order to come up with detection probability estimates for all of the species considered in their analysis. For Dall’s porpoise, harbor porpoise, sea lions, and harbor seals, detection probability was set at 50% (primarily based on the small size of these animals); for all other species it was set at 90%. These probabilities were then integrated in the model for daylight observer effectiveness (at night marine mammal observer effectiveness was set at 0).

However, as Wood et al. (2012) correctly notes, these effectiveness estimates would not be accurate for surveys carried out in poor weather. In order to evaluate the likelihood that the proposed surveys would be carried out in poor weather, Commission staff requested information from the PG&E weather station at DCPP regarding the typical sea state, visibility, and weather conditions during the proposed project period. A “Beaufort Scale” is typically used by marine mammal biologists to describe weather conditions. A Beaufort Scale of two (waves of 1-2 feet, winds of 4-7 mph and no whitecaps) is considered by marine mammal field biologist to represent

the level beyond which sea state conditions impede the likelihood of successfully observing marine mammals, when present.

A review of the weather data provided by PG&E indicates that 33% of the days in November and 58% of the days in December experience wind speeds that exceed those defined as a Beaufort Scale of two. The wave heights on 99% of the days in both months tend to exceed those defined as a Beaufort Scale of two. Specifically, the wind speed for the months of November and December in the project area exceeds 18 mph and the mean wave heights for these months are 5.6 feet and 6.5 feet, respectively. Taken together, these wind and wave conditions most closely represent those defined as a Beaufort Scale of five, thus significantly higher than what marine mammal field biologists consider to be conditions in which they can successfully observe marine mammals.

Thus, based on the specific sea state conditions that are expected to be present in the project area during the proposed surveys, the marine mammal observer effectiveness assumptions used by Wood et al. (2012) appear to be overestimates. A recent letter dated October 11, 2012 from the Marine Mammal Commission to USFWS regarding its proposed IHA raised similar concerns, noting that before moving forward with the issuance of its IHA, USFWS should

provide additional justification for its preliminary determination that the proposed vessel-based monitoring program will be sufficient to detect, with a high level of confidence, all marine mammals within or entering the identified exclusion and buffer zones—such justification should (1) describe the efficacy of visual monitoring under the expected environmental conditions (including nighttime and potentially adverse weather conditions), (2) describe detection probability as a function of distance from the vessel, (3) describe changes in detection probability under various sea state and weather conditions and light levels...

Additionally, the potential lack of efficacy of marine mammal observers is further supported by information from the most recent seismic survey carried out by the proposed survey vessel, the *R/V Langseth*, in July 2012 off the coast of Oregon. A recently released marine mammal observer report from this survey indicates that despite implementation of impact avoidance measures (including many of those proposed by PG&E for the proposed survey), humpback whales were repeatedly exposed to sound levels in excess of 180 dB – levels anticipated to result in Level A harassment - despite the fact that such exposures were not authorized and all of the standard precautionary measures were in place to avoid them. As noted in the *Protected Species Mitigation and Monitoring Report for the Cascadia Thrust Zone Structures in the Northeast Pacific Ocean, 3 July 2012 – 6 July 2012, R/V Marcus G. Langseth*:

Eleven sighting events totaling 23 animals were observed within the 160 dB safety radius; 15 of these 23 animals were observed to be exposed to received sound pressure levels of 180 dB or greater. The humpbacks were observed to be in groups ranging from one to five animals. Of the 23 animals observed six were identified as juveniles.

Although this particular survey lasted just two and a half days and was authorized to expose no more than 12 humpback whales to sound levels at or below 160 dB – the Level B harassment threshold – the use of marine mammal observers and passive acoustic monitors appears not to have been effective. As a result, nearly twice the authorized number of humpback whales were exposed to sound levels of 160 dB or greater, including the 15 exposed to sound levels associated with Level A harassment. While the cause of this incident is not yet clear, the report notes that high wind speeds and swell heights were common throughout the survey. These conditions may have contributed to the lack of effective marine mammal monitoring.

Therefore, it appears likely that the Level A take estimates in Table 1 may be somewhat low as a result of the use of optimistic assumptions regarding the effectiveness of marine mammal monitors.

Level B Impacts

Wood et al. (2012) provides the following introductory discussion to aid in the interpretation of the Level B take estimates included in the analysis submitted to the Commission:

Table 2 Proposed Project YEAR 1 (Box 4) Level B takes of special status species calculated using Probabilistic Disturbance rms and NMFS rms thresholds under three density scenarios. Red cells highlight high magnitude (Listed species >2.5%, non-listed species >25%), orange highlight medium magnitude (Listed species 1.25-2.5%, non-listed species >15-25%) and yellow low magnitude (Listed species >1 individual, non-listed species 5-15%), based on percentage of minimum population estimate. Endangered species are denoted in italics. Take estimates have been modified to include group-specific behavioral avoidance responses whereby animals avoid the Level A threshold area.

Impact Threshold Approach	Minimum population estimate	Wood et al. (2012) Probabilistic Disturbance rms			NMFS	
		Base	Upper	Potential	Base	Base + 25%
Density scenario						
Species						
<i>Fin whale</i>	2,624	56.8	82.0	205.0	5	6
<i>Humpback whale</i>	1,878	26.7	44.9	258.1	3	3
<i>Blue whale</i>	2,046	28.4	46.4	115.9	3	4
Minke whale	202	1.8	2.8	7.1	0	0
Short-beaked common dolphin	343,990	482.4	736.1	920.1	349	436
Long-beaked common dolphin	17,127	14.8	43.2	54.0	14	18
Small beaked whale species	2,498	33.6	52.0	65.0	2	2
Harbor porpoise	1,478	1028.4	2327.9	2327.9	315	394
Dall's porpoise	32,106	196.2	329.7	412.1	16	20
Pacific white-sided dolphin	21,406	51.1	78.2	97.8	38	47
Risso's dolphin	4,913	22.0	43.0	53.8	18	23

Northern right whale dolphin	6,019	22.7	32.5	40.6	22	28
Bottlenose dolphin - CA coastal	290	7.4	10.6	13.2	17	21
Striped dolphin	8,231	*	*	*	2	2
<i>Sperm whale</i>	751	0.4	0.6	0.8	0	0
Harbor seal	26,667	24.7	48.0	48.0	13	16
California sea lion	153,337	1592.9	1991.2	2489.0	182	228
California gray whale	19,126	*	*	*	17	21
Killer Whale	86/162/346 ¹¹	*	*	*	1	2
Baird's beaked whale	615	*	*	*	1	1
Pygmy and dwarf sperm whale	400	*	*	*	1	1
Sea otter	2,800	*	*	*	352	**
TOTAL		3590.3	5869.1	7108.4	1019	1273

*-The analysis provided by SMRU does not include estimated impact numbers for these species.

**-Because the U.S. Fish and Wildlife Service (USFWS) has regulatory authority over the southern sea otter, PG&E submitted an application to it for an IHA. The proposed IHA released for comment by USFWS does not include the 25% buffer assumption included in the NMFS proposed IHA.

As shown in Table 2 above, the estimated level of disturbance to marine mammals from the proposed project would be high. Specifically, under the most conservative (i.e., highest) density estimate and using the Wood et al. (2012) thresholds, over 7,000 individual marine mammals from 17 species would be exposed to sound levels sufficient to result in some level of disturbance and behavioral disruption. Among these species are four – fin whales, blue whales, humpback whales, and harbor porpoise – expected to experience “high or medium magnitude” disturbance, as defined by Wood et al. (2012). Wood et al. (2012) uses the high, medium, and low magnitude thresholds to allow the take estimates to be considered in a population context. For the three large whale species federally listed as endangered (fin whales, humpback whales, and blue whales), medium magnitude disturbance is defined as disturbance estimated to affect 1.25% to 2.5% of the total population of the species. For harbor porpoise, the high magnitude threshold is defined as disturbance to more than 25% of the population. However, for harbor porpoise, the estimated disturbance would greatly exceed this threshold, with approximately 200% of the population estimated to experience Level B disturbance (essentially, every individual in the entire population would experience multiple disturbances).

¹¹ Three stocks of killer whale may be in the area, the minimum population estimate for the eastern North Pacific southern resident stock is 86; the minimum population estimate for the eastern North Pacific offshore stock is 162; and the minimum population for the eastern North Pacific transient stock is 346.

The impact estimates included in Table 2 for the NMFS Level B exposure threshold were calculated by PG&E and provided in its IHA application to NMFS (and subsequently included in the proposed IHA that was released for public comment in late September 2012). Because some of the marine mammals species for which PG&E has requested authorization to harass are federally listed as endangered or threatened under the Endangered Species Act, the NMFS Endangered Species Act Interagency Cooperation Division is currently carrying out a consultation with the NMFS Permits and Conservation Division as well as the National Science Foundation (owner of the seismic survey vessel) regarding the potential adverse effects to these species. This consultation is ongoing and is expected to be completed in mid-November 2012. Although the results of this consultation are not yet available, in personal communications with Commission staff, NMFS Endangered Species Act Interagency Cooperation Division staff has indicated that it has determined that the impact on listed marine mammal species (fin whale, humpback whale, blue whale, sei, and sperm whale as well as Guadalupe fur seals and Steller sea lions) provided by PG&E in its IHA application were calculated in a manner that resulted in potentially substantial underestimations. As such, the NMFS Endangered Species Act Interagency Cooperation Division is working with the NSF, PG&E, and the NMFS Permits and Conservation Division to re-calculate these estimates for listed species to more accurately reflect the likely impact that would occur as a result of the proposed project.

Gray Whales

In addition to the Level A and B impact estimates derived using the Wood et al. (2012) approach for the marine mammals species included above, the proposed project would also have the potential to adversely affect eastern gray whales. Gray whales are not included in the tables above due to an assumption made by SMRU that active air gun activities would be completed prior to December 15. (Although the analysis by SMRU suggests that 160 gray whales may be present in the area before this date, December 15 is considered to be the beginning of their southern migration in this area and represents the date beyond which substantially larger numbers would likely be present.) However, CSLC has authorized PG&E to operate air guns past this date, and PG&E has indicated to Commission staff in its October 1, 2012 modified project proposal that operations through December 31, 2012 would be carried out if necessary. As such, the following discussion from Wood et al. (2012) of the timing of the southbound gray whale migration and its effect on Level A and B impact estimates for this species should be considered:

The Investigation Area co-occurs with the migration route for majority of Eastern North Pacific Stock of gray whales, a population numbering up to 19,126. Southward transit through investigation area is estimated to start mid-December (15th) and peaks mid-January (15th). Small numbers may migrate through area prior to predicted start of migration. The majority of population likely to travel within 3 nautical miles of coast and pass through study area in <24 h. with limited feeding expected to take place. Based on likely sensitivity and (somewhat limited) use of low frequency sounds, gray whales may be more likely than odontocete cetaceans to be affected by seismic noise and they have been shown to exhibit localized avoidance to seismic exploration sound (Malme et al. 1984). However, there is no strong evidence suggesting gray whales are particularly sensitive to seismic or other low frequency noises and responses are expected to be limited and temporary avoidance behavior. Assuming survey is completed prior to the middle of

December, then project impacts considered insignificant. Impacts of survey scale to the degree of delay beyond December 15th. High and medium magnitude impact considered Level B harassment to 25% (n=4504) and 15% (2703) of minimum population, may occur approximately 23 and 18 days after predicted migration start (January 2-6th). Direct effects up to day 23, including potential Level A takes, highly unlikely to exceed residual PBR of 233 animals, given responses to noise, typically inshore travel patterns and low likelihood of potential entanglement and oil contamination. May affect and may have substantial adverse effects assessment if survey delayed beyond January 2th. Special mitigation monitoring recommend (initiated only if delayed surveys continue beyond 15th December) to confirm non-blocking avoidance reaction and study prediction of migration transit timing and rate.

Considering that PG&E has proposed to carry out active air gun operations until December 31, between 160 and approximately 2700¹² gray whales would be likely to traverse the project area by this date. The project, if carried out during this time, as proposed by PG&E in its October 1, 2012 revised project, therefore has the potential to result in exposure of these whales to sound levels sufficient to cause Level A and/or Level B impacts. A portion of these whales would be pregnant females en route to calving grounds in Baja, Mexico, and may be particularly sensitive to disturbance.

Although virtually indistinguishable physically, gray whales are comprised of two distinct populations, the eastern gray whale discussed above and the western gray whale. While the eastern gray whale is no longer on the federal endangered species list, the western gray whale has an estimated population size of less than 150 individuals, is federally listed as endangered, and is considered to be one of the most endangered marine mammal populations in the world. While the current understanding of the geographic range and migratory routes of this population indicates that it is restricted to the western Pacific Ocean – off the coast of Russia – research carried out in the past several years¹³ with the use of satellite tags suggests that this assumption may need to be revisited. Specifically, several tagged western gray whales have been shown to cross the Pacific Ocean and spend fall and winter months off the coast of California and Baja, Mexico. This research has been corroborated through the use of photo identifications of individual western gray whales arriving in Baja in along with the southward migration of eastern gray whales and through the analysis of genetic samples taken of migrating gray whales off the

¹² In its October 17, 2012, marine mammal impact assessment submittal to Commission staff Wood et al. indicate that “grey whale migration will have just started by December 15 and we estimate that 160 animals will have migrated through the study area by that time (Malme et al. 1984; Rugh et al. 1999; Rugh et al. 2001).” Further, in the technical report developed for the EIR, Wood et al. note that Level B impacts to 2703 gray whales may occur by January 2nd. Therefore, the survey activities carried out between the 15th and 31st of December have the potential to result in Level B impacts to between 160 and approximately 2700 gray whales.

¹³ This research was conducted by A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences (IEE RAS) and Oregon State University Marine Mammal Institute in collaboration with the U.S. National Marine Fisheries Service, Kronotsky State Nature Biosphere Reserve and the Kamchatka Branch of the Pacific Institute of Geography. The research was contracted through the International Whaling Commission (IWC) and International Union for Conservation of Nature (IUCN) with funding from Exxon Neftegas Ltd. and Sakhalin Energy Investment Company Ltd.

coast of central California. A limited number of western gray whales may therefore be present within the project area in fall and winter months along with eastern gray whales.

As noted in a March 2012 press release from Oregon State University:

The long-distance journey of [the tagged western gray whales – one of which has been named “Varvara”] is critical because this is the first time scientists have documented that critically endangered western gray whales travel to Baja Mexico, where eastern gray whales frequent. Western gray whales are thought to be genetically distinct from their more populous cousins that are common up and down the West Coast, but Varvara clearly was mingling with eastern gray whales.

Mate said there are only about 130 western gray whales in the world and the behavior of Varvara has significant ecological and management implications.

“Clearly the experience of Varvara, and Flex [another tagged western gray whale] before her, demonstrates that western gray whales can and do come over to the eastern Pacific,” Mate said. “Whether this suggests that they are not a distinct population or that we underestimated their range isn’t yet clear.”

While the number of tagged whales that have been shown to travel to California is low, the possibility exists that other non-tagged whales may also be making a similar journey. This recent information indicates that western gray whales may also be present in the project area during the proposed surveys and may also experience adverse impacts due to exposure to elevated levels of underwater sound. Based on available information, the probability is low that the proposed project activities would result in exposure of western gray whales to sound levels high enough to cause Level A or Level B impacts. Given the extremely limited numbers of western gray whales that exist, however, even a low probability of such impacts occurring should be considered closely.

Harbor Porpoise

As described above and demonstrated in Table 1 and Table 2, harbor porpoise (Morro Bay stock) would likely be the most severely affected of the marine mammal species in the project area. Wood et al. (2012) provides the following specific discussion of the susceptibility of harbor porpoise to noise related impacts and further elaborates on the impacts anticipated to occur as a result of the proposed project:

Harbor porpoise (Morro Bay stock)

The Investigation area co-occurs with the core habitat of the increasing Morro Bay Stock of harbor porpoises. Considered a resident population (best estimate 2044 individuals, minimum 1478 individuals), with very limited opportunity for emigration, as this stock are not encountered south of Point Conception and the coastal areas north of the Investigation area are considered sub-optimal habitat, with relatively low sighting rates in NOAA surveys. Restricted movement into deeper water (>200m) is also unlikely based on strong coastal habitat preferences (mainly <91m water depth). Time period of survey is post the summer calving period and overlaps with the presumed fall breeding season and therefore

considered a sensitive period. Species considered very sensitive to anthropogenic noise effects on hearing (Lucke et al. 2009) and on behavior from a wide range of laboratory and field studies (see Southall et al., 2007). Behavioral responses to seismic noise have been infrequently observed in harbor porpoises (Lucke et al. 2009), and based on their apparent sensitivity to seismic noise in this study and also sounds of various types, there is likely a greater potential for avoidance behavior at large ranges, even given the low frequency nature of seismic air guns.

Injury SEL takes ([2-7] individuals) resulted in up to low direct impact ratings. Level A takes increase dramatically if assumed behavioral avoidance responses to high intensity noise were reduced, but significantly decreased responses are considered unlikely. Both Probabilistic Disturbance rms and NMFS Level B takes were considered high impact, in all 6 scenarios tested (i.e., both methods at all density scenarios). Probabilistic Disturbance rms takes of [1028-2328] individuals equate to [70]-100+% of the minimum population estimate...

The porpoise population is considered at high risk to potential for short-term acoustic-related prey disturbances due to residency. Overall, prediction of substantial interference in movement and reduction in core habitat. A large proportion of the population is likely to be affected. The project may affect and likely have a substantial adverse effect through habitat modifications/reduction and combined direct and indirect acoustic effects. Mitigation: Impacts to porpoise are believed largely through Level B harassments which are considered very difficult to mitigate given the ranges over which they occur. Sighting and acoustic detections are typically short-range and are unlikely to extend beyond the exclusion zone. Thus even with mitigation measures proposed the Project likely has a substantial adverse effect on harbor porpoise.

These analyses and conclusions are supported by NMFS and elaborated on more fully in its proposed IHA. In particular, NMFS raises additional concerns regarding the high energetic requirements of this species and the difficulty it may have on a population level from being displaced from its core habitat and forced to expend large amounts of energy traveling away from the area in order to avoid the air guns. NMFS states:

The proposed seismic operations will occur throughout a large portion of the range of the Morro Bay stock of harbor porpoises (i.e., Point Sur to Point Conception, California), and cover much of the core range and optimal habitat for this stock for the duration of the seismic survey. Sighting rates outside of the operational area are much lower, indicating sub-optimal habitat. Studies have shown that harbor porpoises are sensitive to underwater sound and will move long distances away from a loud sound source; and the Morro Bay stock may be forced to move to sub-optimal habitat at the ends of (North or South), or outside their normal range for days to weeks, which may affect foraging success which could in turn have energetic impacts that effect reproduction or survival. This is a coastal species that is primarily found in shallow water within the approximate 100 m (328 ft) isobath and does not move offshore as this is not suitable habitat, and the seismic air gun operations will ensonify a large area that reaches from land to offshore past where harbor porpoises are typically found. This small-bodied species has a high metabolic rate (Spitz et

al., 2010) requiring regular caloric intake to maintain fitness and health; therefore, there is a potential for adverse health effects if an animal were forced into an area offering sub-optimal habitat for an extended period of time. The November to December, 2012, timeframe of the seismic operations will avoid the peak of their breeding season and after the first few months that are critical to nursing mothers and dependent calves. The phased approach, as suggested by NMFS and agreed to by the applicant, of conducting seismic operations within the survey boxes (i.e., Survey Box 4 first, Survey Box 2 second in 2012) over multiple years (i.e., Survey Box 1 planned for 2013) has significantly reduced the anticipated energetic impacts within a given year by spreading them over two years. Further, the required monitoring plans will allow us to assess the degree to which, and in part the amount of time, harbor porpoises may be displaced from their core habitat (and potentially crowded into sub-optimal habitat and adjust, in real time L-DEO and PG&E's activity to minimize the likelihood of population level effects...

To further illustrate the points raised above regarding the proposed conduct of active survey operations within the core habitat of the Morro Bay stock of harbor porpoise, [Exhibit 6](#) includes a figure demonstrating the location of this core habitat area in relation to the proposed survey areas and a discussion of the genetic and geographic isolation of this stock from the 2011 U.S. Pacific Marine Mammal Stock Assessments developed by NMFS. This figure supports the assessment of Wood et al. (2012) and NMFS that the proposed project will have significant adverse effects on the Morro Bay stock of harbor porpoise. Marine mammal aerial surveys carried out in the project area on October 2, 2012, the results of which are also included in [Exhibit 6](#), further support these conclusions and demonstrate that harbor porpoise are likely to be present within close proximity of the proposed active survey activities.

EIR, Applicant Proposed, and Draft IHA Mitigation Measures for Marine Mammal Impacts
To address the anticipated adverse impacts to marine mammals in general and harbor porpoise in particular, the EIR and the NMFS draft IHA describe a variety of directed and PG&E proposed impact avoidance and reduction measures. These measures include some of the standard operating procedures for high-energy offshore seismic surveys as well as several unique measures developed specifically for this project. These measures are described in detail in Appendix D and include: (1) the establishment of a 160 dB safety zone and a 180 dB exclusion zone around the survey vessel; (2) the use of prolonged “ramp-up” periods to slowly increase the sound levels generated by the air guns; (3) the use of marine mammal scans to ensure that no marine mammals are observed within the exclusion zone prior to the initiation of ramp-up; (4) the use of marine mammal observers on the survey and support boats; (5) the use of passive acoustic monitors to augment the marine mammal observer efforts; (6) the use of aerial surveys before and during the project to determine if large concentrations of marine mammals are present within the survey area; (7) the surveying of nearshore tracklines during daylight hours to increase observer effectiveness; (8) and the use of adaptive management in case of multiple marine mammal sightings within the exclusion zone.

While these measures would reduce the anticipated adverse impacts to marine mammals, adverse impacts are still likely to occur. The expected impact reduction from many of these measures was integrated into the Wood et al. (2012) Level A harassment analysis and the results included in Table 1 include this reduction factor. In addition, despite these measures, the EIR concludes

that “the overall potential noise-related Project impacts on marine mammals are considered to be *Significant and Unavoidable*” (emphasis in original). Accordingly, the draft IHA further builds on PG&E’s proposed marine mammal measures and those required in the EIR and requires additional impact reduction measures for marine mammals, especially for harbor porpoise. These measures are also described in Appendix D and include the development and implementation of a variety of impact assessment and reduction plans. For example, as described in the draft IHA:

NMFS coordinated closely with PG&E to develop a comprehensive and precautionary monitoring, mitigation, and adaptive management framework. This plan, which PG&E has agreed to operationally and financially support, is designed to detect significant responses of harbor porpoises to the activity that can be used to trigger management actions in real-time and allow the activity to proceed in a cautious manner in light of some uncertainty regarding how this species will respond to the activity.

In addition, the draft IHA also describes the need for a NMFS Morro Bay stock of Harbor Porpoise Monitoring Program, a Southern Sea Otter Monitoring Program, and a Marine Mammal Stranding Response Plan. The analysis included in the draft IHA indicates that the implementation of these plans would be essential to reducing anticipated project related impacts to marine mammals and to allowing the IHA to be issued. As such, Commission staff requested copies of these plans from PG&E. On October 5, 2012, PG&E provided Commission staff with a draft Cetacean Aerial Survey and Passive Acoustic Monitoring Plan, a draft Stranding Response Plan, and a Sea Otter Monitoring Plan. The draft Cetacean Aerial Survey and Passive Acoustic Monitoring Plan and draft Stranding Response Plan were prepared by NMFS staff while the Sea Otter Monitoring Plan was prepared by staff of USGS with input from USFWS and CDFG.

The Commission staff has reviewed these plans and concluded that they have been largely developed to assess the magnitude and range of impacts to marine mammals that may result from the proposed surveys rather than to ensure that such impacts do not occur or are mitigated. While the plans would allow severe impacts, such as large stranding events and significant mortality, to trigger the shut-down of survey operations, given the opacity of the marine environment, if such impacts occur they may remain undetected or be discovered subsequent to the completion of the survey. These conclusions are supported by the NMFS and USFWS staff who contributed to the design of these plans (K. Forney and L. Carswell, personal communications).

While implementation of these plans would undoubtedly provide additional insight on the type of and level of impacts to marine mammals (in particular harbor porpoises and sea otters) that would result from the proposed project, the design of these plans would not provide sufficient information to comprehensively assess all of the impacts that may have occurred to marine mammals. In addition, these plans would not be expected to result in a significant reduction in the anticipated amount of Level A and Level B take of marine mammals associated with the project. Further, PG&E has not provided any clear commitment to carry out compensatory mitigation if the monitoring efforts described in these plans conclusively demonstrate that adverse impacts to marine mammals have occurred. As such, the Commission does not find that

implementation of these plans would reduce potential impacts to the Morro Bay stock of harbor porpoise to a level that would be less likely to cause significant population level impacts and potentially jeopardize the continued presence and survival of this species in the project area.

The Commission finds that the project's above described effects, including behavioral harassment and potentially injurious physiological harm to large numbers of marine mammals, cannot be reconciled with the requirement of Section 30230 to protect marine resources and the biological productivity of coastal waters. The Commission therefore concludes that the project's noise effect on marine mammals alone would be inconsistent with Section 30230 of the Coastal Act.

Adult and Juvenile Fish

As with marine mammals, many fishes also depend on sound to communicate with one another, detect prey and predators, navigate, avoid hazards, and interact with their surrounding environment. High levels of underwater anthropogenic sound may therefore result in a wide range of potential impacts on fishes, ranging from behavioral responses to death. The occurrence and magnitude of such impacts may vary depending on many things, from the acoustic characteristics of the source to the distance of the fish from that source, as well as the state and motivation of the fish. Close to a sound source, where the intensity is highest, the impact may include death, physical injury, temporary hearing threshold shift, masking, and behavioral responses. As the animal gets further from the source and the sound intensity level decreases, the number of potential types of impacts also decreases. This concept is discussed by Hawkins and Popper (2012) in their review of available research on the effects of underwater sound on fish and invertebrates:

Perhaps the most important concern is how man-made sounds alter the general behavior of fishes. It is likely that fishes will respond behaviorally to man-made sounds at lower sound levels than would result in physiological effects. Thus, fish will show behavioral responses to sounds at much greater distances from the source than those which will result in physical injury. Changes in behavior could have a population level effect such as keeping fish from migratory routes (e.g., salmon or American shad). Issues not only involve detection but also questions of habituation and how fish, in general, respond to a fright stimulus.

There are very few studies on the behavior of wild (unrestrained) fishes, and these have been only on a few species and the data are often contradictory. This includes not only immediate effects on fish that are close to the source but also effects on fish that are further from the source.

While a review of those few studies that have been carried out in the wild, as well as the similarly limited set of studies conducted in laboratory environments provides useful insights, it is important to note that extrapolation of the results of these studies on a limited number of species to the full diversity of fish species within a particular area should be approached with caution. Over 32,000 fish species have been identified to date and within these species is an extraordinary diversity in ear structures and other anatomical features, such as swim bladders, that may play a significant role in hearing abilities and sensitivities to adverse impacts from

exposure to underwater sound. Additionally, factors such as size, age, behavior at the time of exposure, and surrounding habitat may also strongly influence the susceptibility of individual fish to adverse impacts. Therefore, the observed behavioral and physiological responses of a limited number of species or individuals within a population may not accurately reflect the responses of other species and individual animals.

As described by Hawkins and Popper (2012), several studies have demonstrated that moderate levels of anthropogenic underwater sounds may affect the behavior of at least a few species of fish:

Engås et al. (1996) and Engås and Løkkeborg (2002) examined movement of fish during and after a seismic air gun study - although they were not able to actually observe the behavior of fish directly. Instead, they measured catch rate of haddock and Atlantic cod as a surrogate or indicator of fish behavior. These investigators found that there was a significant decline in catch rate of haddock and Atlantic cod that lasted for several days within the area of active seismic surveys after termination of air gun use. Catch rate subsequently returned to normal. The conclusion reached by the investigators was that the decline in catch rate resulted from the fish moving away from the fishing site as a result of the air gun sounds.

*More recent work (Slotte et al. 2004) showed similar results for several additional pelagic species including blue whiting (*Micromesistius poutassou*) and Norwegian spring-spawning herring. In this study, Slotte et al. (2004) used sonar to observe the behavior of fish schools and reported that fishes in the area of the air guns appeared to swim to greater depths after limited air gun exposure. Moreover, the abundance of animals 30 to 50 km away from the ensonified area increased, suggesting that migrating fish may avoid entering an area of ongoing seismic survey activity...*

Most recently, Løkkeborg et al. (2012) have reported similar experiments to those described above, and obtained data that could be interpreted to suggest that some sounds actually result in an increase in fish catch.

*In similar studies, Skalski et al. (1992) showed a 52% decrease in rockfish (*Sebastodes sp.*) catch when the area of catch was exposed to a single air gun emission at 186 to 191 dB re 1 Pa (mean peak level) (see also Pearson et al. 1987, 1992). They also demonstrated that fishes would show a startle response to sounds as low as 160 dB, but this level of sound did not appear to elicit a decline in catch.*

Wardle et al. (2001) used underwater video and an acoustic tracking system to examine the behavior of fish on a reef in response to emissions from a single seismic air gun. They observed startle responses and some changes in the movement patterns of fish. Startle responses have been observed in several fish species exposed to air gun sounds (Hassel et al. 2004; Pearson et al. 1992; Santulli et al. 1999)

In an evaluation of the behavior of free-swimming fishes to noise from seismic air guns, fish movement (e.g., swimming direction or speed) was observed in the Mackenzie River

(Northwest Territories, Canada) using sonar. Fishes did not exhibit a noticeable response even when sound exposure levels (single discharge) were on the order of 175 dB re 1 µPa²·s and peak levels of over 200 dB re 1 µPa (Jorgenson and Gyselman 2009; Cott et al. 2012).

While relevant, the particular studies described above do not adequately inform an analysis of the potential adverse impacts associated with the particular sound levels and activities associated with the proposed project. For example, the seismic survey studies cited above are based on evaluations of air guns and air gun arrays several times smaller in capacity than those associated with the proposed project. Accordingly, the sound levels evaluated in these studies are substantially lower than the maximum levels that would result from the proposed project. For example, the proposed project would include survey activities in depths of approximately 22 to 400 meters (roughly 100 meters average depth). The configuration of the towed air gun array would place it at a depth of approximately nine meters below the surface, in an orientation that would increase the sound energy directed downward towards the seafloor.

Therefore, when surveying the shallowest areas within the proposed area, the active air gun array would be approximately 10 meters away from the sea floor. Several of these shallow survey areas would be located offshore of Montana de Oro State Beach and adjacent to the Point Buchon marine protected areas (as shown in [Exhibit 4](#)). These areas support persistent kelp and surfgrass beds, extensive areas of rocky reef habitat, and other highly diverse, highly productive marine habitats known to support a wide variety of species and age classes of fish. At a distance of 10 meters from the full air gun array, received sound levels would likely exceed 230 to 236 dB (based on the general spherical spreading assumption that sound levels decrease by 6 dB per doubling of distance from the sound source). In addition, the presence of high relief hard substrate reefs in these areas may cause sound waves to refract and reflect in unexpected ways, potentially accentuating received sound levels at distance and reducing typical attenuation rates.

While research demonstrating the effects on fish from these substantially greater sound levels is limited, a variety of studies do provide useful information. Among these studies are several that note that mortality to adults, juveniles, and larvae of several fish species may occur from exposure to sound intensity levels from 220 dB to 240 dB (Larson 1985, Dalen and Knutsen 1986, Holliday et al. 1987, Greenlaw et al. 1988, Turnpenny and Nedwell 1994, Davis et al. 1998, Wardle et al. 2001, McCauley et al. 2003). These sound intensity levels would likely occur within several meters to several dozen meters of the sound source, suggesting that fish within these areas have the potential to be killed or severely injured.

Although some of the studies cited above were carried out on species that may be found within the project area, only one study has been carried out in the area itself. This study, by Pearson et al. (1992), was carried out in Estero Bay and involved the exposure of rockfish species to ten minute intervals of air gun pulses. The discussion of this study in the draft Environmental Assessment notes that:

In five trials over four days in Estero Bay, California, Pearson et al. (1992) found sound levels as low as 161 dB caused rockfish (blue, olive, vermillion and black rockfish) to change swimming behavior. Shifts in vertical position (up or down), alarm, and startle

responses were also observed. Startle responses are flexions of the body followed by rapid swimming, shudders, or tremors. Alarm responses are changes in schooling behavior that presumably would lead to avoidance behavior. A threshold of about 180 dB elicited alarm responses. A threshold for startle responses for olive and black rockfish was reported as between 200-205 dB. Blue and black rockfish reacted as a group, possibly related to their behavior as schooling fish species. Fish returned to pre-exposure behavior within minutes suggesting that any effects on fishing would be transitory.

It is unclear, however, based on the results of this study, what effect prolonged exposure of rockfish species to sound intensity levels at or above their observed behavioral response threshold of 161 dB and startle response threshold of 200-205 dB would have.

While the studies cited previously provide data suggesting that at the highest received sound levels (220+ dB) and shortest distances from the sound source, physical injury and mortality to a variety of fish life stages may occur, it is important to recognize the limitations of these studies and the relevance of the information they provide to the currently proposed project. As noted in the draft Environmental Assessment, “Extrapolation of experimental results to actual effects during surveys presents some uncertainties due to differences in duration and intensity of exposure.” For example:

Christian and Bocking (2010) noted that the Pearson et al. (1992) studies were quite different from an actual seismic survey in that the duration of exposure was much longer. When caged European bass were exposed to multiple discharges with a source SPL of 256 dB, the air guns were pulsed every 25 s over two hours. The minimum distance to the cage was 180 m (590 ft). Although no pathological injury was reported, Santulli et al. (1999 cited in Christian and Bocking 2010) did find higher levels of cortisol, glucose, and lactate, biochemical parameters that indicated more stress than in control fishes. Video data showed slight responses when the air gun was as far away as 2.5 km (1.5 mi). When the array was within 180 m (590 ft) the fish packed densely in the middle of the cage. Normal behavior returned after about two hours.

In comparison, the proposed project would involve exposure of a wide range of fish species to shorter interval sound pulses (11 to 20 seconds) at both shorter and longer distances from a similar sound source. As such, available research is insufficient to conclusively determine that the proposed survey activities would not cause significant injury to fish populations in nearshore waters. However, the amount of impact that may occur remains unknown and unknowable. Based on a review of available research by Commission staff, it appears that no studies are available that could be used to make a defensible accounting of the magnitude of impact to nearshore fish populations. Essentially, the available research suggests that adverse impacts would be likely to occur immediately below and in the vicinity of the survey but provides no clear indication of the level of these impacts or how they would affect particular fish species.

With regard to the deepwater habitat located throughout the majority of the project area and the potential impacts to the fish species that inhabit these areas, substantial uncertainty also exists. While the depths of offshore areas (typically several hundred feet) would substantially reduce the received sound levels at the bottom compared to the nearshore survey lines, given the high sound source levels associated with the proposed project, even these areas would likely be exposed to

sound levels of over 200 dB. Most available research, including that discussed in Appendix E of the project's draft Environmental Assessment, suggests that the most likely impacts to fish in deeper waters would be disturbance. For example, as noted above, the Environmental Assessment described a study carried out in Estero Bay (Pearson et al. 1992) that found that rockfish showed transitory startle and alarm responses after being exposed to sound intensity levels of 200-205 dB.

However, while the results of this study are important to consider – especially because it was carried out in the project area and targeted several of the key fish species located there – it diverges from the proposed project in several key ways. Primarily, this study exposed fish to approximately 10 minutes of air gun sounds while the proposed project would include several weeks of continuous activity within a fairly limited area. While rockfish appear to recover prior behavioral patterns within a short time after limited exposure, it is uncertain how rockfish species, or other pelagic species for which less information is available, would respond to more prolonged exposure.

One set of fish species about which even less is known regarding potential impacts from underwater sound is the cartilaginous fishes, sharks and rays. There have been no studies concerning how underwater sounds might affect these species, either behaviorally or physiologically. However, as noted by Hawkins and Popper (2012), these species have well-developed ears and substantial evidence exists to suggest that they are able to detect and respond to sound, and that sound plays a major role in their lives (Myrberg 1978, 1990, 2001; Casper and Mann 2009; Casper et al. 2012). Studies of hearing show that sharks and rays detect sounds from below 50 Hz to over 500 Hz (a range that overlaps with the dominant sound frequencies used by air guns) even though they have no swim bladder or other gas bubble associated with the ear. Since they have no internal gas chambers, the likelihood of physiological effects from other than the most intense sounds is substantially lower than for fishes with gas bubbles, but there are likely to be behavioral effects associated with masking and, perhaps at high chronic sound levels, Temporary Threshold Shift (TTS).

To address the recognized uncertainty regarding the magnitude and extent of adverse impacts to fish species as a result of the project, PG&E has proposed to carry out several monitoring efforts in the project area focused specifically on fish and fish catch rates in offshore areas. PG&E describes these efforts as follows:

Study of the Effects of the Seismic Survey on Fishes. PG&E has agreed to fund a two-component study to examine the short- and long-term effects on fish abundance (and invertebrates) of the seismic survey: (1) Remote Operated Vehicle (ROV) surveys to assess the abundance of common rockfishes and other demersal fish and invertebrate species in sites before, during, and after the seismic survey; and (2) funding the California Collaborative Fisheries Research Program (CCFRP), which is an existing program between the fishing communities of Half Moon Bay, Moss Landing/Monterey, Morro Bay, Port San Luis and the academic institutions of Moss Landing Marine Labs and Center for Coastal Marine Sciences at Cal Poly, San Luis Obispo to study the long-term effects of the HESS on fish abundance in shallower waters.

As noted by PG&E in the document it developed to describe its fish monitoring program, however, the currently designed monitoring plan has limitations:

It is unlikely that sufficient statistical rigor will be achieved by either sampling approach to apply a BACI analysis to the assessment, however the information collected by the ROV will certainly provide some quantitative data from which a qualitative description of observations on the immediate to short-term effects of the [high-energy seismic surveys] on these sites.

Although limited to obtaining “snapshots” of several habitat areas that may not be reflective of the larger project area, the proposed ROV survey would nevertheless provide more information than currently exists regarding the response of fish in deepwater habitat to high-energy seismic survey operations. However, PG&E has not proposed to use the results of these monitoring efforts to carry out compensatory mitigation if adverse impacts are observed. Further, in its current form, the proposed monitoring plan is not designed to be able to accurately or completely reveal those impacts to fish that may occur in the project area.

Adult and Juvenile Invertebrates

Very limited information is available regarding noise related impacts to marine invertebrates – either sessile species such as shellfish, anemones and sponges, or mobile species such as squid, crabs, lobster, and marine snails. As noted by Hawkins and Popper (2012):

One question that is very hard to deal with is the potential effect of man-made sounds on invertebrates. There are almost no data on hearing by invertebrates, and the few suggestions of hearing indicates that it is for low frequencies and only to the particle motion component of the sound field (e.g., Mooney et al. 2010, 2012). There are no data that indicate whether masking occurs in invertebrates or to suggest whether man-made sounds would have any impact on invertebrate behavior.

Appendix E from the draft Environmental Assessment provides the following general review of available research:

Christian and Bocking (2010) stated that, “In general, the limited studies done to date on the effects of acoustic exposure on marine invertebrates have not demonstrated any serious pathological and physiological effects.” However, an earlier review by Moriyasu et al. (2004) found that nine quantitative studies showed five cases of immediate impacts and four cases of no impact. However, many of the studies lacked rigorous examinations and lacked clear sound measurements. They found that studies reported by La Bella et al. (1996), McCauley et al. (2000) and Christian et al. (2003) contained the most useful information of the possible impacts of air guns on invertebrates.

*Crab fisheries are a major resource, and much like certain species of fishes, crabs have pelagic larval stages that live offshore in the plankton for several weeks. Pearson et al. (1994) exposed stage II larvae of Dungeness crab (*Cancer magister*) to single discharges from a seven-air gun array and compared their mortality and development rates with those of unexposed larvae. They found no statistically significant differences in immediate*

survival, long term survival, or time to molt between the exposed and unexposed larvae, even those exposed within 1 m of the seismic source. Christian et al. (2003) did not detect any effects on the behavior of snow crab placed in cages at 50 m (164 ft) depth and exposed to sound levels of 197-237 dB.

In addition, the EIR notes that:

*...studies suggest that seismic survey noise-generation activities in the Project area would have very little effect on benthic invertebrates, which would be insensitive to these sounds. For example, Pearson et al. (1994) found sound levels between 222 and 244 dB re 1 µPa had no effect on Dungeness crabs (*Cancer magister*) within distances of only 3.3 feet (1 m) from an air gun array. Kosheleva (1992) exposed mussels (*Mytilus edulis*), amphipods (*Gammarus locusta*), and Periwinkle (*Littorina littorea*) to a 223 dB re 1 µPa air gun only 1.6 feet (0.5 m) away and documented no injury.*

In an in situ study, Wardle et al. (2001) set up cameras and acoustic tags around a natural reef and observed the reef prior to, during, and following exposure to seismic air gun firings with magnitudes as high as 218 dB. No effects on invertebrates were observed.

Based on this available information, it appears that impacts to most invertebrate species would be unlikely. However, recent research focused on the physiological responses of squid and octopus species to underwater sound suggests that these species may be particularly sensitive and susceptible to physical injury. André et al. (2011) exposed four species of wild captured squid and octopus to 157-162 dB sound sweeps at 50-400 Hz for two hours before surgically evaluating them. All exposed animals were found to have suffered significant damage to internal sensory organs. These findings appear to be supported by previous work by McCauley et al. (2000) that observed alarm and startle responses in squid exposed to air gun pulses of between 156 dB and 174 dB. As noted by André et al. (2011), “[i]f the relatively low levels and short exposure applied in this study can induce severe acoustic trauma in cephalopods, the effects of similar noise sources on these species in natural conditions over longer time periods may be considerable.”

While the type of sounds used by André et al. (2011) in their research does not exactly replicate the sound that would be produced by air guns, the significant physiological effects that they observed suggests that squid and octopus species may be particularly susceptible to injury from exposure to low-frequency underwater sound. With a maximum anticipated sound source level of 254 dB, the injury threshold for squid, between 156 dB and 174 dB, would extend throughout the project area. Therefore, injury, disturbance, and displacement to large numbers of squid may potentially occur due to the size of the 156 to 174 dB radius from the project vessel – up to about five miles.

In sum, there are many gaps in the scientific data regarding the effect that seismic surveys, such as the proposed project, may have on fish and invertebrates of various life stages. Available data does show, however, that anthropogenic underwater sounds are likely to adversely affect the behavior of fish and could result in mortality for those fish in close proximity to the air gun arrays. Additionally, available research also suggests that some invertebrate species, including

squid and octopus, may be susceptible to injury when exposed to even moderate levels of underwater sound. Finally, the proposed project includes the use of air guns that have higher maximum sound intensity levels and will be used for substantially more days than those used in the majority of available studies. Thus, the project is expected to have a significant adverse effect on a wide range of fish and invertebrates, including bony fishes, cartilaginous fishes, and squid and octopus.

Fish and Invertebrate Eggs and Larvae

Although limited information is available regarding the effects of underwater sound on eggs and larval organisms in the water column, the few available studies suggest that larval organisms and eggs in close proximity to a high-energy sound source are likely to experience severe injury and mortality. The draft Environmental Assessment (Appendix E) cited several studies that evaluated the effects of underwater sound on specific species at different distances. These studies used varying sound levels and distances to determine effects on particular species, and, although results were not consistent, they generally suggest that the range in which these organisms are killed or injured are typically in the tens of feet from sound sources of comparable intensity to the proposed air guns. For example, as noted in Appendix E to the draft Environmental Assessment:

Eggs and larvae that are closer than 3 m (10 ft) can be damaged by individual air guns, and Davis et al. (1998) calculated that some mortality can occur at a distance of up to 5.5 m (18 ft) from the largest array. They estimated a volume for a zone of lethality as 1,965 m³ per shot, given a typical air gun array of 3,000 to 4,000 in³. Holliday et al. (1987 cited in Davis et al. 1998) found that 2-day old anchovy larvae were more sensitive compared to older larvae and adults (Table 3).

Table 3. Larval and adult anchovy mortality and damage from 75 to 90 kPa (217-220 dB re 1 μPa 0-peak). Data from experiments by Holliday et al. (1987 cited in Davis et al. 1998).

Stage	Effect	Notes	Peak Pressure ¹ (kPa)
Larvae	50% Mortality	2 d old	100
		4 d old	75
Adults (100 mm)	Swim bladder damage	Damage occurred	90
		No damage	40

Based on these studies, the 5.5-meter radius “zone of lethality” described by Davis et al. (1998) is considered an appropriate and conservative threshold for assessing the extent of expected planktonic losses. In response to requests for information from Commission staff and the California Department of Fish and Game, PG&E on September 25, 2012 provided an impact assessment that used the 5.5-meter distance from the air guns as the area within which planktonic organisms would not be expected to survive due to sound exposure. The assessment calculated the volume of water within the project area that would be within this distance of the air guns as they were being fired during the survey. It used data collected from a 1997-99 entrainment study conducted offshore of DCPP to estimate the density and diversity of larvae expected to be within this volume of water, and assumed 100% mortality for the larvae within this water volume. Due

to lack of data, PG&E's analysis did not assess the expected mortality of pelagic fish eggs that would result from survey activities, but stated that "the same or somewhat lower mortality rates would apply."

PG&E's analysis concluded that survey tracks totaling 1,608 miles in length would result in roughly 65 billion gallons of seawater being within the 5.5 meter radius "zone of lethality" of the air guns. Based on the results of the 1997-99 DCPP entrainment sampling, the analysis additionally concluded that this volume of seawater would be expected to contain from 8.56 to 9.20 million fish larvae. Accordingly, with the assumed 100% mortality to larvae within this water volume, PG&E's analysis concluded that the project was expected to cause the mortality of up to 9.2 million larval fish within the project area, along with an unknown number of fish eggs. However, the project evaluated in the September 25, 2012 report from PG&E was subsequently modified and reduced in size. While Commission staff requested an updated evaluation from PG&E that reflects the currently proposed project, this information has not been provided. Commission staff therefore used the information PG&E submitted for the larger project, along with the percent reduction in the project length, to estimate a revised mortality figure. With the currently proposed project (as modified on October 1, 2012), the survey tracks total about 881 miles, or about 54% of the originally assessed 1,608 mile survey length. Assuming the larval densities are the same for both the previously evaluated and currently evaluated survey track lengths, the expected level of mortality would be about 54% of 9.2 million, or approximately 5.0 million larvae.

The DCPP sampling data show the dominant species represented in this number are northern anchovy, Pacific sardine, kelp/gopher rockfishes, northern lampfish, and blue/olive rockfish. PG&E's analysis concluded that this level of mortality was insignificant when compared to the overall number of larvae from these species within the study area and when compared to natural predation of these species. However, for several reasons detailed below, PG&E's analysis does not adequately support this conclusion and appears to underestimate the project's effects.

Evaluating the effects of removing this amount of larval fish on the offshore ecosystem and on adult fish populations is complex. Three methods are typically used for such analysis – the "Adult Equivalent Loss" (AEL) method, the "Fecundity Hindcasting" (FH) approach, and the "Empirical Transport Model" (ETM) and the related "Area of Production Foregone" (APF), which is derived from the ETM approach. All three methods have been used to determine the effects of larval losses that result from a stationary intake drawing in seawater for a power plant, desalination facility, or similar industrial use, with the APF approach developed most recently to approximate the amount of lost ocean productivity these organism losses represent. ETM is used to identify the proportional mortality of the losses – that is, the number of organisms killed compared to the number of organisms in the source water area that have the potential to be killed. The proportion may be different for each species because each has a different concentration per unit volume of water and has a different source water area because they are susceptible to entrainment during a different number of days or weeks of life stages – for example, a species that grows slowly and cannot swim away from an intake for its first several weeks of life may have a source water area that extends dozens of miles upcoast or downcoast, depending on the speed of the current that carries it towards the intake. This proportional mortality can then be used to identify the APF – that is, the number of acres of different types of

ocean or estuarine habitat types needed to replace the productivity represented by these lost organisms. PG&E's analysis, which used a modified version of this approach, is the first analysis known to staff that applies this approach to a mobile array of air guns instead of a stationary intake. While the analysis includes some reasonable assumptions, several questions remain about the appropriateness of the data used and whether the approach used in the analysis accurately characterizes the likely impacts.

- **Appropriateness of Data Used:** Most of PG&E's proposed survey would occur in deep water offshore, but the entrainment data used in the analysis was primarily from shallow areas with different biological characteristics. As noted above, PG&E used sampling data collected in 1997-99 from nearshore waters off of DCPP. Samples were collected from several transects parallel to the shoreline, with the most seaward transect about a mile from shore. Most of the sampling locations were in areas with water depths of less than 60 meters. Even so, the samples showed distinct differences in the species types and abundance collected in the nearshore and shallower waters and those in the deeper offshore areas. Most of PG&E's proposed seismic survey would occur in areas much farther offshore and with significantly deeper waters than these sampling locations – for instance, roughly two-thirds of the survey area is more than three miles offshore, with depths of more than 400 meters and an overall average depth of more than 100 meters. The biological gradient observed in the 1997-99 sampling showed significant differences between species collected near the shoreline and those collected in areas of about 60 meters depths, suggesting that the community of species that would be affected by the proposed survey would be much different than those used as the basis of PG&E's recent analysis. It is therefore not clear that PG&E's assessment accurately describes the potential impacts to the planktonic community.

Modifying the assessment to include additional data with the 1997-99 data could provide a better representation of the types and expected abundance of larval species that would be affected by the project. One source of additional data may be the California Cooperative Oceanic Fisheries Investigations program (CalCOFI). CalCOFI has several sampling stations in federal waters offshore of Point San Luis near the proposed project area that could provide more appropriate data on representative larval fish species and density in the project area. It is not clear, however, whether CalCOFI has conducted sampling at these nearby sites during the fall season. If fall sampling data are available, Commission staff recommends that it be incorporated into the analysis. Given the seasonal variability in larval fish diversity and abundance in the water column, offshore samples from spring and summer seasons may not accurately represent the species types and numbers present during the proposed survey period; however, PG&E could review those spring/summer sampling data to determine the degree of correlation to the DCPP sampling data, which may allow partial inclusion of the offshore CalCOFI data to improve the analysis.

- **Appropriateness of Approach Used:** PG&E's analysis used the entire volume of water within the survey area as the basis for the expected project impacts. By doing so, the analysis substantially underestimated the proportional mortality that would result from the survey, and thereby discounted the significance of the survey's potential effects. The

analysis assumed that larval mortality would be limited to areas within 5.5 meters of air guns that would be towed at a depth of about 10 meters; therefore, the area of the water column within which larvae would be subject to mortality would be no more than about the uppermost 16 to 20 meters. However, rather than use this upper part of the water column as the source water area, the analysis based its proportional mortality calculations on the entire water column within the survey area, including areas with depths of greater than 400 meters. By including these substantial volumes of water within which plankton are not likely to be affected, the analysis significantly underestimated the proportional effects on the various species.

Conducting the analysis using just the top 20 meters of the water column as the source water area would substantially increase the expected proportional mortality of the survey – that is, the larvae affected by the survey would represent a larger proportion of the total larval population in the top 20 meters of the survey area than the total population living in the entire 400+ meter depths of the water column. Even though larval densities are generally higher in the upper water column than the lower, recalculating the source water area using just the top 20 meters is likely to significantly increase the proportional mortality and the overall effect of the survey on the planktonic community. We note, too that even though there are diurnal differences in the larval composition, this characteristic is already reflected in both the DCPP and CalCOFI data, since those samples are taken during 24-hour periods.

While modifying PG&E's analysis to address the above concerns would likely improve the impact assessment, there would remain a substantial degree of uncertainty. The estimates of expected plankton mortality due to in-water sound are based on a limited number of studies, most of which were done in other areas and on species not present in the survey area. The level of uncertainty might be reduced by using additional assessment methods, such as the above-referenced AEL and FH methods, which calculate the effects of plankton losses on adult fish populations. However, these methods have been used primarily to determine effects on commercially-important fish species, and rely on having extensive knowledge about the affected species' life history, which is unavailable for most species in the survey area. These methods are not as useful for identifying the effects of planktonic losses on food web dynamics, community structure, or other similar ecosystem functions. Additionally, and as noted above, there are apparently no studies describing the lethal or sub-lethal effects of the project's air guns on fish eggs, so this would remain an area of uncertainty.

Based on the data used by PG&E and the assessment provided, it is likely that the survey would result in mortality to about five million fish and invertebrate larvae in the project area and an unknown number of fish eggs. The proposed project does not include measures to mitigate for this adverse effect. Further, given the paucity of relevant data and studies, as well as the questions about the suitability of the submitted assessment in accurately characterizing likely effects, it is not clear that the extent of this adverse effect, or its significance, has been adequately assessed. Nonetheless, the evidence shows the proposed project would adversely affect larvae and fish eggs, and the Commission finds that it does not include measures to minimize or mitigate these effects, as required under Section 30231.

Wildlife Entanglement

The proposed hydrophone streamers, air-gun array and associated equipment that would be towed behind the survey vessel have the potential to entangle marine wildlife.

Hydrophone Streamers

The proposed towing of four 3.7 mile long cable streamers, an air-gun array and associated equipment behind the project survey vessel presents an entanglement risk to marine wildlife. Sea turtles and marine mammals could become trapped by or wrapped around the air gun array, hydrophone streamers, cables, buoys, or other deployed seismic gear, which could cause injury or fatal drowning. Although PG&E would use marine mammal monitors, the survey is to be carried out on a 24 hour basis during a period in the fall/winter that is often characterized by weather and sea state conditions that would likely reduce the ability of marine mammal observers to effectively sight marine wildlife. The proposed use of passive acoustic monitoring is expected to slightly increase the chance that marine mammals in the area would be identified, but this technology is not effective in identifying the location of the marine mammals relative to the vessel or streamer array and is not capable of detecting sea turtles. In addition, the length of the streamers – 3.7 miles – means that portions of them would extend a great distance from the survey and scout vessels that would support the marine mammal monitors. Therefore, marine wildlife may be able to approach to within close proximity of the project equipment without being observed. Further, the project vessel would respond to observations of marine wildlife within the safety or exclusion zone by reducing speed, not removing the source of potential entanglement from the area.

While a reduction in speed may reduce the potential for entanglement of marine wildlife approaching in some directions, this measure may not be an effective means of responding to animals approaching from all directions. However, given the lengthy process required to deploy and recover the streamers, air gun arrays, and associated equipment, removal of this equipment when marine wildlife is observed near the vessel or streamers is not a feasible option. The most effective means of reducing the potential for entanglement to occur would be for project activities to be carried out during the period of lowest marine mammal and sea turtle density in the project area. As discussed previously, available information regarding marine mammal and sea turtle presence and abundance in the project area suggests that November 1 through December 15 is the period of lowest expected density. If this project were otherwise consistent with Coastal Act requirements, the Commission could condition an approval of the project to require that active air gun operations be limited to the period of November 1 through December 15. This would reduce the likelihood of this wildlife entanglement in project equipment.

Ship Strikes

The proposed project includes the transit of at least one large vessel to the project area and the use of three additional smaller vessels within the project area for an estimated 33 days. The primary project vessel is being held in Astoria, Oregon and is proposed to travel approximately 1000 miles to the project area. In addition, the proposed survey would involve approximately 900 additional miles of survey tracks in Estero Bay for a combined total of nearly 2000 miles of vessel travel by the primary survey vessel, the 235-foot *R/V Marcus Langseth*. Three additional support vessels would also be used during the project, the 110-foot *Nushagak Spirit*, the 100-foot *Michael Uhl*, and the 80-foot *Enterprise*. These vessels would be expected to travel at least 1000

miles during the proposed survey since they would follow the survey vessel. The *Michael Uhl* is a local vessel and would not be required to travel to the project area. PG&E has not provided the current locations and travel distances for the other two support vessels.

Although any oceangoing vessel may be involved in a ship strike with marine wildlife, larger, fast moving vessels are most typically associated with collisions and are the predominant cause of collisions that result in death to marine wildlife. Among the three primary project vessels, the 235-foot *R/V Marcus Langseth* is the largest. This vessel is not known to have been involved in a ship strike since it began operation for the National Science Foundation in 2007, but similar large research vessels operating in California have been known to strike and kill marine wildlife, including large whale species. As a recent example, a similar seismic research vessel, the 176-foot *Pacific Star*, struck and killed an adult blue whale in mid-October of 2009 during low-energy seafloor mapping activities off the coast of northern California.

The EIR notes that:

*Sea turtles, fish, or marine mammals could be disturbed or struck by the vessels during mobilization to the Project area. As reported in Jensen et al. (2003), of 11 species of whales known to be hit by ships, fin whales (*Balaenoptera physalus*) are struck most frequently; right whales (*Eubalaena glacialis* and *E. australis*), humpback whales (*Megaptera novaeangliae*), sperm whales (*Physeter catodon*), and gray whales (*Eschrichtius robustus*) are also commonly hit. Of 292 large whale ship strikes reviewed in 2004, a total of 48 were known to result in injury and 198 resulted in mortality. No injuries to the whale were reported in only seven ship strike cases. The average vessel speed in 58 of the reported cases that resulted in ship strikes was 18.6 knots (34.4 km per hour), with speed ranges falling into one of three categories: 13 to 15 knots (24 to 38 km per hour), 16 to 18 knots (29.6 to 33.3 km per hour), and 22 to 24 knots (40.7 to 44.4 km per hour) (Jensen et al. 2003).*

...
As noted above, the Project-related vessels would typically travel at speeds of approximately 10 to 12 knots (18.5 to 22 km per hour), which is lower than the range of speeds associated with marine mammal collisions (greater than 13 knots [24 km per hour] [Jensen et al. 2003]) during transit to the site. However, lethal collisions, even with slow-moving survey boats, have recently occurred in the region and the risk of collisions may increase at night when surface feeding rates increase.

During mobilization and demobilization, the survey vessel's activity would be equivalent to that of similar vessels in the area, such as fishing boats and commercial vessels.

Regarding the potential for vessel collisions to occur with marine wildlife during active operations, the EIR notes that some whale species in central California, including blue whales, have been shown to be particularly susceptible to ship strikes and that the risk of collisions may increase at night when surface feeding behavior in these whales becomes more common.

The potential occurrence of ship strikes would be reduced primarily by the low proposed speeds of the project vessels during survey operations, the use of marine mammal observers on the project vessels, and the adherence of project vessels to appropriate safety protocols. In its approval, the CSLC is requiring PG&E to prepare and implement a Marine Wildlife Contingency Plan. On October 17, 2012, PG&E submitted to the Commission a draft plan that includes commitments to: (1) maintain at least three dedicated protected species observers onboard of all of the project support vessels during transit to the project area; (2) carry out these transits during daylight hours; (3) have the protected species observers positioned on the vessel with a clear view of the area in the direction of and adjacent to the course of travel to look for marine wildlife; (4) maintain a minimum distance of 1,640 feet from any observed marine mammals or sea turtles; (5) slow the vessel or change course as necessary in order to maintain this distance and avoid contact; (6) initiate a series of whale specific safety measures; and (7) immediately record key information regarding any collisions and report them to the NMFS Stranding Coordinator, DFG, and CSLC staff.

While these measures would reduce the potential occurrence of collisions between project support vessels and marine wildlife, the plan does not specify that such measures would also apply to the primary research vessel, the *R/V Langseth*. In order to ensure that the risk of collision is reduced, the Commission could require that PG&E's Marine Wildlife Contingency Plan include standard measures for this vessel as well, such as the use of marine mammal observers during daylight hours, and reduced vessel speeds (less than ten knots) near areas in which whales have been sighted. With the addition of such a requirement, the Commission could find that PG&E would be minimizing the potential risk the project would pose to marine wildlife from ship strikes.

Marine Protected Areas

The California Marine Life Protection Act Initiative process in the central coast study region was carried out from 2004 to 2007 with collaboration, input, and expertise from a wide variety of stakeholders, scientists, and experts. The goal of this process was to redesign California's system of marine protected areas (MPAs) to function as a network in order to: increase coherence and effectiveness in protecting the state's marine life and habitats, marine ecosystems, and marine natural heritage, as well as to improve recreational, educational and study opportunities provided by marine ecosystems subject to minimal human disturbance. Ultimately, this process resulted in the identification of specific areas within state coastal waters which supported unique assemblages of diverse species and habitats which, if provided with additional protection from injury, disturbance, and loss, would be expected to: 1) protect the natural diversity and abundance of marine life, and the structure, function and integrity of marine ecosystems; 2) help sustain, conserve and protect marine life populations, including those of economic value, and rebuild those that are depleted; 3) improve recreational, educational and study opportunities provided by marine ecosystems that are subject to minimal human disturbance, to manage these uses in a manner consistent with protecting biodiversity; 4) protect marine natural heritage, including protection of representative and unique marine life habitats in California waters for their intrinsic values; 5) ensure California's MPAs have clearly defined objectives, effective management measures and adequate enforcement and are based on sound scientific guidelines; and 6) ensure the State's MPAs are designed and managed, to the extent possible, as a network.

On April 13, 2007, the Fish and Game Commission voted unanimously to adopt 29 marine protected areas (MPAs) covering many of those areas along the central coast that were identified as particularly important through the Marine Life Protection Act Initiative process due to the habitats and species of special biological significance they support. The proposed project would include high-energy seismic survey activities in close proximity to two of these 29 MPAs, the Point Buchon State Marine Reserve and Point Buchon Marine Conservation Area. In addition, the project would also result in elevated sound levels within the White Rock State Marine Conservation Area. The discharge of elevated sound levels into these MPAs has the potential to result in the disturbance, injury, and loss of marine life within the MPAs.

Section 30230 of the Coastal Act requires, in part, that special protection be given to areas and species of special biological significance. Given the collaborative stakeholder process and detailed scientific evaluation that informed the designation of the Point Buchon State Marine Reserve, Point Buchon Marine Conservation Area, and White Rock State Marine Conservation Area all three of these MPAs are considered to support areas and species of special biological significance. The Commission must therefore find that the proposed project provides all three areas with special protection. Given all of the project's expected impacts, described above, the proposed use of high-energy air guns in the nearshore and offshore waters adjacent to the Point Buchon MPAs clearly does not provide these areas with special protection. The Commission therefore finds that the proposed project is inconsistent with Section 30230 of the Coastal Act.

Conclusion

The Commission finds that, for the reasons discussed above, the proposed project would result in adverse impacts to marine resources and the biological productivity of coastal waters. These adverse effects include behavioral harassment and potentially injurious physiological effect on large numbers of marine mammals; the loss of fish and invertebrate eggs and larva; the injury, disturbance, and loss of adult fish and invertebrates; and damage to marine protected areas. While the use of marine mammal monitors, the relatively low speed of the research and support vessels and other mitigation measures may reduce some of these impacts, such measures are limited in their effectiveness under expected project conditions, so these impacts are likely to occur to some degree regardless of the inclusion of impact reduction measures.

In addition, the proposed project has the potential to result in additional adverse impacts to marine biological resources through entanglement of marine wildlife in project equipment and ship strikes. These latter impacts, however, could be addressed through imposition of additional mitigation measures.

For these reasons, the Commission finds the proposed project inconsistent with Sections 30230 and 30231 of the Coastal Act. However, this project qualifies for special consideration under the Coastal Act's coastal-dependent industrial "override" policy (Coastal Act Section 30260), which is discussed in the Coastal Dependent Industrial Override Section of this report. See Section M of this report.

H. COMMERCIAL AND RECREATIONAL FISHING

Section 30234.5 of the Coastal Act states:

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

Commercial Fishing

Commercial fishing is an important component of the regional economy in San Luis Obispo County. The County's LCP, which the Commission may use for guidance, identifies commercial fishing as a top priority coastal use.¹⁴ The area's commercial fishing activities focus on several species, including crab, various rockfish, and pelagic species such as salmon and albacore. The commercial fishery employs a range of gear types, including trawl, gill net, trap, diving, round-haul nets, and hook-and-line. Most of the area's commercial fishing is conducted out of Morro Bay Harbor or Port San Luis Harbor. Although the proposed survey is relatively short-term, it would cause adverse fishing-related effects in areas important to the local commercial fishing interests and is likely to result in some degree of longer-term effects on fishing.

Commercial Fishing Data

Commission staff used several data sources, including "fish catch blocks", commercial landings, and seasonal records to assess the importance of the area's commercial activities and possible survey-related effects on those activities, as described below:

- **Fish Catch Blocks:** The California Department of Fish and Game (DFG) collects commercial catch data using "fish catch blocks," which are mapped and numbered areas covering much of the state's offshore waters. Commercial buyers and recreational fishing vessels report catches within these blocks, each of which covers about 100 square nautical miles of marine waters. Although there are inaccuracies inherent in this reporting system (e.g., as explained in *Report on Marine Protection Act Initiatives* in Ecotrust 2006), it has provided an established means for the past several decades of reporting and characterizing fish catch in California's offshore waters.¹⁵

¹⁴ The San Luis Obispo County Local Coastal Program includes the following policy in its Chapter 5 – Commercial Fishing and Recreational Boating:

Policy 1: Protection of Commercial Fishing and Recreational Boating Opportunities – Commercial fishing and recreational boating shall be protected and where feasible upgraded. Commercial fishing needs shall be assigned first priority. Recreational boating facilities shall be designed and located to not interfere with the needs of the commercial fishing industry. [THIS POLICY SHALL BE IMPLEMENTED AS A STANDARD.]

¹⁵ Additional information about the Fish Catch Block System and data collection can be found at the DFG website: <http://www.dfg.ca.gov/marine/landings10.asp>

The footprint of the proposed survey, and the areas in which the survey's anticipated sound propagation levels are expected to affect marine life (as described in Section G of these Findings), are within portions of four blocks, including Fish Catch Blocks 607, 608, 615, and 616. Mobilization and demobilization of project equipment may affect other nearby areas.

These catch blocks represent an important component of the area's commercial fisheries, as shown in the table below. It lists the total annual catch from the catch blocks, by weight and dollar value, for the most recent 10 years available – 2001 to 2010 – as well as the main species caught within those blocks, in order of average weight (CSLC 2012).

Fish Catch Block	Predominant Species Caught	Average Weight (lbs.)	Average Value (current \$\$)
607	Pacific sardine, market squid, pink shrimp	59,278	\$110,495
608	Market squid, Dover sole, longspine thornyhead	56,297	\$59,689
615	Hagfish, market squid, sablefish	159,871	\$371,799
616	Sablefish, chinook salmon, hagfish	20,946	\$31,486
Total:		296,392	\$462,974

- **Commercial Landings Data:** In addition to the information available from the Fish Catch Block System, commercial fishing data for the project area is available from landings reported at Morro Bay and Port San Luis. While “catch” refers to the amount and value of fish caught, and is reported in terms of weight and dollars, respectively, “landings” refer to the amount and value of fish brought in to the ports, with landings values representing the amount of money paid to the fishermen. Similar to the catch values above, these data do not provide an exact description of commercial fishing’s importance in the area’s economy – for example, they include fish landed by commercial fishing interests from outside the area, and do not include fish taken to other harbors by local commercial fishing interests – however, they provide a general measure of economic value. The table below, which is derived from the project EIR, provides the annual commercial landings for Port San Luis and Morro Bay for all gear types and species from 2000 to 2009. Although the annual landings are highly variable, they represent an average yearly value of about \$1.19 million at Port San Luis and about \$2.6 million at Morro Bay.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Port San Luis										
Weight (in millions lbs.)	1.13	1.26	3.14	2.89	1.63	0.18	0.29	0.24	0.25	0.32
Value (in millions \$\$)	1.14	1.32	1.86	1.69	1.26	0.71	1.02	0.96	0.89	1.09
Morro Bay										
Weight (in millions lbs.)	2.47	2.62	1.65	2.14	3.13	1.68	0.86	0.66	1.03	2.60
Value (in millions \$\$)	4.41	3.44	2.49	1.70	2.18	2.19	1.90	1.68	1.84	3.72

Note: Dollar values are in current dollars (not adjusted for inflation).

Source: CDFG 2011b, CDFG 2011e, BOEMRE 2011.

- **Seasonality of Fishing in Project Area:** The area's commercial fishing activity varies seasonally, with the peak fishing season generally occurring in the summer and lower or moderate levels during November and December. Data provided in the EIR (see EIR Table 4.13-5) show that catch totals during the November-December period for the past ten years represent between 10-15% of the average year's catch (i.e., about 140,000 lbs. of an annual total of about 1.07 million lbs.), with the average year's landings representing a similar proportion (i.e., about 370,000 lbs. of an annual total of about 3.025 million lbs.).

Recreational Fishing

Recreational fishing is a similarly important part of the local and regional economy. Although the abundance of fish caught varies year-to-year, the proposed November-December survey period would generally coincide with parts of the peak seasons for several species that support recreational fishing activities, including charter boats and other fishing-related businesses in the area, as well as an active community of recreational divers and fishers. For example, the albacore season changes each year, but generally occurs sometime between August and November. The lingcod and rockfish seasons generally run from May through December. The project EIR, although based on a larger project than the currently proposed survey, nonetheless concluded that preclusion of recreational fishing during a peak season would cause a significant adverse effect. The EIR states:

The Project would not restrict recreational fishing for the entirety of a peak season for all targeted species, and recreational fishing could still take place outside of the active Project area. However, for the purposes of this analysis, preclusion does occur during a peak season and is therefore significant.

Numeric estimates of the proposed survey's effects on recreational fishing in the survey area are not available but, as stated in the EIR, the disruption of this activity due to the proposed project would result in significant and unavoidable impacts.

Effects on Fishing Activities

While the survey would result in some adverse impacts to commercial and recreational fishing, the Commission, for several reasons, cannot determine the exact effects of the proposed survey on these activities. For example, because commercial fishing data are tabulated by entire catch blocks and by full months, they do not allow for calculations to determine the effects of a survey occurring within only portions of those blocks or during just part of a month. Additionally, the survey would occur within only part of the offshore fishing grounds used by the regional fishing community, so its exact effects on the overall catch or landing totals are unclear. Still, we can identify two main types of the survey's adverse effects on commercial and recreational fishing: first, effects on the fishing activities themselves, such as preclusion of fishing vessels and fishing effort from areas within the survey footprint during active operations and the potential for lost fishing gear; and second, effects on the area's fish and invertebrates that would reduce catch opportunities. These are each described in more detail below.

The proposed project would entail the use of up to five vessels within the project area for up to about 33 days between mid-November and December 31. PG&E expects active survey operations to occur for about 10 of those days, though survey activities could occur throughout the expected 33 days due to maintenance delays, disruption due to unfavorable ocean conditions, the observed presence of marine mammals within the survey area, or other factors.

Due to the risk of vessel collisions, entanglement with project equipment, and other considerations, much of the project footprint would be restricted or closed to non-project vessels during these periods. As noted in the EIR, PG&E would request that the U.S. Coast Guard (USCG) issue a Notice to Mariners outlining restrictions to other vessels within and near the survey area. The EIR states that for purposes of safety and to ensure the integrity of the data collection process, PG&E has proposed that vessels maintain the following distances from the *R/V Langseth*:

- 3.2 km (2 mi.) ahead,
- 8.8 km (5.5 mi.) astern; and,
- 4.8 km (3 mi.) to the side when a ship or other vessel is passing the survey vessel.

These proposed distances would create a continually moving 35-square mile exclusion zone around the survey vessel that would directly preclude commercial and recreational fishing activities. This preclusion area would move within the approximately 150-square miles of Box 4 during the proposed six-week survey period from mid-November through December, 2012. This closure would coincide with parts of the peak seasons for several area fisheries. As shown in the table below (based on data from the project EIR), the survey is proposed to occur during seasons for several important commercial fisheries and result in reduced fishing opportunities for several of those fisheries.

Species	Seasonal Factors for 2012	Impact of Proposed Six-Week Survey Period
Market squid	Generally year-round; however, the season closed in November 2011.	If the fishery remains open throughout 2012, the project may restrict the fishery for up to six weeks
Pacific sardine	25% of annual harvest allocation opens on Sept 15 th , plus any remaining allocation from earlier in the year.	Would reduce season by an unknown proportion.
Hagfish	No seasonal restrictions.	Would reduce season by about 12.5% (i.e., 1 ½ months out of 12).
Sablefish	Longline, trap, and trawl by-catch allowed year-round.	Would reduce season by about 12.5% (i.e., 1 ½ months out of 12).
Dungeness crab	Season opens November 15 th	Would restrict first six weeks of season.
Spot prawn	Opens August 1 st	Would restrict approximately 1 ½ months of season

Although some fishing activities may be able to respond to preclusion by relocating to areas outside the project footprint, this could result in increased fuel costs, increased competition, and the need to fish in areas with lower productivity. However, for those fisheries in which licenses apply to specific areas, the ability to relocate may be limited or infeasible. Additionally, while fisheries may be able to “fish around the survey” by targeting those portions of the project area that are not being actively used for project operations, this, too, may be limited or infeasible in some cases. For example, fisheries using set gear, such as crab pots, would not be likely to employ this strategy since it may not be possible or practical to plan the placement of gear around the anticipated survey schedule and location. Those fishing vessels that do place gear in or near the survey area risk losses due to entanglement or collision. Overall, therefore, the adverse effects resulting from preclusion of fishing within the survey area are not likely to be significantly reduced or avoided by relocating those fishing efforts to areas outside the project area or by “fishing around” the active survey locations.

Effects on Area Fish and Invertebrates

The survey is likely to result in both short- and long-term effects on nearby species, including many marine life populations important to commercial and recreational fishing. Each category is described in more detail below.

- **Short-term Effects:** The most likely short-term adverse effects to the fishing community are the reductions in catch that could result from the species’ “startle” and “alarm” behavioral responses caused by the sounds generated by the survey’s air guns. A number of studies have attempted to describe and quantify this effect, including several summarized in the project EIR (see EIR Table 4.13-10 – Summary of Literature Showing Observable Effects of Seismic Surveys on Fish Catch). Many of these studies attempted to determine a “no

observable effect” decibel level for various species, though most of the cited studies were conducted in areas other than the project area and on species not present in the survey area. Results of these studies show a range of responses by different species at different decibel levels – e.g., no observable effect on hake at less than 149 decibels, rockfish catch reductions of about 50% at 186-191 decibels, ear damage on pink snapper at 180 decibels, etc.

Additionally, the study designs were generally limited to identifying specific effects of a narrow decibel range at a particular distance. It is therefore difficult to determine the full range of likely effects the proposed survey’s inwater sounds would have on area species, the distance at which those effects would occur, and the time period during which those effects might last. The study results suggest, however, that adverse fishing-related effects, such as multiple days of reduced catch levels, can occur with sounds in the range of at or above about 160 decibels. This is well below the expected 250 decibel maximum sound levels from the air guns and would cover a distance of up to about six miles from the air gun array.

Another associated short-term adverse effect is an increase in “catch per unit effort” or CPUE. The effect described above – i.e., the reduced likelihood of catching species that show “alarm” or “startle” responses to the air gun sounds – can lead to the need for a greater level of effort required to catch a given number of fish. Increased CPUE can show up in a number of ways that affect the economic vitality of the local fishing community – increased fuel consumption needed to cover a larger fishing area, inefficiencies associated with fishing in a less familiar area, cumulative effects of having more fishing boats share a smaller overall fishing area, etc. The effects of increased CPUE are similar in at least one way to those described above regarding overall reductions in catch – i.e., they are difficult to measure precisely – but they differ in that the increased CPUE effects would be felt over a larger area and by more of the fishing community than those directly affected by the catch reductions.

In sum, these short-term impacts, while difficult to measure, would likely result in reductions in catch throughout the survey area as well as increased CPUE that would extend beyond the survey area. In both cases, the effects are likely to last for up to several weeks, and are likely to adversely affect the economic vitality of the local fishing community for at least that period of time. Although the project EIR evaluated these issues for a larger version of the proposed project, it noted that the combination of both these effects within the same area and timeframe resulted in a significant adverse impact.

- **Long-term Effects:** The most likely long-term effects to area fishing interests are those associated with mortality and injury of adult and larval fish and invertebrates, as well as eggs of those organisms, as previously discussed in Section xx of these Findings. However, because of the many environmental and population variables that go into determining survivorship, population dynamics, community structure, and other similar ecosystem characteristics, it is not possible to determine with precision the extent of these effects.

Losses of adult fish are likely to be relatively low, since they would need to be relatively close to the air guns (i.e., within several dozen feet) to experience death or injury. However, a loss of adults in some species could result in reduced catch rates in the area for as many as several seasons – for example, because rockfish generally grow relatively slowly to adulthood, losses of adult rockfish could require some time for replacement populations to

develop. Regarding larvae and eggs, the losses are expected to be in the range of about 5 million, as discussed in Section G above. The EIR notes that several factors are likely to reduce the potential effects resulting from these losses – for example, this total represents a relatively small proportion of larvae within the survey area and within the region, and the survey would occur outside the area’s peak larval concentrations in the spring and summer. Commission staff requested that PG&E calculate the expected effects of these larval losses on adult populations; however, that information has not yet been provided. In general, however, losses of these organisms are likely to reduce to some degree the numbers of certain species that would otherwise be available to the fishing community.

- **Cumulative Impacts:** As noted in the 2008 Morro Bay and Port San Luis Commercial Fisheries Business Plan, the area’s commercial fishing is still an important part of the local and regional economy, but has been in decline over the past several decades. This Plan describes the decline as “precipitous” due largely to declines in fish stocks, the cyclical nature of many stocks, market problems, and reduced access to certain stocks due to fisheries regulations. As a result, any unmitigated impacts from the survey would be in addition to the existing set of adverse effects already contributing to this ongoing decline.

In sum, although the exact type and extent of adverse effects cannot be calculated, the proposed project will clearly cause some degree of disruption and possible losses to the area’s commercial and recreational fishing interests. Mitigation measures needed to address these effects are described below.

Mitigation Measures

To address the effects of preclusion, the California State Lands Commission required PG&E to develop a Communications Plan for managing communication and outreach with the fishing community and to ensure that fishermen have adequate information about the project to limit the need to avoid the project area to the minimum necessary. On October 5, 2012, PG&E submitted to the Commission a draft Communications Plan; however, the draft Plan does not yet include sufficient measures to provide adequate, updated, and complete noticing to the public in the project area regarding the location, timing, duration, and sound levels associated with the proposed project. For example, it does not: (1) propose a method to provide updated sound propagation information if the sound source verification process reveals that the modeled assumptions were inaccurate; (2) provide for updating PG&E’s database of interested parties based on the participants in the review and comment opportunities provided by the Coastal Commission, California Department of Fish and Game, National Marine Fisheries Service, U.S. Fish and Wildlife Service, or National Science Foundation; and (3) include common means of communication such as email or social media that may be more likely to provide timely information to a wider audience. A modified Communications Plan that includes the above-identified elements, if fully implemented, would reduce expected impacts to the fishing community, though fishing within most of the survey area would still be effectively eliminated during all or much of the survey period. In addition, and as described below, PG&E has not yet reached agreement with the fishing community regarding adequate mitigation for lost fishing opportunities and the additional costs to the fishing community that may result from the survey. Without an adequate Communications Plan, the Commission is unable to determine that PG&E’s proposed survey will be adequately protective of commercial fishing activities.

Regarding impacts such as lost catch opportunities, possible lost fishing gear, and others, Commission staff requested that PG&E develop and submit a Fishing Mitigation Plan outlining the steps PG&E would take to address adverse impacts to commercial and recreational fishing operations, including the loss and/or damage of fishing gear due to contact or entanglement with the proposed geophone array and reduction or displacement of fishing activities or catch during and after survey operations. PG&E had initially proposed a base compensation amount of \$1.2 million dollars to be disbursed to the fishing community and noted the existence of its existing claims process for damages related to PG&E operations (e.g., damages due to electrical outages, powerline damages, etc.). PG&E provided a September 5, 2012 letter outlining the key steps of its proposed fishing mitigation plan, which included the following:

Under PG&E's existing claims process, an individual or business would file a claim form with supporting documentation to the company. Supporting documentation would include official fish tickets submitted to the California Department of Fish and Game (CDFG) and other financial data to demonstrate losses. After reviewing the documentation, PG&E's Claims Department would issue payment for those demonstrated losses. The length of this process varies depending on the magnitude of the loss, where smaller claims with appropriate documentation being processed in about 30 days. Larger claims are subject to additional internal controls and may take longer to process.

There are several ways to submit a claim to the company. A claimant can:

(a) File claims online at:

<http://www.pge.com/mybusiness/customerservice/contact/claims/>

Supporting documents are sent by email to claimsdocs@pge.com

(b) File claim by email by sending completed claim form and documentation to lawclaims@pge.com.

*(c) File by mail at PG&E Claims, 1850 Gateway Blvd, 6th Floor,
Concord, CA 94520*

PG&E's lead representative for any claims associated with the CCSIP is:

Carolyn Hanson

Pacific Gas and Electric Company

160 Cow Meadow Place

Templeton, CA 94365

(805) 434-4404

For any disputed claims, an eligible mediator in the San Luis Obispo County area would be hired to resolve the claim. Mediation does not require legal representation and the mediator acts to understand the perspectives of both sides to help reach an agreement. The mediator would be jointly selected by representatives from PG&E, the Morro Bay Commercial Fishermen's Organization (MBCFO), the Port San Luis Fishing Association (PSLFA) and ocean-based businesses located in San Luis Obispo County.

Commission staff noted that this proposal lacked several key details. It no longer included the earlier proposed \$1.2 million baseline compensation fund, it did not specify how payments would be made, and it was vague about the information needed to process a claim and the criteria

that would be used to evaluate the claims. The proposal also suggested the need for additional mediation with the fishing community to further modify the plan and to reach an agreement on its implementation. Commission staff believed this proposal lacked sufficient information and certainty to ensure it would protect commercial and recreational fishing activities as required by Coastal Act Section 30234.5.

Commission staff then requested PG&E provide additional detailed information, including a proposed compensation amount, and develop a claims process specifically applicable to possible damages resulting from the proposed survey. Staff recommended that PG&E develop a process similar to the Joint Oil/Fisheries Liaison Office (JOFLO), which has been used successfully since 1983 to manage claims from fishing interests for damages associated with offshore oil and gas production in California. The JOFLO process includes several key characteristics that result in a successful mitigation strategy to address damages to fishing interests. JOFLO provides an independent liaison office to review claims, to assist fishing interests in meeting filing requirements, and to provide mediation when necessary to settle claims. It also includes a standardized claims process and benefits from having an established contingency fund adequate to address valid damage claims from the fishing community. Although JOFLO was established as a means to provide long-term mitigation, Commission staff believe it serves as an appropriate model on which to base mitigation needed for PG&E's relatively short-term survey.

On October 5, 2012, PG&E submitted additional information about its proposed plan, which included the following:

- PG&E noted that its proposed base compensation amount was still being negotiated with local fishing interests. PG&E has proposed providing an initial lump sum that would be disbursed among affected commercial fishing interests in a manner still to be determined.
- PG&E again proposed to use its existing claims process to address claims beyond the initial base compensation amount, and again proposed the same mediation process as described in its September 5, 2012 proposal to settle any disputed claims.
- PG&E proposed to retain the JOFLO Liaison Office to assist parties in filing claims and to serve as an ombudsman, though it did not propose to incorporate other aspects of the JOFLO process into its claims process.

This most recent proposal, however, still lacks the information and certainty needed to ensure effective mitigation for potential impacts to the fishing community. The Commission believes that a more robust mitigation plan based on the JOFLO model would likely provide the necessary level of mitigation; however, absent some basic information about the level of compensation PG&E would provide, the process and basis for making damage claims and resolving those claims, and concurrence from the affected fishing interests about this approach, the Commission finds that there is insufficient information to find the currently proposed compensation plan is adequate to protect fisheries or is consistent with Coastal Act Section 30234.5.

Conclusion

The project would result in significant short-term impacts to both commercial and recreational fishing from preclusion of fishing efforts in the project area during the proposed survey and from behavioral reactions of targeted fish and invertebrate species that would reduce catch per unit effort both during and after the project. In addition, the anticipated injury and mortality to fish and fish larvae that would result from the proposed project activities has the potential to cause both short and long term adverse impacts to commercial and recreational fishing. For these reasons, the Commission finds the proposed project to be inconsistent with the commercial and recreational fishing policy of the Coastal Act, Section 30234.5. While a comprehensive and detailed fishing mitigation plan could be sufficient to ensure protection of commercial and recreational fishing activities, the Commission does not currently have a plan that is detailed enough for it to assess whether mitigation would be adequate to meet this Coastal Act policy.

I. ACCESS AND RECREATION

Section 30210 of the Coastal Act 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.

Section 30211 of the Coastal Act 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.

Section 30220 of the Coastal Act states:

Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.

Water-oriented or ocean-based recreation activities in and around the project area include whale watching, fishing (discussed above in Section H of this report), diving, surfing, swimming, sailing, boating, and other similar water sports. The proposed project has the potential to adversely affect coastal access and recreation in several ways, including (1) by restricting water-oriented recreational activities from occurring in areas near active survey operations due to human safety concerns; (2) by establishing a vessel closure area around the survey vessel during active survey operations; and (3) through the placement of structures in beach areas.

Restriction of Water-Oriented Recreation

Underwater sound levels in several nearshore areas may result in a temporary reduction in water-oriented recreation within the project area. Regarding the effect of underwater noise on human health, the EIR notes that studies have shown that high levels of underwater noise can cause dizziness, hearing damage, or other sensitive organ damage to divers and swimmers, as well as indirect injury due to startle responses. The table below (derived from information in the EIR) shows suggested noise thresholds for recreational divers.

Source	Frequency Range (Hz)	Maximum Value (dB re: 1 µPa)
NATO Undersea Research Centre	600 to 2500	154
Diving Medical Advisory Committee	Unspecified; believed to be 1,500	201
Parvin	500 to 2500	155

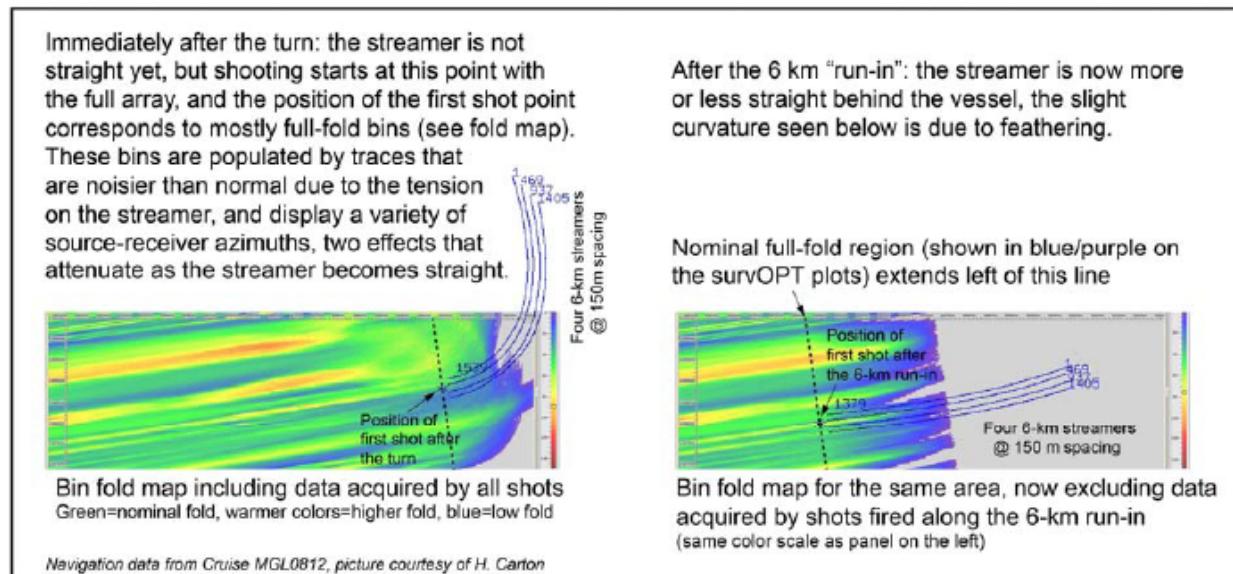
Based on this information, the EIR concluded that noise levels in excess of 154 dB re 1 µPa could be considered potentially harmful to recreational divers and swimmers in the project area. Additional studies carried out in 1997 and 1999 (Stevens et al. 1997 and Cudahy et al. 1999) to assist the U.S. Navy in establishing safety thresholds for diver exposure to low frequency active sonar resulted in the Navy setting standard safety protocols that call for the avoidance of all low-frequency active sonar levels above 145 dB in known commercial or recreational dive sites. The studies carried out for the Navy used frequency ranges (100 to 500 Hz) that were substantially lower than those in the table included above and more closely match the dominant frequencies that would be generated by the proposed seismic surveys (0 to 188 Hz). Although no research has been carried out on human exposure to seismic air gun generated sound, the research carried out for the Navy using low frequency active sonar may be the closest available approximation.

While divers, swimmers, surfers, and other persons would be unlikely to approach within close range of the active survey vessel (primarily because it would remain at least one mile from shore and would be flanked by support vessels enforcing a vessel and diver exclusion zone), the proposed sound levels associated with the survey would result in elevated received sound levels a substantial distance from the vessel itself, including in nearshore areas frequented by surfers, swimmers, spearfishers, and divers. Some of these exposed areas, including sites in Montana de Oro State Beach, near Morro Rock, and in Cayucos, are among the most popular and consistently used ocean recreation areas in San Luis Obispo County, primarily due to their consistent draw for surfers. These sites are especially popular during the late fall and winter months when swell size and frequency provides consistent opportunities for surfing.

At the request of Commission staff, PG&E submitted a map of the nearshore waters that would be expected to receive sound levels at or above 145 dB re 1 µPa, based on sound propagation models. This map is included as [Exhibit 7](#) and suggests that nearshore areas from Montana de Oro State Park to Cambria would be expected to experience received sound levels in excess of 160 dB re 1 µPa.

Given the information provided in [Exhibit 7](#) and the proximity of proposed survey activities to shore in several locations, sound exposure levels for nearshore recreational areas in Montana de Oro, Morro Bay, and between Cambria and Cayucos are anticipated to be substantially higher than the levels found to be safe for human exposure. Individuals engaged in water-oriented recreational activities in these areas during active survey operations may therefore be at an increased risk of injury. While PG&E has not proposed to close any beaches, recreationists concerned about their safety may avoid surfing, diving, and swimming during the survey (perhaps a total of 17 days (the estimated amount of time required for preliminary sound verification work and the survey of Box 4)).

As noted above, PG&E submitted the figure included as [Exhibit 7](#) to demonstrate the anticipated sound propagation distances and received sound levels in beach areas throughout the project area. However, this figure does not accurately depict the anticipated sound levels that would be received in beach and coastal areas within the project area because the vessel locations from which the “full air gun array” sound propagation distances are calculated are further offshore than the survey vessel would be when it begins firing of the full air gun array. As discussed in a letter provided to the Independent Peer Review Panel on October 19, 2012, the full air gun array would begin firing as soon as the vessel completes each turn:



This would substantially increase the received sound levels in nearshore waters along the coast from Montana de Oro State Beach to Cambria beyond those depicted in the figure provided in [Exhibit 7](#). Received sound levels would be expected to exceed 160 dB throughout this area during the proposed survey activities, with the highest levels received each time the survey vessel approaches or completes one of its shoreside turns. Additionally, the sound propagation distances depicted in the figure above are based on the modeled behavior of underwater sound waves in the project area. Until five day sound source verification process is completed at the initiation of active survey operations, the actual sound levels and distances will not be known with complete certainty. As such, the received sound levels in nearshore areas may further exceed or fall short of modeled expectations.

The CSLC is requiring PG&E to develop a Communication Plan that would include providing beach and ocean users with accurate and updated notifications of the dates of air gun use. On October 5, 2012, PG&E submitted to the Commission a draft Communications Plan. In its current form, the Communications Plan does not provide sufficient efforts or measures to provide adequate, updated, and complete noticing to the public in the project area regarding the location, timing, duration, and sound levels associated with the proposed project. Specifically, it does not: (1) include posting of signage or notices at beaches, coastal access sites, or beach parking areas; (2) propose a means of providing updated sound propagation information if the

sound source verification process reveals that the modeled assumptions were inaccurate; (3) provide a means of updating PG&E's database of interested parties based on the participants in the review and comment opportunities provided by the Coastal Commission, California Department of Fish and Game, National Marine Fisheries Service, U.S. Fish and Wildlife Service, or National Science Foundation; and (4) include common means of communication such as email or social media that may be more likely to provide timely information to a wider audience. A modified Communications Plan that includes the above-identified elements, if fully implemented, would reduce expected ocean recreational impacts, but recreational use in these popular coastal areas would still be effectively eliminated during the estimated 17 days of air gun use. Thus, without mitigation to compensate for lost recreational opportunities, the project is not consistent with the Coastal Act's standard to protect water-oriented recreational activities. Since PG&E has not offered mitigation for the loss of surfing days and other lost ocean recreational opportunities due to survey operations (e.g., local public access and recreational improvements or in lieu mitigation payment), the Commission cannot at this time find that the project will be carried out consistent with the Coastal Act's public access and recreation protection policies.

Preclusion of Vessel Activity

In coordination with the U.S. Coast Guard, PG&E proposes to close to non-project vessels all waters within a specified proximity of active survey operations. This moving closure would follow the survey vessel and apply to all non-project vessels, including recreational boating, sailing, and whale watching activities. The closure would be in place both as a safety measure (to prevent collisions and entanglement with project equipment) and to preserve the integrity of survey operations. The closure would include all waters two miles ahead, five and a half miles behind, and three miles to each side of the survey vessel (for a total area of about 35 square miles roughly centered on the survey vessel).

The location of this 35 square mile closure area would be continually adjusted as the survey vessel moves, requiring recreational boats in offshore areas to temporarily change course. PG&E's Communications Plan is also a tool to disseminate to recreational boaters accurate and current project information and survey dates and therefore increase the ability of the recreational boating community to respond and adapt to preclusion areas. The plan can serve to provide adequate noticing, but implementation of the project would nevertheless result in recreational boating preclusion during survey operations.

Placement of Structures in Beach Areas

Although PG&E proposes to place temporarily approximately 90 passive seismic monitoring devices (geophones) on Morro Strand beach – the beach area stretching from Montana de Oro State Park to the inlet of Morro Bay -- their presence will not interfere with the public's access to and use of the beach. The proposed geophone devices are approximately five inches in diameter, would be installed by hand widely spaced throughout a several mile long stretch of Morro Strand beach, and would be buried in place for the duration of the survey only. As such, the Commission finds that the placement onshore of temporary geophones would not adversely affect coastal access or recreation.

Conclusion

As described above, the proposed project would result in the temporary closure of the offshore project area to recreational boating and diving activities. Expected high nearshore underwater sound levels may also discourage surfers, swimmers and divers from entering the ocean during survey operations and therefore result in a “de facto” closure. An appropriately thorough communications and noticing strategy by PG&E would serve to minimize some of these impacts but would not mitigate or compensate fully for lost ocean recreation use. If the proposed project were otherwise consistent with the Coastal Act, the Commission could require (1) a more comprehensive Communication Plan to minimize the project’s impacts on public access and recreation, and (2) mitigation in the form of public access and recreation improvements or an in lieu mitigation payment.

J. CULTURAL RESOURCES

Section 30244 of the Coastal Act states:

Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.

The proposed project involves very limited ground disturbing activities onshore – the temporary placement by hand of 90 small geophones on Morro Strand beach for the duration of the proposed project. The State Historic Preservation Officer (SHPO) has not identified any archeological or paleontological resources in the areas in which PG&E would temporarily place geophones.

However, the Northern Chumash Tribal Council (NCTC) has also expressed a variety of concerns to the Commission regarding potential adverse impacts to cultural resources. In a letter dated August 29, 2012, Mr. Fred Collins of the NCTC states:

As I have mentioned before in our conversations NCTC is extremely concerned about the abuse of the Chumash Nation Creation Story, most people all over the world know about the “Rainbow Bridge” story, the Dolphins are our Ancestors. The potential killing of our Ancestors is Traumatic Trauma to the members of NCTC and the Chumash community. NCTC is of the opinion that this is one of many violations of our Freedom of Religion Act rights, and many other law, treaties and regulation that mandate meaningful consultation. (Ninth District Court, Quechan Tribe v. US Department of Interior 2010)

In addition, the following excerpt from a September 17, 2012 letter to the Commission from Maura Sullivan, a member of the Coastal Band of the Chumash Nation, provides an additional description of some of the concerns of the Chumash community regarding the anticipated adverse project related impacts to marine mammals:

The dolphins and whales are our relatives. When crossing the Santa Barbara channel for our annual Tomol crossing we encounter these blessed creatures and immediately our community erupts in applause and songs and prayers of gratitude. The animals are more

than creatures with whom we cohabit. These spirits are our guides and our caretakers. They teach us how to move through our lives in a fluid and graceful way. We cannot live without them.

...
We consider all of these animals, from the whales down to the tiny krill on which they feed, to be valuable resources in our community. This letter is in direct support of the NCTC (Northern Chumash Tribal Council) and the Northern Chumash peoples' rights to protect their environment and the sea creatures as a cultural resource. This is summarized in article 26 of the UNDRIP:

Article 26

1. *Indigenous peoples have the right to the lands, territories and resources which they have traditionally owned, occupied or otherwise used or acquired.*
2. *Indigenous peoples have the right to own, use, develop and control the lands, territories and resources that they possess by reason of traditional ownership or other traditional occupation or use, as well as those which they have otherwise acquired.*
3. *States shall give legal recognition and protection to these lands, territories and resources. Such recognition shall be conducted with due respect to the customs, traditions and land tenure systems of the indigenous peoples concerned.*

The Chumash community thus considers marine mammals to be important cultural resources. Dolphins have a particular importance to the Chumash people because their origin story, the story of the Rainbow Bridge, establishes that dolphins and humans are descended from one people. Mati Waya of the Chumash Nation's Sea Turtle Clan on the Wishtoyo Foundation website, states:

As the Rainbow Bridge story tells it, when the Chumash crossed over from the islands to the mainland, on the Rainbow Bridge, the Creator told them not to look down, or they would die. However, some could not resist. Instead of letting them die, the Creator saved them, turning them into Dolphins.

Although the Coastal Act does not provide a policy basis for protecting cultural resources in the absence of an identification by SHPO that archaeological or paleontological resources are present, the Commission, in the Marine Resources section of the report (Section G), evaluated this project's impacts to dolphins and finds that it will result in significant adverse impacts to dolphins and other marine mammals, and therefore is inconsistent with the Coastal Act's marine resource protection policy (30230). However, with respect with to the Coastal Act cultural resource protection policy, the Commission finds the project consistent with Section 30244.

K. ENVIRONMENTALLY SENSITIVE HABITAT AREAS

Coastal Act Section 30240(b) states that:

(b) 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.

In addition, Coastal Act Section 30107.5 defines "Environmentally sensitive area" as follows:

"Environmentally sensitive area" means any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments.

The proposed project includes the temporary placement of approximately 90 passive seismic monitoring devices (geophones) on sandy beach area along a 5.53 mile linear transect on the Morro Bay Sandspit (0.81 miles within Montana de Oro State Park (MDOSP), 3.51 miles within Morro Dune Natural Preserve (MDNP), and 1.21 miles on non-park property). Each geophone is small (5-pounds, 6-inches-high, and 5-inches-wide with a 5-inch spike located at the bottom of the device to assist in placement) and will be placed 100 meters apart along the beach and buried about one foot to avoid trampling and vandalism (see [Exhibit 2](#) for the transect location and [Exhibit 3](#) for a diagram of a typical geophone nodal). The geophones would be removed when the survey is complete. All work associated with the onshore geophone -- placement, maintenance, and removal – would be conducted manually without the use of heavy equipment on the beach.

The area of the Morro Bay Sandspit where geophones are to be placed is composed of coarse-grained sand. The wildlife habitat associated with this sandy beach area is barren with generally less than 2 percent vegetative cover. Many bird species nest in this barren habitat along the coast, including the western snowy plover (*Charadrius alexandrinus nivosus*), a Federal-threatened species, and other plovers, stilts, avocets, several gulls, and terns including the California least tern (*Sternula antillarum*), a Federal-endangered species, but the project would be carried out during the non-nesting season.

Areas landward of the Morro Bay Sandspit sandy beach area include coastal foredunes and central dune scrub, habitats that are rare and sensitive and qualify as environmentally sensitive habitat areas (ESHA) under the Coastal Act. These habitat areas are inhabited by many small mammal species, including the Botta's pocket gopher, California mouse (*Peromyscus californicus*), and western harvest mouse (*Reithrodontomys megalotis*). Bird species that inhabit central dune scrub include California towhee (*Pipilo crissalis*), rufous-sided towhee (*Pipilo erythrorthalmus*), white-tailed crowned sparrow (*Zonotrichia leucophrys*), wrentit (*Chamaea fasciata*), California thrasher (*Toxostoma redivivum*), and scrub jay (*Aphelocoma coerulescens*). Reptiles include southern alligator lizard (*Elgaria multicarinata*), western skink (*Eumeces skiltonianus*), and western fence lizard (*Sceloporus occidentalis*). Special-status species that may

occur in this habitat include the federally protected Morro shoulderband snail (*Helminthoglypta walkeriana*), the Federal- and State-endangered salt marsh bird's beak (*Chloropyron maritimum* ssp. *maritimum*), Blochman's leafy daisy (*Erigeron blochmaniae*), and the State-threatened beach spectaclepod (*Dithyrea maritima*).

In order to avoid impacts to sensitive habitats and species (especially the sensitive dune vegetation located inshore of the beach on the Morro Bay Sandspit) that could result from the temporary placement, operation, and removal of the geophones, PG&E has incorporated the following design features and mitigation measures into the project:

- A worker environmental awareness training program would be conducted to discuss the area's sensitive species, habitat areas, and mitigation measures.
- Pre-activity biological surveys of area to be conducted by a qualified biologist no more than two weeks prior to the start of onshore activities and submitted to the Coastal Commission and other agencies. Areas with sensitive flora and fauna would be recorded with GPS, clearly marked in the field, and have an exclusion zone established around them.
- A qualified biologist would be maintained on site during placement and retrieval of the geophones to ensure exclusion areas are maintained and sensitive resources are avoided.
- The geophones would be placed above the high high-water mark in areas devoid of vegetation on the side of trails in areas that do not contain sensitive species or habitat.
- Exclusion zones would be established around kangaroo rat burrows and any presence of Morro shoulderband snail (50 feet).
- Areas within Montana de Oro State Park and the Morro Dune Natural Preserve would be accessed by foot from the southern sandspit parking lot or by boat from a more central location.
- Onshore project activities would not occur during the nesting.
- Burial of geophones will be done with hand tools only. No heavy equipment would be used.

With implementation of these measures, the Commission believes PG&E will avoid disturbing ESHA and sensitive species. The Commission therefore finds the project would be carried out consistent with Section 30240(b) of the Coastal Act.

L. OIL SPILLS

Section 30232 of the Coastal Act states:

Protection against the spillage of crude oil, gas, petroleum products, or hazardous substances shall be provided in relation to any development or transportation of such materials. Effective containment and cleanup facilities and procedures shall be provided for accidental spills that do occur.

The proposed project includes the operation of three ocean vessels that could potentially increase the chance of a vessel collision and a release of fuel oil into marine waters during mobilization, demobilization, and survey activities.

The first test of Coastal Act Section 30232 requires an applicant to “protect against the spillage of crude oil, gas, petroleum products, or hazardous substances...” In this case, PG&E has incorporated into its project a number of measures that reduce the risk of an oil spill. To avoid the potential for a vessel collision, PG&E will provide a Notice to Mariners and local fishing associations prior to the start of field operations. The use of support boats during the project will minimize the potential for non-project vessel interference. Additionally, project vessels will not refuel within the project area in order to avoid the potential for releases during on-water fuel transfers.

With implementation of these measures, the Commission finds that PG&E is undertaking appropriate measures to prevent a spill from occurring and therefore the project is consistent with the first test of Coastal Act Section 30232.

Notwithstanding implementation of the above-described prevention measures, accidental spills can and do occur. The second test of Section 30232 requires that effective containment and cleanup facilities and procedures be provided for accidental spills that do occur. To meet this test the Commission requires an applicant to: (a) submit an oil spill contingency plan that demonstrates that the applicant has sufficient oil spill response equipment and trained personnel to contain and recover a reasonable worst case oil spill, and to restore the coastal and marine resources at risk from a potential oil spill; and (b) demonstrate financial ability to pay for all oil spill clean-up costs and resource damages in the event of an oil spill.

PG&E currently has in place a California Nontank Vessel Contingency Plan covering the *R/V Marcus G. Langseth* that has been approved by the California Department of Fish and Wildlife’s Office of Spill Prevention and Response (“OSPR”). The nontank vessel contingency plan includes spill notification procedures and general oil spill response and cleanup techniques. Oil spill equipment that would be available on-scene/onboard the *R/V Marcus G. Langseth* are identified in the Ship Oil Spill Response Kit, and include: 30 bags of dry absorbent, 12 absorbent socks 3”x4’ long, 4 absorbent booms 5”x10’ long, 2 bundles (100 per bundle) of absorbent mats 20”x15”, and associated spill equipment (e.g., shovels, scoops, buckets, tape, goggles, gloves, etc.). In addition, a current and project specific list of contacts and spill notification numbers (including but not limited to: the identified Responsible Person/ Party, Cal-EMA oil spill reporting number, USCG, OSPR, and Port San Luis and Morro Bay Harbormasters) will be updated prior to the start of field operations and will be onboard *R/V Marcus G. Langseth* for the duration of the project. Moreover, PG&E has agreed in its oil spill contingency plan to include “protective measures developed to protect sensitive resources and habitats in the Project area, as described in the Area Contingency Plan (ACP) prepared by the USCG, California Department of Fish and Game, and other resource agencies” (see APM-27 – Oil Spill Contingency Plan). Over the years, Coastal Commission Oil Spill Program staff has been instrumental in developing and updating an ACP for this area that identifies area-specific coastal and marine resources at risk and area-specific oil spill response techniques and capabilities.

However, PG&E has not demonstrated the financial ability to pay for all oil spill clean-up costs and resource damages in the event of an oil spill. The implementing regulations, found in California’s certificate of financial responsibility regulations (14 CCR Sections 791-797), require

that, prior to operating in California, all operators or owners of marine facilities where a spill could impact the marine waters of the state must demonstrate to the satisfaction of the Administrator of the OSPR the financial ability to pay for all costs and damages caused by a spill. The OSPR Administrator issues a California Certificate of Financial Responsibility (“COFR”) when the standards set forth in the regulations have been met. Even though PG&E’s nontank vessel contingency plan has been previously approved by OSPR (January 24, 2011), PG&E, as the operator of nontank vessel *R/V Marcus G. Langseth*, has not received a COFR from the OSPR Administrator, making the plan and vessel “non-compliant.” In order to ensure vessel and contingency plan compliance, the Commission could require PG&E to provide evidence that a COFR has been issued by the OSPR Administrator prior to the start of field operations.

With the addition of such a requirement, and given PG&E’s implementation of the approved California Nontank Vessel Contingency Plan for the *R/V Langseth*, the Commission could find that PG&E would provide effective containment and cleanup equipment and procedures for accidental spills that may occur and that the project would satisfy the second test of Coastal Act Section 30232.

M. COASTAL DEPENDENT INDUSTRIAL OVERRIDE

Section 30260 of the Coastal Act states:

Coastal-dependent industrial facilities shall be encouraged to locate or expand within existing sites and shall be permitted reasonable long-term growth where consistent with this division. However, where new or expanded coastal-dependent industrial facilities cannot feasibly be accommodated consistent with other policies of this division, they may nonetheless be permitted in accordance with this section and Sections 30261 and 30262 if (1) alternative locations are infeasible or more environmentally damaging; (2) to do otherwise would adversely affect the public welfare; and (3) adverse environmental effects are mitigated to the maximum extent feasible.

Coastal Act Section 30101 defines a coastal-dependent industrial development or use as that which “requires a site on or adjacent to the sea to be able to function at all.” Ports, offshore oil and gas platforms, and power plants that require seawater for cooling are types of coastal-dependent development that the Coastal Act gives priority over other types of development on or near the shoreline. Coastal Act Section 30001.2 finds that, notwithstanding the significant adverse effects a coastal-dependent industrial development may have on coastal resources or coastal access, it may be necessary to locate such developments within the coastal zone. Consequently, Section 30260 of the Coastal Act provides for special consideration of coastal-dependent industrial facilities that may otherwise be found inconsistent with the Coastal Act’s Chapter 3 policies. Coastal-dependent industrial facilities must be evaluated under all applicable policies and standards contained in Chapter 3. If the proposed project is inconsistent with any Chapter 3 policy, Section 30260 provides that the Commission may nonetheless approve such developments if it finds that the proposal meets that policy’s three-part test.

PG&E proposes to conduct the seismic survey to provide the California Energy Commission, the California Public Utilities Commission, and the Nuclear Regulatory Commission with additional seismic data as part of its effort to re-license and therefore extend the operation of the Diablo Canyon Power Plant (DCPP). The Commission has previously determined the DCPP to be a coastal-dependent industrial facility, finding “While nuclear power plants in general are not necessarily coastal-dependent, DCPP’s reliance on billions of gallons a day of seawater requires that it be sited on or adjacent to the sea in order to function at all, and it is therefore coastal-dependent.” (See Commission’s Final Adopted Findings for E-06-011/A-3-SLO-06-017 Diablo Canyon Steam Generator Replacement Project.)

As discussed in Section G of this report, the proposed project is inconsistent with the marine resources protection policies (Section 30230 and 30231) of the Coastal Act due to significant adverse impacts to marine mammals and other marine wildlife that cannot be mitigated. Since the survey to be undertaken is in support of the temporal expansion of an existing coastal-dependent industrial facility, the Commission may nevertheless approve the project if all three requirements of Section 30260 can be met. As discussed in detail below, the Commission finds that the project does not meet the first of the three tests, and therefore cannot be approved pursuant to Section 30260.

Project Alternatives

The first test of Section 30260 allows the Commission to approve the project if it finds that “alternative locations are infeasible or more environmentally damaging.” Since the Commission also is required under the California Environmental Quality Act (CEQA) to evaluate a reasonable range of alternatives if the proposed project results in significant adverse environmental effects, the Commission here analyzed a broad range of potential project alternatives, including alternative locations and configurations.

The Commission notes that the project currently proposed and evaluated in this report is itself an alternative version of the originally proposed project. In response to concerns raised by the National Marine Fisheries Service over potentially high levels of marine mammal “take” and requirements of the State Lands Commission, PG&E had reduced the original proposal evaluated in the EIR. On October 1, 2012, PG&E further modified the project to carry out surveys on only one of the four originally proposed survey “boxes,” or areas, and to eliminate the use of seafloor geophones. The result of these modifications is that the total number of anticipated operational days in the water would be 33 (including mobilization of project vessels, deployment of air gun arrays and streamers, air gun testing, and active surveying), down from the 82 total days that were anticipated in the initial proposal and evaluated in the EIR. The total number of days of active air gun use (including equipment calibration, sound propagation model verification, contingency days, and surveying) has been reduced from 65 under the initial proposal evaluated in the EIR to 17 under the most recently modified proposal.

Background

The EIR evaluated a variety of survey configurations. These alternatives included a single survey “racetrack” covering a larger area between Cambria and Point Sal as well as configurations with one, two, and three, survey loops focused on different areas and targets. The currently proposed project includes one survey box, Box 4, and would be limited to the months

of November and December only. The current proposed project, which would cover about 880 miles over approximately 12 days (not including the five days of air gun use for equipment calibration and sound propagation model verification), is therefore substantially smaller in size and shorter in duration than the five alternative survey footprint locations evaluated in the project EIR. Because the extent and duration of the adverse impacts associated with this project are directly related to the size of the survey and the number of survey days, all of the larger and lengthier alternatives discussed in the EIR are expected to be more damaging than the currently proposed project. The Commission therefore focused its assessment of alternatives on whether PG&E could obtain the necessary data using methods that would further decrease the survey's extent or duration.

In addition to considering alternative survey footprints to reduce the significant effects of the proposed project, the Commission also evaluated (1) the installation of seafloor geophones as a means of eliminating or reducing the number or length of nearshore survey lines; (2) using data collected from previous seismic surveys in the project area as a means of either eliminating the need for the project or reducing its size or duration; (3) using data collected from the recently conducted and ongoing onshore 2D seismic studies and recently conducted offshore low-energy 3D seismic surveys (carried out in 2011 and from August 20 to October 5, 2012) as a means of eliminating the need for the project, or reducing its size or duration; and (4) the use of alternative survey techniques – such as a research vessel with the capacity to use more than four streamers, marine vibroseis devices, etc. These evaluations are provided below.

Seafloor Geophones

PG&E's initial project proposal included the use of seafloor geophones. PG&E stated in a July 9, 2012 letter to Commission staff that "Marine geophone or node locations were selected to 'fill in' nearshore areas where the *R/V Langseth* cannot survey due to shallow water <25 m (82 feet) and other navigation obstacles." In other words, the use of geophones was proposed as a means of extending the seismic imaging area beyond the area in which the air gun array was proposed to be used. As such, Commission staff requested additional information from PG&E regarding the potential use of additional seafloor geophones as a means of reducing the proposed amount of nearshore survey activities. PG&E provided the following response on September 14, 2012:

The spatial area of the proposed survey is dictated by the location of the geologic features being evaluated in the proposed study. In particular the Hosgri and Shoreline fault structures are located offshore; therefore, imaging these structures must be conducted in direct proximity to their locations. PG&E has carefully evaluated the use of additional onshore surveys and seafloor geophones as a means of reducing the number or length of nearshore or offshore survey transects. ...The number or length of nearshore or offshore survey transects has been minimized to the extent feasible. (emphasis added)

Commission staff then requested additional information regarding the evaluation that PG&E referenced in its letter regarding the use of additional onshore surveys and seafloor geophones to reduce the number or length of nearshore or offshore survey transects. PG&E responded (K. Vardas personal communication on September 14, 2012) that no written record of such an evaluation was available for review by Commission staff. PG&E has therefore not provided the Commission with information that would allow it to analyze the feasibility of using additional

seafloor geophones. Subsequently, PG&E eliminated the use of seafloor geophones from its project, as reflected in the revised proposal submitted to Commission staff on October 1, 2012. The Commission finds this potentially feasible alternative needs further evaluation. The use of seafloor geophones may reduce the amount of survey activities and thereby reduce identified impacts to coastal resources through lowering the extent and duration of sound levels that would be received in the marine environment, particularly in highly productive and diverse nearshore habitat areas, water-oriented recreation sites, and fishing locations. As a result, the Commission finds that it has insufficient information to determine if a survey using seafloor geophones would result in a feasible and less damaging project alternative.

Use of Data from Previous Seismic Surveys

The collection, evaluation, and, if necessary, re-processing of previously collected seismic survey data using current methods has the potential to eliminate the need for the proposed project or reduce its scope or duration. Approximately 19 seismic surveys have been carried out in the project area since the early 1970s. These previous surveys have been carried out by government agencies, research organizations, the oil industry and PG&E. The table and figure included in [Exhibit 8](#) to this report provide a brief summary of these previous surveys and shows the specific areas they targeted. In response to questions regarding whether or not the data collected during these previous surveys could be used to reduce the duration, scope, or design of the proposed project, PG&E states that:

Diablo Canyon is the only nuclear power generating facility in the country that employs a full time seismic department staffed with experts. The scientific staff continually studies earthquake faults in the region of the power plant and global seismic events as part of a comprehensive safety program, known as the Long Term Seismic Program (LTSP). The LTSP is a requirement of our NRC operating licenses. The analyses and models used in the seismic assessments under the LTSP are continually updated and confirm the plant is designed to withstand probable ground motions from nearby faults.

PG&E's advanced seismic research was called for by the state and includes the use of a combination of on-shore 2D and 3D studies, off-shore 3D low and high-energy surveys, as well as the ongoing use of seismic monitoring devices.

The advanced studies will enhance our seismic knowledge of the area, and provide a more accurate, detailed picture of the region's seismic characteristics, including the angle of faults, how they are shaped and if they are interconnected. This data will help further define the ground motions that faults in the region are capable of producing, which PG&E will use as part of its ongoing work to continually assess and validate the seismic design of the plant. The data will also be used to support a federal requirement for a new seismic risk evaluation following the Fukushima Daiichi power plant tragedy.

This response does not clarify the extent to which data resulting from these previous surveys has been collected, evaluated, and re-processed by PG&E using more modern techniques. In response to a request from Commission staff to PG&E for additional information on this issue, PG&E noted in a September 20, 2012 email to Commission staff that it has evaluated and discussed all of the seismic survey data collected during the surveys shown in [Exhibit 8](#).

PG&E's response refers to a variety of references in which the previously collected survey data was evaluated, the majority of which are well over ten years old. This suggests that a more recent evaluation making use of more advanced processing techniques that may currently be available has not been carried out. In addition, the September 18, 2012 decision by the CPUC to approve PG&E's request to recover in customer rates a total of \$64.25 million to carry out 2D and 3D seismic studies onshore and offshore of DCPP provided specific funds for "purchasing and evaluating existing industry data" collected during offshore seismic surveys. PG&E suggested in subsequent communications with Commission staff that the data purchased was onshore data only and it was used to inform the design of the onshore 2D seismic imaging program.

This issue is of key importance to a consideration of the proposed project because the extensive amount of seismic data collected in the vicinity of DCPP over the past 40 years has the potential to be used to further refine the proposed project and change the location or reduce the size and duration of survey efforts – modifications that would reduce anticipated significant and adverse impacts to coastal resources and identified conflicts with the Coastal Act. The Commission believes that a re-evaluation of older data, in conjunction with completing the assessment of recently acquired 2D and 3D low-energy survey data (as discussed below), has the potential to further reduce the survey location, scope, or duration.

Use of Data from Recently Conducted and Ongoing Studies

The proposed project is one element of a \$64 million, multi-year seismic research program initiated by PG&E in 2010. Other elements include partially-completed extensive onshore seismic imaging efforts in Los Osos, San Luis Obispo County, and the vicinity of DCPP as well as several separate 2D and low-energy 3D offshore surveys and the installation of long-term seismic monitoring devices on the seafloor.¹⁶ The following excerpts from the recent September 18, 2012 CPUC funding decision for this work provide a brief description of its scope and objectives:

In addition to more than doubling the offshore area to be studied using 2--D and 3--D technology, PG&E is performing two types of 3--D seismic surveys: high--energy and low--energy. The low--energy survey provides high--resolution imagery at subsurface depths of approximately 1/2 kilometer (km). The high--energy survey provides imagery at depths of up to 12 km, but provides poor resolution imagery at shallow depths, so the high-- and low--energy technologies complement each other. PG&E plans to perform high-- and low--energy 2--D and 3--D surveys to illuminate shallow and deep structures and resolve uncertainties related to the Shoreline, Los Osos, and Hosgri/San Simeon fault zones. Understanding the geometry of these faults at seismogenic depths, coupled with slip rate information that PG&E hopes to obtain from the low-energy surveys will improve PG&E's ability to define the seismic hazard in the region.

...

¹⁶ In April 2012, PG&E received Commission approval to install these devices, known as "Ocean Bottom Seismometers" or OBS units; however, PG&E has not yet done so.

PG&E identified the Los Osos and San Luis Bay fault zones as having a deterministic seismic hazard that was comparable to the offshore Shoreline and Hosgri fault zones. Reducing the uncertainty in the source characterization (geometry, slip rate) of these fault zones will further define the seismic hazard at Diablo Canyon. Additionally, the data collected from the onshore 2--D surveys will provide constraints on the geometry and style of faulting beneath the Irish Hills. Using this data, PG&E will develop a 3--D model of the geologic structure beneath the Irish Hills to address the geometry and rate of uplift of the hills and the distribution of hypocenters beneath the range. PG&E determined that it should implement 2--D seismic surveys rather than 3--D surveys onshore because of the difficulty and cost of using instruments in rugged hilly terrain, as well as land ownership and environmental issues.

Even then, the highly folded and deformed nature of the rocks in the Irish Hills region limits the resolution possible with conventional 2--D seismic surveys. In light of that reality, PG&E conducted computer--based illumination studies to optimize the proposed onshore source and receiver routes, which caused PG&E to modify the four survey routes it had originally proposed. This revised survey plan covers approximately 2.5 times the mileage originally proposed in 2010 and uses two types of seismic sources: (1) Vibroseis trucks for deep (approximately 10 km) penetration; and (2) Accelerated Weight Drop trucks for shallow (approximately 5 km) penetration and infilling in areas that the larger Vibroseis trucks are unable to access. The additional line mileage, the deployment of geophones, and the use of two different types of seismic sources will enable improved imaging of fault structures at depth that will approach the resolution of conventional 3--D seismic coverage.

While PG&E has indicated that these projects and the proposed high-energy offshore survey are directed at separate targets and research questions, the review and analysis carried out by the Independent Peer Review Panel (IPRP) suggests that some of the other data being collected may shed light on the high-energy offshore targets as well, potentially causing the project location, scope, and duration to be further refined. Specifically, after carrying out its review of PG&E's proposed project targets and objectives as well as the available information for the project area, the IPRP recommended that PG&E eliminate its proposed northern survey area, survey box 3, because recently conducted low-energy surveys provided sufficient information to satisfy the remaining questions and scientific debate regarding the research targets in that area. PG&E ultimately agreed and dropped Box 3 during the CSLC review of the project, subsequently reducing the survey size by approximately 25% (based on the initially proposed survey of four separate boxes). This suggests that the not-yet-completed evaluation of the low-energy offshore data and 2D onshore data collected by PG&E over the past two years may also further refine and reduce the extent and duration of the proposed survey. PG&E expects to complete the data processing for those surveys in early to mid-2013, which will likely help inform any high-energy offshore seismic survey proposed for the fall of 2013. Even a small reduction in the survey area or duration has the potential to substantially reduce the impacts associated with the project.

PG&E may also obtain additional guidance on the necessary scope of its seismic surveys through the Nuclear Regulatory Commission's Senior Seismic Hazard Analysis Committee (SSHAC) Level 3 review process. PG&E is currently participating in this process as part of its application for relicensing. As part of this process, an independent panel of experts analyzes available

seismic data to evaluate the seismic hazard at DCPP and determines if additional data should be gathered and how it should be gathered. The results of this data analysis phase of the SSHAC process are not yet available, so it is unclear if the experts involved in the SSHAC process will recommend seismic surveys in the location or of the length and scope proposed by PG&E.

Therefore, until the other elements of PG&E's seismic research program (low-energy offshore surveys and onshore seismic imaging) can be completed and their results evaluated, and until more is known about the recommendations generated through the SSHAC process, the Commission is unable to determine whether the proposed project could be further refined in location, scope, or duration. We note that PG&E has modified the survey at least six times in roughly the past six months, with modifications as recently as October 2012, even before completing the processing and evaluation of the recently acquired data. This suggests further refinements and further reductions of the survey and its impacts are likely. The Commission therefore finds that insufficient information is currently available to analyze whether further refinements will lead to a feasible and less environmentally damaging alternative to the proposed project. Thus, insufficient information is available for the first "test" of Section 30260 of the Coastal Act to be met.

Alternative Survey Techniques

There is also the possibility to use alternatives to air guns and alternative means of collecting data using high-energy air gun surveys.

In a letter to the Commission dated September 17, 2012, the San Luis Obispo County Board of Supervisors, questioned whether an oil industry vessel capable of using 10 streamers instead of four streamers (as proposed by PG&E) may be a better alternative that results in less survey days and therefore less coastal resource impacts. The letter states:

.... The proposed survey vessel would tow 4 laterally-separated streamers of hydrophones, covering a swath of 300-400 m of ocean surface with each pass of the survey vessel. In contrast, industry vessels can tow 10 or more streamers similarly spaced, resulting in a swath about 1000 m wide. As noted in PG&E's response (Attachment 2), the greater number of streamers "can reduce data collection time by a factor of 2 or 3."

PG&E contends, but has not demonstrated, that operation of a 10-streamer boat is not feasible in this survey area. The question should be settled by an industrial-level survey design review, which would model data acquisition geometry based on state-of-the-art streamer positioning technology. While the issue of data collection efficiency is certainly important because of reduced survey time would reduce impacts to marine life, the larger streamer numbers and other industrial survey technologies could also improve the image quality of the geologic targets.

The need for further evaluation of this alternative data acquisition method has been repeatedly raised by the IPRP in its reports as well as by the California State Lands Commission during its consideration of PG&E's application for a Geophysical Survey Permit. In addition, the CPUC has provided \$210,000 to San Luis Obispo County to expedite the addition of one or more experts to the IPRP with sufficient technical knowledge to carry out a review of the feasibility of

alternative streamer/vessel configurations. To date, this review has not been completed. As such, the Commission does not currently have sufficient information regarding the feasibility and potential impact reduction qualities of this alternative to make a determination that it would not be a feasible, less environmentally damaging alternative to the proposed project. As noted by Supervisor Gibson in Attachment 3 of the September 17, 2012 letter from the San Luis Obispo County Supervisors to the Commission:

This project should be submitted for a complete survey design review that would include a navigational obstruction survey of the area and modeling of streamer tracking behavior (horizontal and vertical) based on modern streamer steering and control technology. The survey design review would assess data collection efficiency, including 1) the potential use of greater numbers of streamers, and 2) the application of a second shooting boat, which is a common industry practice that improves data collection efficiency and image quality as well.

The Commission agrees that this survey design review should be carried out in order to identify potential acquisition or processing modifications that could be made to decrease the duration or scope of the proposed project. Until the results of this independent third party review process are available and evaluated, the Commission is unable to determine whether the proposed project could be further refined in scope or duration. As such, the Commission finds that insufficient information is currently available for this project alternative to be rejected as one that would be either infeasible or more environmentally damaging than the proposed project. The Commission therefore finds that insufficient information is available for the first “test” of Section 30260 of the Coastal Act to be met.

In addition, the EIR includes a detailed discussion and analysis of a variety of other non-air gun technologies, including microseismic and passive seismic monitoring, electromagnetic surveys, controlled-source/marine vibroseis technologies, and deep-towed acoustics/geophysical systems. The EIR concluded that all of these technologies have limitations that would make their use infeasible at this time. The Commission has carried out an additional review of these technologies and also finds that none of them would be feasible alternatives to the proposed use of air guns.

No Project and “No Project At This Time” Alternatives

As discussed in Section G of this report, the proposed project is inconsistent with Coastal Act policies designed to protect marine resources. Thus, the no project alternative would clearly have fewer adverse environmental impacts than the proposed project. The question remains, however, whether this alternative meets the purpose of the project. Another, related, alternative is essentially the “no project at this time” alternative. This alternative allows PG&E and the Commission to fully evaluate existing and recently gathered data to determine whether a project of the location, size and scope proposed by PG&E is necessary to meet PG&E’s data acquisition goals.

These alternatives would not involve the immediate implementation of seismic surveys. Instead, PG&E would use existing information and analyses to assess seismic features, movement, and hazards. This information would include:

- Data collected to date and incorporated into existing reports, such as PG&E's Shoreline Fault Report (PG&E 2011).
- Data that are currently being collected as part of PG&E's Long-term Seismic Program, including the results of the low-energy survey carried out in 2011 and 2012; and
- Data and reports prepared by other agencies and organizations such as the United States Geological Survey.
- A third party review of proposed survey data acquisition and processing.

Based on the evaluation of these data, PG&E may then be able to propose a refined and reduced survey. Additionally, these evaluations may result in sufficient reduction of uncertainty about the seismic characteristics of the area and potential effects on DCPP that a high-energy offshore survey may be unnecessary, making the no project alternative a feasible alternative.

Conclusion

For the reasons described above, at this time the Commission lacks sufficient information necessary to find that alternative project locations, or other alternatives, are infeasible or more environmentally damaging and that the first test of Section 30260 has been met. Because the Commission is unable to determine that the proposed project meets the first test of Section 30260, further evaluation of the remaining two tests is unnecessary, as the project cannot be found consistent with Coastal Act Section 30260.

N. CALIFORNIA ENVIRONMENTAL QUALITY ACT

Public Resources Code (CEQA) Section 21080(b)(5) and Sections 15270(a) and 15042 (CEQA Guidelines) of Title 14 of the California Code of Regulations (14 CCR) state in applicable part:

CEQA Guidelines (14 CCR) Section 15042. Authority to Disapprove Projects. [Relevant Portion.] A public agency may disapprove a project if necessary in order to avoid one or more significant effects on the environment that would occur if the project were approved as proposed.

Public Resources Code (CEQA) Section 21080(b)(5). Division Application and Nonapplication. ... (b) This division does not apply to any of the following activities: ... (5) Projects which a public agency rejects or disapproves.

CEQA Guidelines (14 CCR) Section 15270(a). Projects Which are Disapproved. (a) CEQA does not apply to projects which a public agency rejects or disapproves.

Section 13096 (14 CCR) requires that a specific finding be made in conjunction with coastal development permit applications about the consistency of the application with any applicable requirements of CEQA. This report has discussed the relevant coastal resource issues with the proposed project. All public comments received to date have been addressed in the findings

above. All above findings are incorporated herein in their entirety by reference. Section 21080(b)(5) of the CEQA, as implemented by Section 15270 of the CEQA Guidelines, provides that CEQA does not apply to projects which a public agency rejects or disapproves. The Commission finds that denial, for the reasons stated in these findings, is necessary to avoid the significant effects on coastal resources that would occur if the project was approved as proposed. Accordingly, the Commission's denial of the project represents an action to which CEQA, and all requirements contained therein that might otherwise apply to regulatory actions by the Commission, do not apply.

Appendix A **Substantive File Documents**

Coastal Commission Findings:
CD-47-91; CC-110-94; CDP 3-95-40; E-06-011/A-3-SLO-06-017; CD-037-06; CD-086-06

Environmental Documents:

California State Lands Commission, Final Environmental Impact Report, PG&E Central Coastal California Seismic Imaging Project, July 2012.

U.S. Fish and Wildlife Service, Proposed Incidental Harassment Authorization, September 27, 2012.

National Marine Fisheries Service, Proposed Incidental Harassment Authorization, September 19, 2012.

National Science Foundation, Draft Environmental Assessment of Marine Geophysical Surveys by the R/V Marcus G. Langseth for the Central Coastal California Seismic Imaging Project, June 2012.

National Marine Fisheries Service, Draft Environmental Assessment on the Effects of Scientific Research Activities Associated with Behavioral Response Studies of Pacific Marine Mammals using Controlled Sound Exposure: Research Applications to Support Conservation Management, June 2009.

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Appendix B

History of Concerns Over Offshore Seismic Surveys in California

Oil Industry

In the 1980s the oil industry conducted hundreds of seismic surveys in California offshore waters pursuant to joint permits issued by the US Department of the Interior's Minerals Management Service (now called the Bureau of Energy Management ("BOEM")) and the California State Lands Commission. The major issues the Commission staff was aware of at that time were: (1) impacts to commercial fishing equipment from the long tow lines used by the oil companies; and (2) impacts of loud noises on fish catch and fish development (e.g., eggs and larvae development). The Commission rarely asserted jurisdiction in part due to the existence and success of the joint oil and fisheries liaison office in the Santa Barbara Channel, which mediated disputes between fishermen and oil companies, although it reserved the ability to assert jurisdiction if those mediation efforts were not successful.

One such instance occurred in 1988, when the Commission requested permission from the Office of Ocean and Coastal Resource Management ("OCRM")¹⁷ to review an MMS seismic survey application by Exxon in federal waters offshore of northern California that would have coincided with the peak salmon fishing season. OCRM did not grant the Commission's request, and the Commission did not further pursue the matter, because Exxon subsequently met with fishing groups and agreed to modify its activity to avoid the peak fishing season.

U.S. Geological Survey (USGS)

In 1991, the Commission concurred with USGS' consistency determination for a seismic survey in the San Francisco Bay Region (CD-47-91). The Commission found that the activity would: (1) avoid important fishing grounds; (2) only be conducted for one or two days within areas of Coastal Commission jurisdiction (as opposed to within San Francisco Bay, which comes under the purview of the San Francisco Bay Conservation and Development Commission (BCDC)); and (3) be consistent with the marine resources policies of the Coastal Act. That survey involved use of a relatively large air gun array (10 guns, 5828 cu. in.). The monitoring report concluded that the air gun profiling did not alter the feeding behavior of sea lions, seals, or pelicans, all of which were observed feeding in parts of the study area.

After the 1991 Heard Island Feasibility Test ("HIFT"), in which scientists transmitted underwater sound half way around the world through the deep sound channel (Sound Fixing and Ranging ("SOFAR") channel, serious concerns began to arise over the effects of sound on marine mammals. In 1994-95 the Commission became involved in the debate over the effects of underwater sound on marine mammals when Scripps Institution of Oceanography (one of the partners in HIFT) subsequently proposed to use the same SOFAR channel to transmit sound from offshore central California to New Zealand, to monitor ocean temperature (the Acoustic Thermometry of Ocean Climate ("ATOCL") project. Although it was controversial, in June 1995 the Commission ultimately concurred with a combined consistency certification/coastal development permit for the project (CC-110-94 & CDP 3-95-40). During the Commission's

¹⁷ Pursuant to 15 CFR Part 930, Section 930.54, Unlisted federal license and permit activities.

review the project was greatly modified, including refocusing its scientific research to study effects on marine mammals rather than ocean temperatures.

In 1994, the Commission staff issued a “no coastal development permit” letter to the Thums Long Beach Company for a seismic survey in State waters just offshore of Long Beach. Marine mammal and fisheries avoidance measures were incorporated into this survey and the survey was of short duration.

In 1995, the Commission staff agreed with a “No Effects” determination by Exxon for a seismic survey at the Santa Ynez Unit in federal waters offshore of Santa Barbara County. The Commission agreed not to require a consistency certification in part due to Exxon’s incorporation of marine mammal protection measures, including visual, aerial and acoustic monitoring, acoustic model verification, marine mammal preclusion/avoidance areas, and other measures being required under the National Marine Fisheries Service (NMFS) marine mammal harassment permit. Nevertheless, due in part to the controversy, extensive time it took for regulatory approvals, and growing interest in marine mammal issues, the Minerals Management Service convened an inter-agency task force (which included the Commission) to address the issues.

This effort became known as the “HESS” Team, which stands for High Energy Seismic Survey Team. The team consisted of an intergovernmental effort consisting of broad cross-section of state and federal regulators, oil and gas and commercial fishing interests, local government, marine research, geophysical operators, and environmental organizations, meeting in a mediated setting, to attempt to fashion a coordinated regulatory approach and consensus decisionmaking for high energy seismic activities. The Team’s output was a report called *High Energy Seismic Survey Review Process and Interim Operational Guidelines for Marine Surveys Offshore Southern California*. The HESS team report (dated February 19, 1999) contained operational guidelines concerning review procedures and recommended mitigation/avoidance/monitoring measures for agencies to consider in analyzing high energy seismic surveys.

After the 1991 Heard Island Feasibility Test (“HIFT”), in which scientists transmitted underwater sound half way around the world through the deep sound channel (Sound Fixing and Ranging (“SOFAR”) channel, serious concerns began to arise over the effects of sound on marine mammals. In 1994-95 the Commission became involved in the debate over the effects of underwater sound on marine mammals when Scripps Institution of Oceanography (one of the partners in HIFT) subsequently proposed to use the same SOFAR channel to transmit sound from offshore central California to New Zealand, to monitor ocean temperature (the Acoustic Thermometry of Ocean Climate (“ATOC”) project. Although it was controversial, in June 1995 the Commission ultimately concurred with a combined consistency certification/coastal development permit for the project (CC-110-94 & CDP 3-95-40). During the Commission’s review the project was greatly modified, including refocusing its scientific research to study effects on marine mammals rather than ocean temperatures.

On May 11, 1999, the Commission objected to USGS’ consistency determination for the 1999 southern California seismic survey, based on concerns over nighttime operation when visibility (and therefore ability to monitor for the presence of marine mammals) is limited. On May 26,

1999, the Commission subsequently concurred with USGS' revised proposal, in which it agreed to avoid nighttime use of the main air gun.

On April 14, 2000, the Commission concurred with USGS' consistency determination for a three-week seismic survey in southern California offshore waters to collect high-resolution seismic reflection data to investigate: (1) landslide and earthquake hazards in the nearshore region from Los Angeles to San Diego; and (2) saltwater intrusion into freshwater aquifers that provide water supply for the Los Angeles-San Pedro area. This project made use of a "minisparker" instead of an air gun and had several benefits over the 1999 proposal. From an acoustic standpoint, the 180 dB area of acoustic footprint for the minisparker was much smaller, enabling USGS, even at night, to maintain visibility within the area for preclusion of marine mammals.

On March 15-16, 2000, 16 whales of four different species beached themselves in the Bahamas off the east coast of the U.S., coinciding with Navy mid-frequency sonar and testing activities. Seven whales died, including four Cuvier's beaked whales, a Blainville's dense beaked whale, and a spotted dolphin. This was the first time necropsies were performed quickly enough to definitively establish a direct link between military sonar and strandings. While evidence from earlier strandings of beaked whales had previously temporally linked military sonar to the strandings, evidence was generally considered only circumstantial. However, for the Bahamas stranding, NMFS reported at the time that: "The injuries to the six beaked whale heads were all consistent with an intense acoustic or pressure event. ... These animals died from being stranded. We do not know what caused the animals to strand, but we think it is possible that the animals suffered vestibular effects (disequilibrium and disorientation) from an acoustic or pressure event." This event significantly intensified concerns over the effects of anthropogenic noise, and Navy sonar in particular, on marine mammals. It also shifted concerns that had previously been expressed over low frequency sonar to mid-frequency sonar (in part because it occurs more commonly in the marine environment than low frequency sonar).

Because the beaked whales in the Bahamas had not been subjected to the types of sound intensities previously associated with physiological damage, this event also called into question the prevailing assumptions regarding thresholds for marine mammal impacts.

On December 13, 2005, the Commission expressed this and a number of other concerns in a report entitled "Coastal Commission Comments on the Effects of Anthropogenic Sound on Marine Mammals Statement for The Report of the Advisory Committee on Acoustic Impacts on Marine Mammals to the Marine Mammal Commission." This report can be found on the Commission's website at: <http://www.coastal.ca.gov/energy/comments-mmcc-12-2005.pdf>.

Appendix C

Underwater Noise – Background Information

Fundamentals

The issues associated with underwater sound generation and exposure are complex. The following brief discussion of the acoustic process, the relevant measurements used to describe sound, and some of the key factors that affect exposure is therefore provided as background.

In “Marine Mammals and Noise (generally considered the definitive text on the subject), Richardson et al (1995) introduce the the subject with a “source-path-receiver” model of the acoustic process, such that, for a whale swimming near a drillship: the ship is a source of underwater sound, the water (including surface and bottom) is the path from source to whale, and the whale is the receiver. Richardson et al further note that source characteristics vary over time (including, for example, transient versus continuous), and vary in both frequency and strength. The transmission paths to a receiver may include various combinations of air, water, or bottom materials, are often not a straight line, and multiple transmission paths (multipaths) can occur when sound reflects from surfaces along the path, such as the surface and (in underwater sound transmission) the bottom. Rough surface or bottom features can absorb sound and/or cause sound to be scattered. Finally, the characteristics of the sound receivers (in this case primarily marine mammals) include an animal’s hearing sensitivity to sounds at different frequencies and its responsiveness to different types and levels of sounds.

Four of the primary factors to consider when evaluating exposure to sound are the received sound intensity, pressure, frequency, and duration. Sound intensity is typically measured in decibels. As noted by Chapman and Ellis (1998):

The decibel (abbreviated dB) is simply a numerical scale used to compare the values of like quantities, usually power or intensity. Acousticians introduced the decibel to devise a compressed scale to represent the large dynamic range of sounds experienced by people from day to day, and also to acknowledge that humans—and presumably other animals—perceive loudness increases in a logarithmic, not linear, fashion. An intensity ratio of 10 translates into a level difference of 10 decibels; a ratio of 100 translates into a level difference of 20 dB; 1000 into 30 dB; and so on. (The term "level" usually implies a decibel scale.)

Most sound receivers are sensitive to sound pressure, which is measured in micropascals (μPa), as well as intensity. Received sound intensity, or dB level, is heavily influenced by the medium the sound is traveling through (for example, water vs. air) and the distance between the sound source and the receiver. Differences in the relative impedance of air and water (the stiffness or density of the medium) has led acousticians to use different standard reference sound pressures for these two media. As Chapman and Ellis (1998) discuss:

The standard reference pressures used in underwater acoustics and in-air acoustics are not the same. In water, acousticians use a standard reference sound pressure of 1 micropascal (i.e. 10^{-6} newtons per square metre), abbreviated μPa . In air, acousticians use a higher standard reference sound pressure of 20 μPa . The in-air standard was chosen so that the threshold of hearing for a person with normal hearing would correspond to 0 dB at a

frequency of 1000 Hz. Adopting different standards for air and water inevitably leads to a confusing consequence: the same sound pressure that acousticians label 0 decibels in air would be labeled 26 decibels in water.

Just as the differences in the relative impedance of air and water affects the respective reference sound pressures used for these media, these differences also affect the propagation and attenuation (gradual loss in intensity) of sound waves in air and water. Obviously, sound intensity in both air and water decreases as the distance from the sound source increases, however, the rate of this decrease is different in each medium and both are affected by the physical makeup of the surrounding environment. For this reason, notations of sound intensity levels often include references to the distance from the sound source (for underwater sound, the typical convention when describing a sound source is to note its intensity level at a distance of one meter). When such notations are not provided, it is important to consider the context so as to avoid the mistake of comparing a source level at one meter with a received sound level at a greater distance. For example, comparisons are frequently made between the sound of a jet airplane (often cited as 120 dB) and the maximum output of a seismic survey air-gun (cited at 250 dB). This comparison is extremely misleading for several key reasons. First, as noted above, the reference sound pressures used in air and water are different – such that converting from 20 μPa to 1 μPa would result in the addition of 26 dB. Second, the 120 dB (re 20 μPa) level is typically associated with a jet airplane take-off measured at a distance of 500 meters while the 250 dB (re 1 μPa) is the source level of an air-gun at one meter. Making an assumption of “spherical spreading” in air, referencing the jet airplane sound level back to a one meter distance would increase it by another 54 dB. As a result, when considered with the same standard reference pressures and at the same distance, the jet airplane would be 200 dB re 1 μPa at one meter and the air-gun would be 250 dB re 1 μPa at one meter. Although still greater, the difference is greatly reduced.

For the equipment proposed to be used for this project, the source sound levels are as follows: each of the two 3,300 cubic inch air-gun arrays would generate 252 dB re 1 μPa at one meter; the multi-beam echosounder would generate 242 dB re 1 μPa at one meter; the sub-bottom profiler would generate 204 dB re 1 μPa at one meter; and the single 40 cubic inch air-gun would generate approximately 210 dB re 1 μPa at one meter.

Sound intensity in deep water generally diminishes as the square of the distance from the source (i.e., $1/r^2$, with a 6 dB reduction for a doubling in distance), also called “spherical spreading.” In shallow water, cylindrical spreading can occur ($1/r$, or a 3 dB reduction for a doubling in distance). Because an air-gun array such as the 18-gun array proposed to be used in this project is comprised of multiple sound sources and is therefore not a typical single-source (and because it would operate in many different ocean conditions and depths), its transmission loss calculations are complex. While the Greenridge Sciences, Inc. technical report provided as Appendix A of the draft EA includes a comprehensive discussion and modeling of the sound propagation expected with this project, the following table (copied from the draft EA) provides estimates of the anticipated received sound levels at a variety of distances from the proposed air-gun array based on seafloor characteristics (i.e. decreasing depth – upslope, increasing depth – downslope, and alongshore).

SPL (dB re 1 Pa)	Upslope: Distance			Downslope: Distance			Alongshore: Distance		
	(m statute mi nautical mi)								
190	250	0.16	0.13	280	0.17	0.15	320	0.20	0.17
187	390	0.24	0.21	370	0.23	0.20	410	0.25	0.22
180	1,010	0.63	0.55	700	0.43	0.38	750	0.47	0.40
170	2,990	1.86	1.61	1,760	1.09	0.95	1,760	1.09	0.95
160	6,210	3.86	3.35	4,450	2.77	2.40	4,100	2.55	2.21
154	8,570	5.33	4.63	7,820	4.86	4.22	6,780	4.21	3.66
120	24,650	15.32	13.31	251,320	156.16	135.70	94,870	58.95	51.23

An additional factor to consider when evaluating sound exposure is sound frequency. Sound frequency is a measure of the rate of oscillation or vibration and is measured in cycles per second, or hertz (Hz). As noted by Richardson et al. (1995), “An animal’s sensitivity to sounds varies with frequency, and its response to a sound is expected to depend strongly on the presence and levels of the sound in the frequency band (range of frequencies) to which it is sensitive.” While humans are often said to hear sounds ranging from 20 to 20,000 Hz, some animals including dolphins and porpoise, can detect ultrasonic frequencies (>20,000 Hz) and others, including some baleen whales, can detect infrasonic sounds (<20 Hz).

For the equipment proposed to be used for this project, the sound frequencies are as follows: each of the two 3,300 cubic inch air-gun arrays and the single 40 cubic inch air-gun would generate broad frequency sound with dominant components from 0 Hz to 188 Hz; the multi-beam echosounder would generate sound with a frequency of approximately 1200 Hz; and the sub-bottom profiler would generate sound with a frequency of 350 Hz.

The final factor to consider when evaluating sound exposure is duration – the period of exposure to a given sound level. This period of exposure can affect an individual’s perception of a given sound. On a basic level, sound durations can be divided into two categories – continuous sound and impulse sound. Each of the two 3,300 cubic inch air-gun arrays would generate brief (0.1 second) pulses of sound every 11 to 20 seconds (the two arrays would trade off firing) along each of the proposed transect lines and would be characterized as an impulse sound source. While the single air-gun would only be activated during vessel turns and would generate impulse sounds similar to those generated by the full arrays, the sub-bottom profiler and echosounder would be in use during both transects and turns. These devices would generate a new sound pulse every second or fraction of a second and would therefore be considered continuous sound sources.

Adverse Impacts of Underwater Sound on Marine Mammals

As noted by Wood et al. (2012), anthropogenic noise may adversely affect marine mammals in a variety of ways:

2.1 Noise overview

Both solitary and social mammals rely on communication and sensing of their environment for various important life functions (reproduction, foraging, etc.). This communication and environmental sensing utilizes a number of production and sensory organs. However, a

species' ability to utilize different modalities depends on physical limitations imposed by the environment in which that species communicates. Water is relatively opaque to light and chemicals diffuse slowly. This has placed a selective pressure on marine mammals that has resulted in a heavy reliance on sound to sense and communicate within their environment. Because of this, an increase of acoustic noise in the marine environment can have potentially serious implications for the basic life functions of marine mammals.

The oceans are noisy environments. Sources of noise include wind, waves, rain and earthquakes (abiotic noise sources) as well as shrimp, fish and marine mammals (biotic noise sources). However, over the last two decades, concern has been mounting over the noises that human activity generates (anthropogenic noise). This noise is either generated as a byproduct of an activity (shipping, construction, etc.) or used as a method of gathering data (sonar, depth sounding, seismic surveys).

The impact this anthropogenic noise has on marine mammals varies a great deal depending on a variety of biological and environmental factors, from no effect to potentially lethal. A large amount of research over the last two decades has attempted to quantify these effects. There are a number of reviews on this subject (Richardson et al. 1995; Southall et al. 2007; Nowacek et al. 2007; Gotz et al. 2009), which we briefly review, then focus specifically on reported effects from seismic surveys, especially the more recent and relevant scientific studies ...

2.3 Types of noise effects

Sound is limited in duration by the time over which the source produces it. To be detected by an animal at sufficient levels to induce an impact, the receiver must be within sufficient proximity to the source. In other words, the animal must be within sufficient range at the time the sound is being produced, for the sound to have an impact on it. In addition, the amplitude, duration and frequency of the noise, as well as the hearing ability and behavioral state of the animal, all influence how or if there is an impact on the animal. Impacts (if any) range from acoustic masking to disturbance, temporary hearing loss, permanent hearing loss, and other physiological effects, including stranding and/or death. Evidence has been mounting that acoustic impacts are occurring at all these levels in marine mammals. For example, killer whales increase the amplitude of their calls to avoid masking by boat noise (Holt et al. 2009), commercial shipping may dramatically increase

calls of con-specific baleen whales (Clark et al. 2009), migrating gray whales change

direction to avoid noise from seismic surveys (Malme et al. 1984) and temporary hearing loss has been demonstrated in a captive bottlenose dolphin (e.g., Mooney et al. 2009a). Of higher concern, there have been a number of strandings of beaked whales in areas where naval sonar exercises have recently occurred. There is uncertainty about the mechanism of injury (whether the injuries were caused by high levels of sonar or by a behavioral reaction of the animals to the sonar at levels below those which would cause direct tissue damage),

but strong evidence exists that beaked whale species are at risk from naval sonar in some circumstances (Cox et al. 2006; D'Amico et al. 2009).

In spite of this mounting evidence, there are still large data gaps and uncertainty. For example masking can be tested directly in captive species (e.g., Erbe 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation (see masking section below). Likewise in studies of hearing loss, tests can be done in captivity and models applied to estimate this impact in the wild. All of these impact models rely on three main inputs; the propagation of the noise, the hearing abilities of that species, and the behavioral reaction of that species to the noise. All of these inputs are complex and require a number of other additional inputs themselves. Modeling noise propagation has benefited from concerted efforts over many years, but can vary a great deal with local bathymetry and local oceanographic conditions, such that noise is not always lower in amplitude the further it has travelled (e.g., Madsen et al. 2006a). A number of propagation models are however available (Range Dependent Acoustic Models (RAM), ray tracing, normal modes, parabolic equations, wave number integration) that do well at approximating in situ noise propagation. These predictions can and should be verified with tests on site (as has been proposed for this study) and can vary a great deal by distance, depth and frequency.

Hearing in marine mammals is multifaceted and much more complicated than just understanding the hearing sensitivity across frequency (auditory curve)... Many of these variables can only be tested accurately in captive animals, but it is costly, time consuming and limited to certain marine mammal groups given logistical considerations (e.g., the lack of a sufficient facility to house and test the hearing of a large whale). Due to this fact, while

the hearing abilities of over 20 species have been tested so far, only a few species (3-4) and

a few individuals have been tested comprehensively. Therefore most of these variables have not been tested directly in most species of marine mammals, and little to nothing is known about the individual variation of these variables within a species. Likewise behavioral reactions are easier to quantify in captivity, but suffer from small sample size and difficulty in extrapolating these measurements to wild populations. Meanwhile behavioral reactions in wild populations are difficult to quantify (especially if the reaction is subtle), are logically challenging, and can vary a great deal depending on a number of factors (see behavioral reaction section below). This leads to a situation where our ability to predict acoustic impacts is impaired by our lack of appropriate input parameters and lack of understanding of the variability in those parameters.

As noted above, impacts of anthropogenic noise on marine mammals can result in masking, behavioral disturbance, temporary hearing loss, permanent hearing loss, and other physiological effects, including stranding and/or death. The draft Incidental Harassment Authorization developed by the National Marine Fisheries Service provides the following description of these impacts:

Masking - The term masking refers to the inability of a subject to recognize the occurrence of an acoustic stimulus as a result of the interference of another acoustic stimulus (Clark et al., 2009). Introduced underwater sound may, through masking, reduce the effective communication distance of a marine mammal species if the frequency of the source is close to that used as a signal by the marine mammal, and if the anthropogenic sound is present for a significant fraction of the time (Richardson et al., 1995).

...
Behavioral Disturbance - Marine mammals may behaviorally react to sound when exposed to anthropogenic noise. Disturbance includes a variety of effects, including subtle to conspicuous changes in behavior, movement, and displacement. Reactions to sound, if any, depend on species, state of maturity, experience, current activity, reproductive state, time of day, and many other factors (Richardson et al., 1995; Wartzok et al., 2004; Southall et al., 2007; Weilgart, 2007). These behavioral reactions are often shown as: changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where noise sources are located; and/or flight responses (e.g., pinnipeds flushing into the water from haul-outs or rookeries). If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (e.g., Lusseau and Bejder, 2007; Weilgart, 2007).

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be expected to be biologically significant if the change affects growth, survival, and/or reproduction...

...
Hearing Impairment and Other Physical Effects - Exposure to high intensity sound for a sufficient duration may result in auditory effects such as a noise-induced threshold shift - an increase in the auditory threshold after exposure to noise (Finneran, Carder, Schlundt, and Ridgway, 2005). Factors that influence the amount of threshold shift include the amplitude, duration, frequency content, temporal pattern, and energy distribution of noise exposure. The magnitude of hearing threshold shift normally decreases over time following cessation of the noise exposure. The amount of threshold shift just after exposure is called the initial threshold shift. If the threshold shift eventually returns to zero (i.e., the threshold returns to the pre-exposure value), it is called temporary threshold shift (TTS) (Southall et al., 2007).

Researchers have studied TTS in certain captive odontocetes and pinnipeds exposed to strong sounds (reviewed in Southall et al., 2007). However, there has been no specific documentation of TTS let alone permanent hearing damage, i.e., permanent threshold shift (PTS), in free-ranging marine mammals exposed to sequences of air gun pulses during realistic field conditions.

Temporary Threshold Shift - TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises and a sound must be stronger in order to be heard. At least in terrestrial mammals, TTS can last from minutes or hours to (in cases of strong TTS) days. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the noise ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals, and none of the published data concern TTS elicited by exposure to multiple pulses of sound.

...
Permanent Threshold Shift - When PTS occurs, there is physical damage to the sound receptors in the ear. In severe cases, there can be total or partial deafness, whereas in other cases, the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985). There is no specific evidence that exposure to pulses of air gun sound can cause PTS in any marine mammal, even with large arrays of air guns. However, given the possibility that mammals close to an air gun array might incur at least mild TTS, there has been further speculation about the possibility that some individuals occurring very close to air guns might incur PTS (e.g., Richardson et al., 1995, p. 372ff; Gedamke et al., 2008). Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage, but repeated or (in some cases) single exposures to a level well above that causing TTS onset might elicit PTS.

...
Stranding and Mortality – When a living or dead marine mammal swims or floats onto shore and becomes “beached” or incapable of returning to sea, the event is termed a “stranding” (Geraci et al., 1999; Perrin and Geraci, 2002; Geraci and Lounsbury, 2005; NMFS, 2007)... Marine mammals are known to strand for a variety of reasons, such as infectious agents, biotoxidosis, starvation, fishery interaction, ship strike, unusual oceanographic or weather events, sound exposure, or combinations of these stressors sustained concurrently or in series. However, the cause or causes of most strandings are unknown (Geraci et al., 1976; Eaton, 1979; Odell et al., 1980; Best, 1982).

Appendix D

Marine Mammal Mitigation Measures

PG&E:

One element of the project is PG&E's development and proposed implementation of a Marine Wildlife Contingency Plan (MWCP) that includes measures designed to reduce the potential impacts on marine wildlife during project operations. This MWCP would be implemented in compliance with measures developed in consultation with NMFS. The vessel-based operations of the PG&E MWCP were designed to meet the anticipated requirements of Incidental Harassment Authorization and Letter of Authorization permits that PG&E will need from the NMFS and USFWS, respectively, and to meet any other stipulation agreements between PG&E and other permitting agencies.

PG&E shall implement the following additional measures during the project to provide worker awareness of biological resources, to identify any significant biological resources present in the work areas, and to modify project activities in order to reduce or avoid impacts to significant biological resources, if present:

APM-1 Survey Timing. To be less disruptive to migrating and summer season whales, the survey shall be timed to occur during the months of September through December.

APM-2 Establishment of Safety Zone and Exclusion Zone. PG&E used acoustic models to predict sound levels associated with the air gun array, and this information was used to establish both a Safety Zone (the distance from the air gun array at which noise levels are >160 dB re 1 μ Pa) and an Exclusion Zone (the distance from the air gun array at which noise levels are >180 dB re 1 μ Pa) in marine waters around the air guns. The survey vessel shall avoid the presence of sensitive marine wildlife (marine mammals and turtles) within the Exclusion Zone to the maximum extent feasible.

APM-3 Real-Time Sound Measurements/Exclusion Zone Adjustments. An acoustics contractor shall perform real-time, direct underwater sound measurements during air gun deployment; these data shall be used to verify and adjust the Exclusion Zone distances, as needed.

APM-4 Use of Ramp-Up Process. To warn marine wildlife in the vicinity of the air guns and provide time for them to leave the area and avoid potential injury or hearing impairment, at the start of air gun operations (after a period of no operation), the seismic operator shall start off with low sound levels and gradually increase them (ramp up).

APM-5 Air gun Operation During Turns and Transects. During turns or brief transits between seismic transects, the seismic operator shall continue firing a single air gun to avoid periods of silence when marine wildlife could otherwise attempt to migrate into the Exclusion Zone.

APM-6 Aerial Surveys to Identify Presence of Marine Mammals. PG&E shall conduct aerial surveys as follows: (1) Approximately 1 week5 days prior to seismic survey to obtain pre-survey information on the numbers and distribution of marine mammals in the seismic survey area; (2)

During initial stages of seismic survey to document changes in the behavior and distribution of marine mammals in the area during seismic operations. If needed, aerial surveys shall be extended for a longer period of the seismic surveying; and (3) One week prior to completion of seismic survey to document whether detectable changes in numbers and distribution of marine mammals have occurred in response to the seismic operations.

APM-7 Use of Marine Mammal Monitors During Surveys. Qualified Marine Mammal Observers (MMOs) shall be onboard the primary seismic vessel whenever the air guns are firing during daylight, and during the 30-minute periods prior to ramp-ups, as well as during ramp-ups. Their role shall be to watch for and identify marine mammals; record their numbers, distances, and reactions to the survey operations; and document observations.

A scout vessel with qualified MMOs shall traverse the Exclusion Zone to monitor marine wildlife within the survey area and report to primary vessel operator if any animals are observed.

If marine mammals or other sensitive wildlife are observed within or about to enter the Exclusion Zone around the survey activities, the speed of the vessel shall be adjusted to avoid entry of the marine mammal into the Exclusion Zone. If the mammal still appears likely to enter the Exclusion Zone, further mitigation actions shall be taken, including reducing the number and volume of air guns firing, or complete air gun shutdown.

APM-8 Use of Passive Acoustic Monitoring. Passive Acoustic Monitoring (PAM) shall be available to supplement visual monitoring in conditions of poor visibility or low lighting. When a vocalization is detected while visual observations are in progress, the acoustic MMO will contact the visual MMO immediately, to alert him/her to the presence of cetaceans (if they have not already been seen), and, if necessary, to allow a power down or shutdown to be initiated.

Project EIR:

MM MARINEBIO-12a Expand Pre-Survey to 8.6 Miles (14 Kilometers) and Perform 10 Days in Advance of Survey. Pacific Gas & Electric Company (PG&E) shall conduct a pre-survey of the Project area and vicinity to 8.6 miles (14 kilometers) (twice the maximum 160-decibel re 1 μPa root mean square isopleth) for mysticetes (baleen whales), approximately 10 days prior to the start of the survey to allow for analysis of data obtained during the pre-survey and to make adjustments to the survey schedule as needed. For this mitigation measure, PG&E shall conduct a sighting survey to specifically assess and record mysticete density and the location of all major marine mammal concentrations. Based on the results of the pre-survey, PG&E shall develop an approach for the seismic survey to reduce potential impacts to marine mammals, such as proceeding with the survey Zone with the lowest mammal density or delaying the survey until non-critical densities of marine mammals are detected.

Survey Approach:

- Use protocols established for aerial surveys by the National Atmospheric and Oceanic Administration (NOAA, e.g., Forney et al. 1995), with line spacing of the aerial surveys

modified to maximize coverage in the pre-survey area. Surveys shall only be carried out in suitable conditions (e.g., Beaufort 4 and below, good visibility).

Analysis of Pre-survey Data:

- Assess mysticete densities in the pre-survey area in comparison to Environmental Impact Report assumptions and thresholds. The following densities correspond to high magnitude Level B take estimates for Endangered Species Act (ESA) listed baleen whales:

<u>ESA-Listed Mysticete Species</u>	<u>Density Threshold Predicted to Result in High Magnitude Intensity Rating (per km²)</u>	<u>Number of Animals within Estimated Aerial Survey Area of 3,074 km²</u>
Fin Whale	0.0073	23
Blue Whale	0.0063	19
Humpback Whale	0.0053	16

Assumptions:

1. Densities correspond to 2.5 percent threshold for probabilistic Level B noise disturbance over duration of Project.
2. Pre-survey aerial survey area based on 14-kilometer buffer proposed in this mitigation.

- Identify locations of sightings of porpoise and large concentrations of mammals.

Actions:

- Report pre-survey findings to the California State Lands Commission and the National Marine Fisheries Service as soon as feasible, but at least two days prior to beginning the survey.
- If the density of animals in the aerial survey area exceed the values noted above PG&E shall consult with the California State Lands Commission and the National Marine Fisheries Service about potential strategies to avoid conducting the survey in areas with higher concentrations of these mysticete species.
- Prioritize survey areas to avoid large concentrations of mysticetes and harbor porpoise.

MM MARINEBIO-12b Extend Aerial Surveys Throughout Survey Period. Pacific Gas & Electric Company shall conduct aerial surveys of the Project area 25 and vicinity one week prior to initiating survey activities in each survey zone. The 26 aerial surveys shall cover the area out to approximately 8.6 miles (14 kilometers), 27 twice the maximum 160-decibel re 1 μ Pa root mean square isopleth for mysticetes, 28 to determine whether large concentrations of mysticetes were occurring within the 29 larger ensonified area or other zones to be surveyed. High concentrations would 30 lead to survey operation modifications as per MM MARINEBIO-12a.

MM MARINEBIO-12c Avoidance of Pinniped Haul-Outs. Pacific Gas & Electric Company shall establish a flight plan for the aerial surveys that includes plans to avoid local pinniped haul-outs or to maintain sufficient altitude (greater than 500 feet [152 meters] above sea level) when passing local pinniped haul-outs.

MM MARINEBIO-12d Required Marine Mammal Observer Qualifications, Use of Equipment and Procedures to Enhance Detection Rates, and Performance of Nighttime Monitoring. This

mitigation measure expands upon the monitoring activities identified under APM-7. The Marine Mammal Observers (MMOs) used for the Project shall be independent and demonstrated to have had considerable experience sighting local species and using Passive Acoustic Monitoring. Appropriate equipment/procedures shall be used to improve daytime detection rates (including big-eye binoculars, sufficient numbers of MMOs, and required rest periods). Monitoring shall be performed during the nighttime using Passive Acoustic Monitoring that may be supplemented by equipment to enhance night detection rates (including advanced infrared equipment, sodium lighting, and/or millimeter waves radar). There shall be a minimum of three MMOs assigned to each vessel (survey vessel and two scout boats), with two MMOs on watch at a time. The third would rest and then rotate with other MMOs to enhance vigilance during watch times.

MM MARINEBIO-12e Increase Size of Exclusion Zone During Surveys. Pacific Gas & Electric Company shall increase the size of the Exclusion Zone for the full air gun array to 1.1 nautical miles (2 kilometers) for baleen whales (mysticetes), whose hearing sensitivity overlaps the greatest with seismic air gun signals; sperm whales; and large groups of marine mammals (i.e., porpoises).

Responses to such observations shall be as described under APM-7 (reduce speed to avoid).

Exclusion Zones for array power-down and the single mitigation air gun shall be estimated from sound measurements conducted during air gun deployment (APM-3), and shall include real-time measurements over at least one area of rocky seabed. PG&E shall submit results of the real-time measurements and recommended power-down and mitigation gun Exclusion Zones based on the real-time measurements. This information shall be submitted to the California State Lands Commission and National Marine Fisheries Service for review and approval prior to the survey.

MM MARINEBIO-12f Monitoring Using Two Scout Boats with Marine Mammal Observers During Surveys. A total of two scout boats with MMOs shall be used to increase detection rates within the Exclusion Zone. These boats shall maintain a distance of half the Exclusion Zone on either side of the survey vessel. While surveying near shore, these scout boats shall remain outside of surface kelp area to avoid additional otter disturbance.

MM MARINEBIO-12g Perform Track Lines with Highest Mammal Densities During Daylight Hours. To the extent feasible, Pacific Gas & Electric Company shall perform the inshore tracks of the seismic survey to coincide with daylight hours. In addition, Pacific Gas & Electric Company shall conduct surveys near Church Rock (North 35° 20.675 West 120° 59.049) during daylight hours to the extent possible.

MM MARINEBIO-12h Increase Pre-Ramp-Up Scan Period. As a modification to APM-4, Pacific Gas & Electric Company shall increase the pre-ramp-up scan period to 45 minutes, especially in poor sighting conditions. Some species have long dive times and only spend short periods of time at the surface between dives. Other species are hard to spot at long range or in poor conditions. Increasing the pre-ramp-up scan period will increase the chance of sighting

these individuals. Also, Pacific Gas & Electric Company shall increase the time for observation in the Exclusion Zone following power-down or shutdown.

MM MARINEBIO-12i Adaptive Management in Case of Multiple Shutdowns. If more than three shutdowns occur for mysticete whales observed in the Exclusion Zone, PG&E shall initiate an immediate project review in consultation with the California State Lands Commission and the National Marine Fisheries Service to assess the safety of Project area conditions. The two agencies shall be notified within 24 hours of the fourth consecutive shutdown. Aerial survey data and observations noted by the Marine Mammal Observers shall be provided to the noted agencies for review and consideration of potential refinements required in mitigation strategy. The survey activity may proceed while the agencies assess the situation, unless otherwise directed by the California State Lands Commission.

MM MARINEBIO-12j Contingency for Sighting of North Pacific Right Whale. PG&E shall shut down air guns if a North Pacific right whale is sighted at any distance from the survey vessel.

NMFS Proposed IHA:

Because of heightened concern over impacts from seismic operations to harbor porpoises from the proposed action, NMFS coordinated closely with PG&E to develop a comprehensive and precautionary monitoring, mitigation, and adaptive management framework. This plan, which PG&E has agreed to operationally and financially support, is designed to detect significant responses of harbor porpoises to the activity that can be used to trigger management actions in real-time and allow the activity to proceed in a cautious manner in light of some uncertainty regarding how this species will respond to the activity. Additional measures include:

- Implementation of an extended initial ramp-up (around the length of time it takes to run the first transect of the aerial survey) at the beginning of each of the two survey boxes.
- Ensuring that air gun operations for each survey box begin in the daylight.

Data collected during pre-activity survey operations and on-going operational monitoring activities will be used during the proposed seismic operations to adjust or redirect seismic operations should significant adverse impacts be observed to marine mammals in the proposed project area. The Adaptive Management Plan will be finalized in consultation with resource agencies involved in the permitting and monitoring activities associated with the proposed 2012 seismic operations. Information sources used as part of this plan will include, but not be limited to the following:

- Pre-activity and weekly aerial surveys (see Appendix G of the IHA application);
- Sound source verification study;
- Visual monitoring by PSOs onboard vessels;
- NMFS Morro Bay stock of Harbor Porpoise Monitoring Program (see Appendix D of the IHA application), which will use aerial surveys, C-PODS (passive acoustic devices tuned to detect high frequency harbor porpoise vocalizations), and moored hydrophones (tuned to

identify received levels of seismic signals) to detect broader scale harbor porpoise responses to seismic surveys; and

- Marine Mammal Stranding Response Plan (see Appendix F of the IHA application), which will utilize response personnel and necessary equipment to monitor the action area for behaviors suggestive of stranding responses, and subsequently run appropriate tests if an event occurs.

USFWS Proposed IHA:

As described in the USFWS September 26, 2012 proposed IHA for the project, in response to concerns about potential adverse impacts to southern sea otters:

[PG&E] would be required to conduct monitoring of southern sea otters during the seismic surveys in order to implement the mitigation measures that require real-time monitoring and to satisfy monitoring required under the MMPA. Project personnel would be required to record information regarding location and behavior of all sea otters observed during operations. When conditions permitted, information regarding age (pup, independent) and tag color and position (for flipper-tagged animals) would also be required to be recorded.

In addition, USFWS notes in the proposed IHA that due to the lack of scientific understanding and research regarding the response of southern sea otters to high levels of underwater sound:

[USFWS] has recommended that PG&E and LDEO use the survey as an opportunity to investigate the potential effects of air guns on sea otters. PG&E and LDEO have agreed to address this request by arranging, with input from the Service, for the design and implementation of an ancillary scientific study during and after the survey and subsequent analysis. The study would be conducted by researchers with the appropriate scientific expertise and permits (USGS, Biological Resources Division, in cooperation with the California Department of Fish and Game and other research partners). The Sea Otter Monitoring Program is described in Appendix E to the revised IHA application.

Further, PG&E would also be required to carry out both an aerial and vessel-based monitoring program before and during survey activities and to report the results of these monitoring efforts to USFWS. The vessel-based monitoring effort would also be directed to record the presence of sea otters within the “exclusion zone” around the survey operation. As noted in the proposed IHA, “if a southern sea otter were seen within the exclusion zone, the geophysical crew would be notified immediately so that the mitigation measures called for in the applicable authorization(s) could be implemented.”

Appendix E Timeline

2006 - AB 1632 signed by Governor Schwarzenegger, requires the California Energy Commission (CEC) to carry out a “compilation and assessment of *existing scientific studies* that have been performed by persons or entities with expertise and qualifications in the subject of the studies to determine the potential vulnerability to a major disruption due to aging or a major seismic event of large baseload generation facilities, of 1,700 megawatts or greater.” (emphasis added)

2007 – In response to AB 1632, the California Public Utilities Commission issues Decision 07-03-044 which establishes that “PG&E shall incorporate the CEC’s AB 1632 assessment into its license renewal study” and requires “PG&E to submit by no later than June 30, 2011, an application on whether to pursue license renewal. The application shall include PG&E’s license renewal study and shall address (1) whether renewal of the licenses is cost effective and in the best interests of PG&E’s ratepayers, (2) the CEC’s AB 1632 assessment, and (3) any legislative framework that may be established for reviewing the costs and benefits of license renewal.”

2008 - The U.S. Geological Survey, on a project funded by PG&E, discovers a zone of seismicity indicating the presence of a previously undiscovered fault zone (since named “Shoreline”) located roughly 0.6 mile offshore of the DCPP. Also in 2008, the CEC responds to the requirements of AB 1632 with the issuance of its evaluation, titled, *An Assessment of California’s Nuclear Power Plants: AB 1632 Report* (AB 1632 Report). This report describes the severe consequences to the State’s electrical capacity if DCPP were lost due to a natural disaster and the uncertainties regarding the seismic hazards in the vicinity of the plant. The AB 1632 Report also includes a variety of recommendations, including that PG&E use “3D geophysical seismic reflection mapping and other advanced techniques” to supplement previous and ongoing seismic research programs at DCPP.

2009 – In response to PG&E’s contention that seismic studies and other AB 1632 recommended studies do not need to be included as part of its license extension studies for the CPUC, CPUC President Peevey issues a letter to PG&E directing it to “report on the major findings and conclusions from Diablo Canyon’s sesicmic/tsunami studies, as recommended in the AB 1632 Report (pp. 6, 7, 10, and 13)... and report on the implications of these findings and conclusions for the long-term seismic vulnerability and reliability of the plant.”

In addition, on December 29, 2009, Coastal Commission staff sent a letter to PG&E in response to its submittal of a Consistency Certification for the Nuclear Regulatory Commission License Renewal for Diablo Canyon Power Plant. This letter requested that PG&E “Additionally, and as recommended by the Technical Advisory Team established pursuant to AB 1632, please provide the three-dimensional seismic data should [it] be collected and interpreted as part of this evaluation.” This letter did not specify whether this 3D seismic data should be collected onshore, offshore, or both.

2010 - The CPUC issues Decision 10-08-003 which establishes an Independent Peer Review Panel (IPRP) to conduct a peer review of the seismic study plans PG&E developed in response to

the AB 1632 Report recommendation and CPUC requirement that PG&E carry out “three-dimensional geophysical seismic reflection mapping and other advanced techniques to explore fault zones near Diablo Canyon.” In addition to reviewing PG&E’s proposed research questions and survey targets, the IPRP would also review the results of the study, if implemented. The IPRP includes geologists and technical staff from the CPUC, CEC, California Seismic Safety Commission, California Emergency Management Agency, California Coastal Commission, and County of San Luis Obispo with contract support from the California Geological Survey.

In addition, Decision 10-08-003 clarifies that:

PG&E’s ability to proceed with the off-shore studies is conditioned upon obtaining all required permits for the project, including permits from the State Lands Commission and the California Coastal Commission. The permitting process has the potential to delay the anticipated schedule for completion and increase the costs of performing the seismic surveys and studies. As discussed in section IV below, PG&E requests authority to recover its actual costs of conducting the surveys, including any increase in costs associated with the permitting process, including the costs of delay. In addition, it is possible that permits necessary to implement the additional seismic surveys and studies may not be granted at all. In such an event, PG&E would refund to customers any unspent funds collected in rates. The LTSP would continue in effect and fully satisfy NRC regulatory requirements and ensure Diablo Canyon’s safe operation.

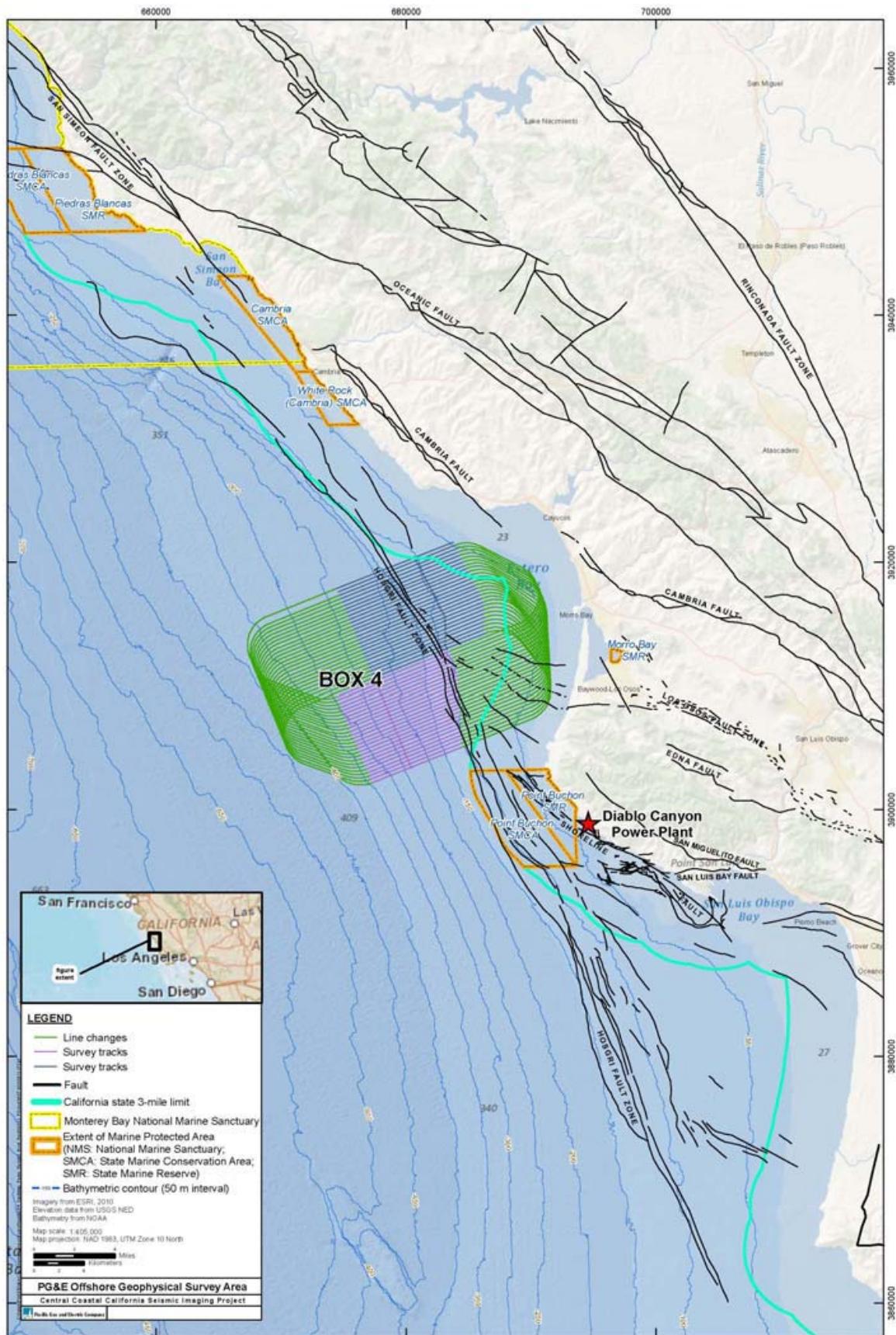
2011 - In March, Japan’s Fukushima Dai-ichi nuclear power plant is destroyed following the Tōhoku earthquake and tsunami. In April, PG&E submits a Geophysical Survey Permit application for the project to the State Lands Commission (received May 2011). The State Lands Commission begins preparation of an Environmental Impact Report (EIR) for the project as required by the California Environmental Quality Act.

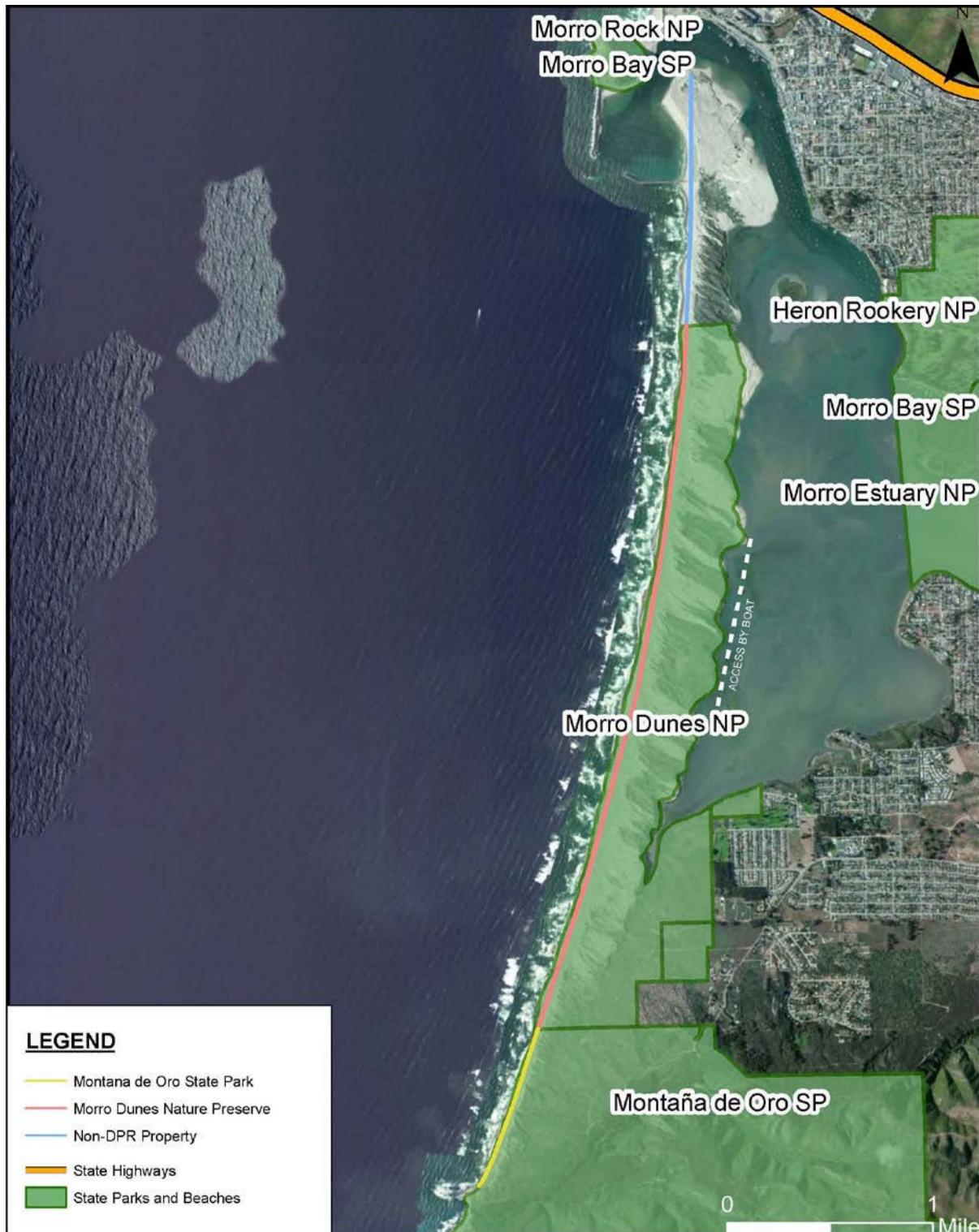
2012 - In March, the Nuclear Regulatory Commission (NRC) releases a request for information requiring PG&E and other reactor licensees in the nation to expeditiously re-evaluate the seismic, tsunami, flooding, and other external hazards at their facilities and submit a report to the NRC. This request is known as the “50.54(f) Letter” and is discussed further below.

In August, the California State Lands Commission certifies the Environmental Impact Report for the project and authorizes the issuance of a Geophysical Survey Permit to PG&E.

In September, the California Public Utilities Commission approves Decision 12-09-008, authorizing PG&E to use a total of \$64.25 million to design and implement a multi-faceted seismic study program at DCPP that would potentially include four primary techniques: (1) onshore 2D and 3D seismic mapping; (2) offshore 2D seismic mapping; (3) offshore 3D low-energy seismic mapping; and (4) offshore 3D high-energy seismic mapping.

E-12-005 and CC-027-12
 Pacific Gas and Electric Company







Feature	Description
Receiver Model	Fairfield Zland
Height	6 inches (15 cm)
Diameter	5 inches (13 cm)
Spike Length	5 inches (13 cm)
Weight	5 pounds (2.3 kg)

Source: PG&E 2011b.

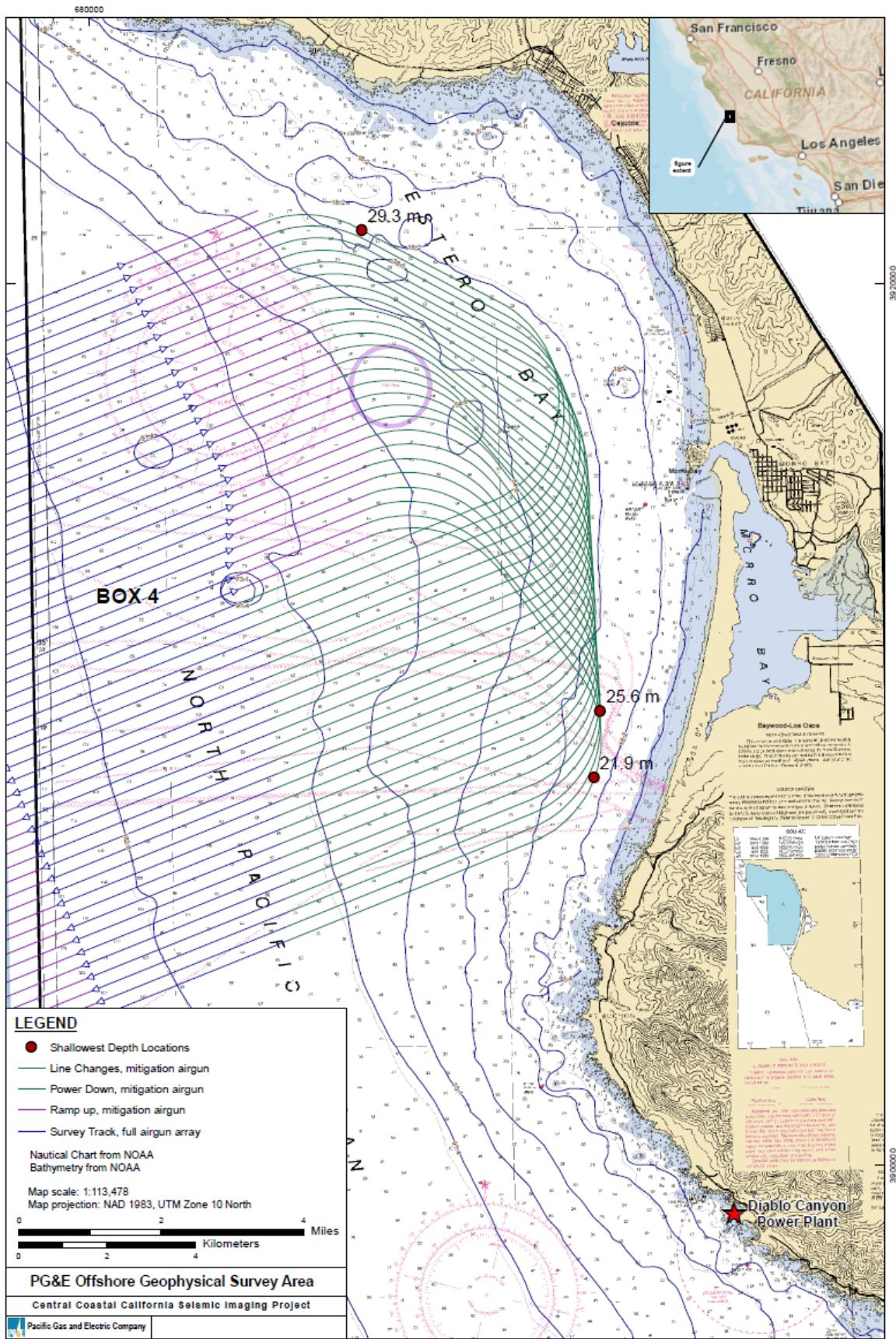


Figure 2.5-2 Langseth Hydrophone Towing Configuration

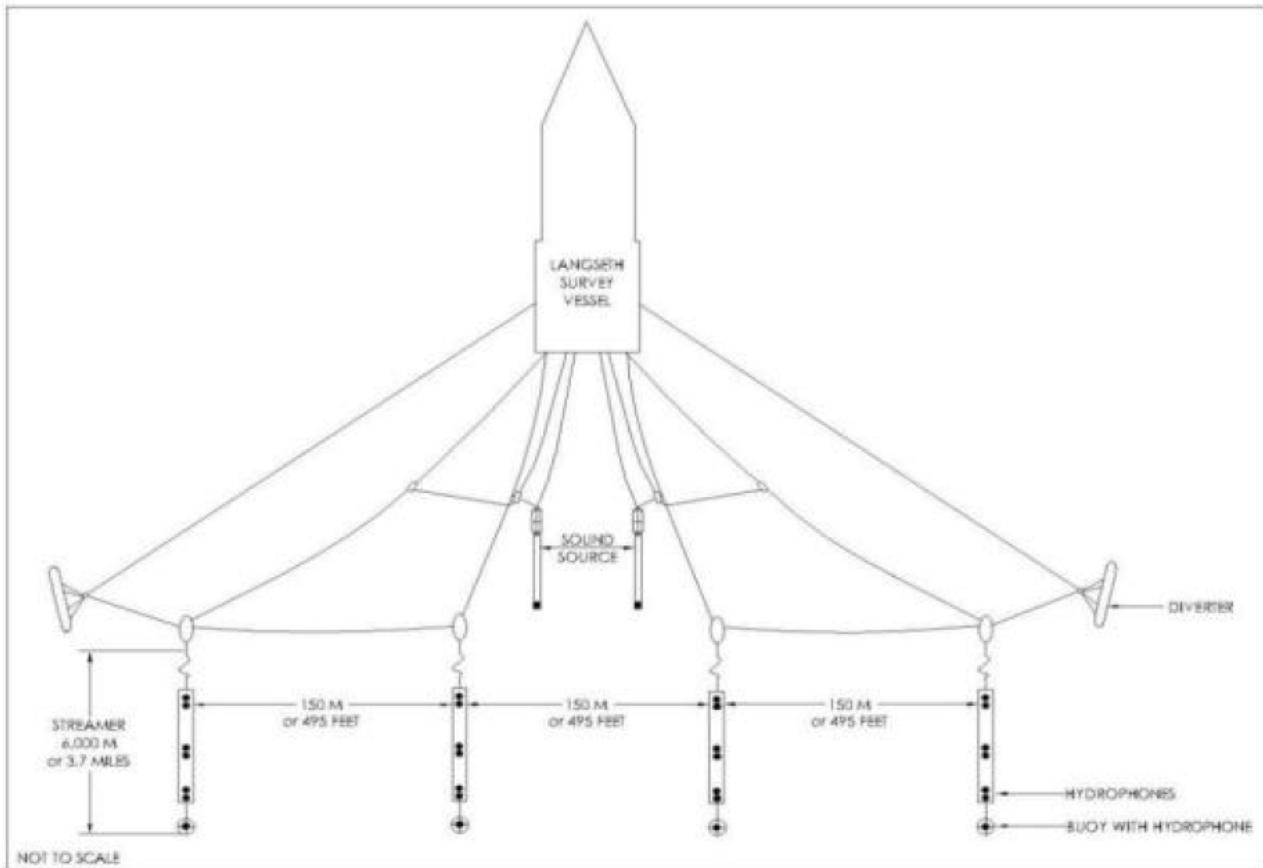


EXHIBIT 5
Air Gun
Array and
Streamer
Configuration

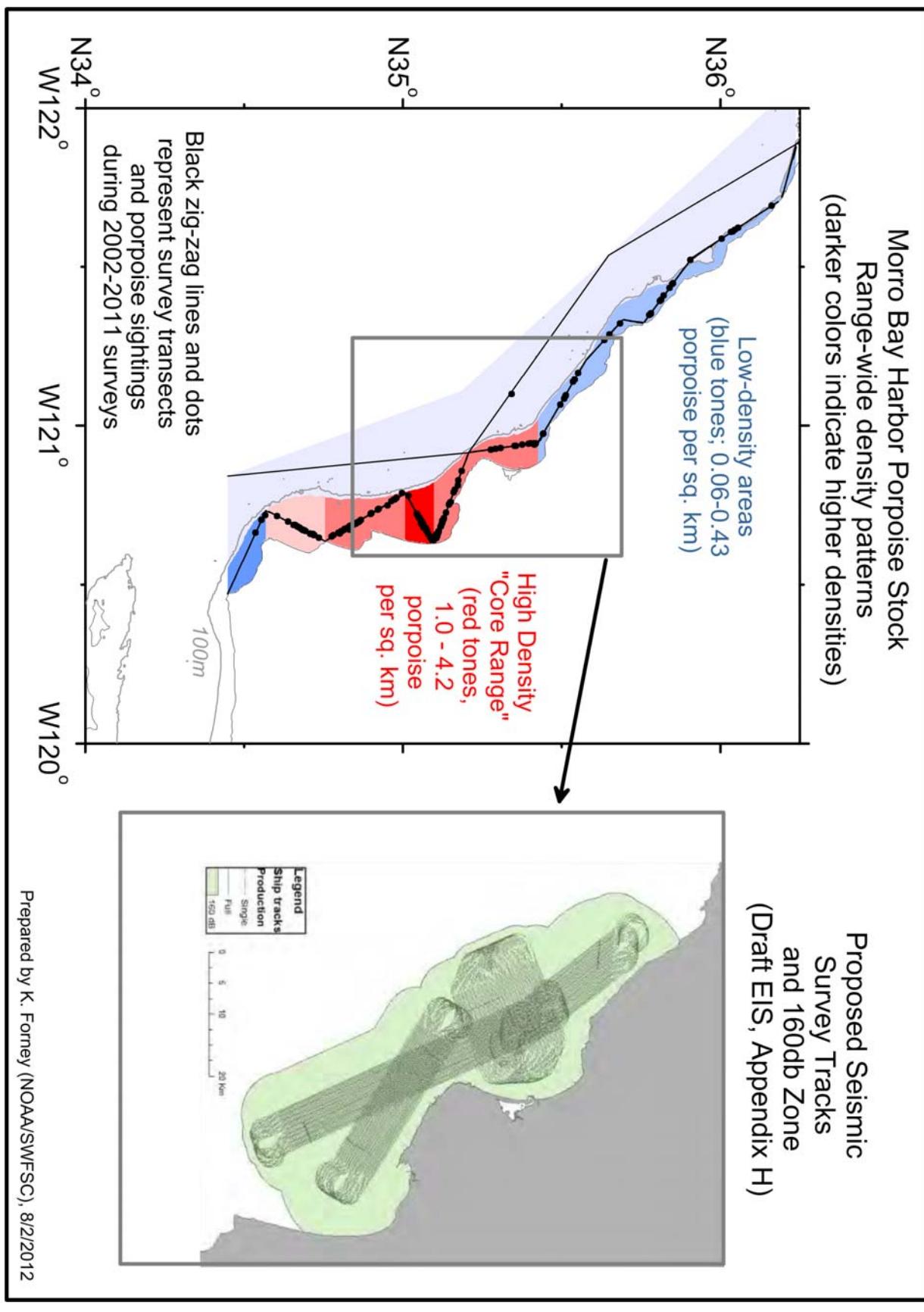


EXHIBIT 6
Morro Bay
Stock of
Harbor
Porpoise
Core Habitat

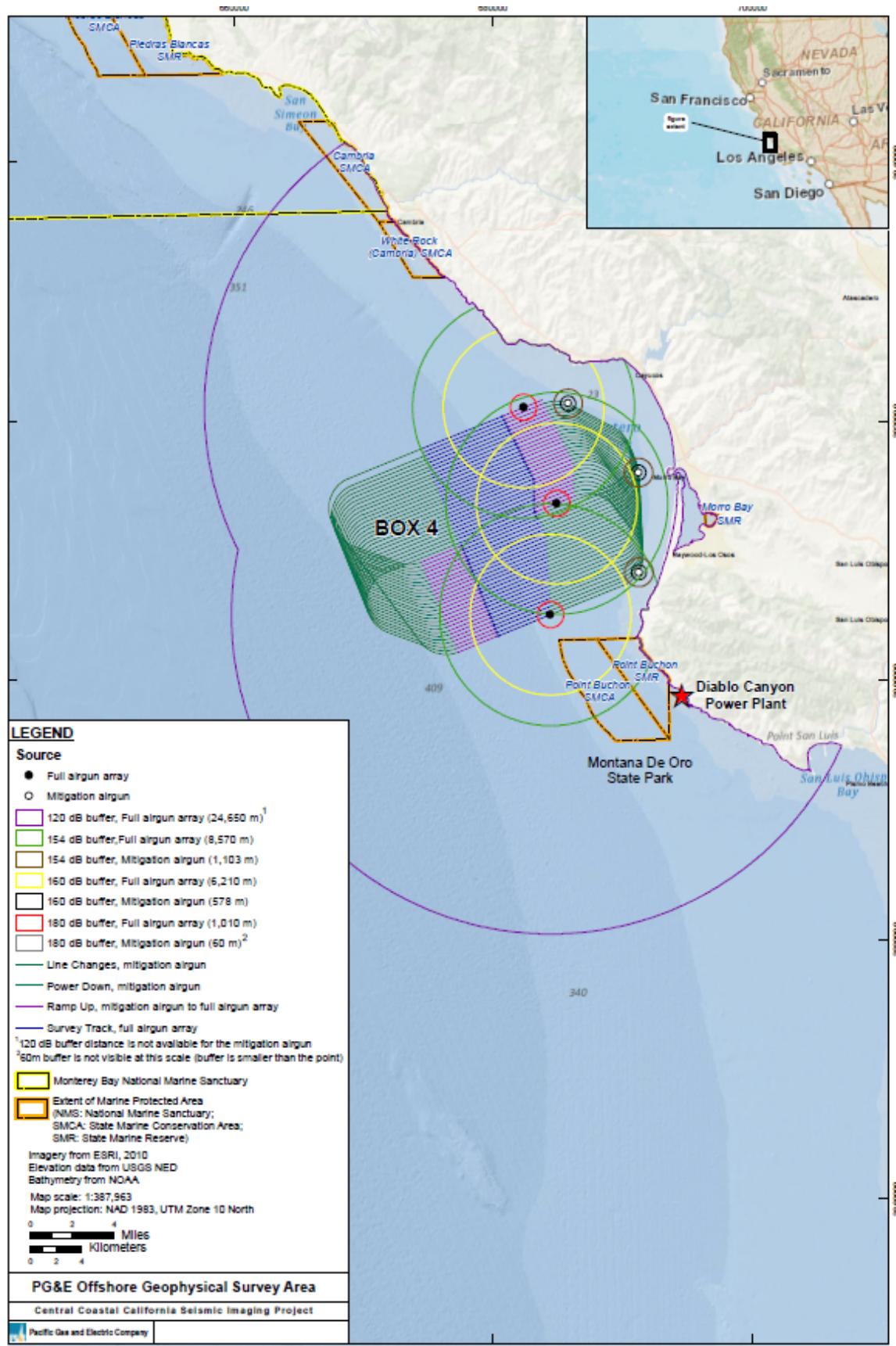
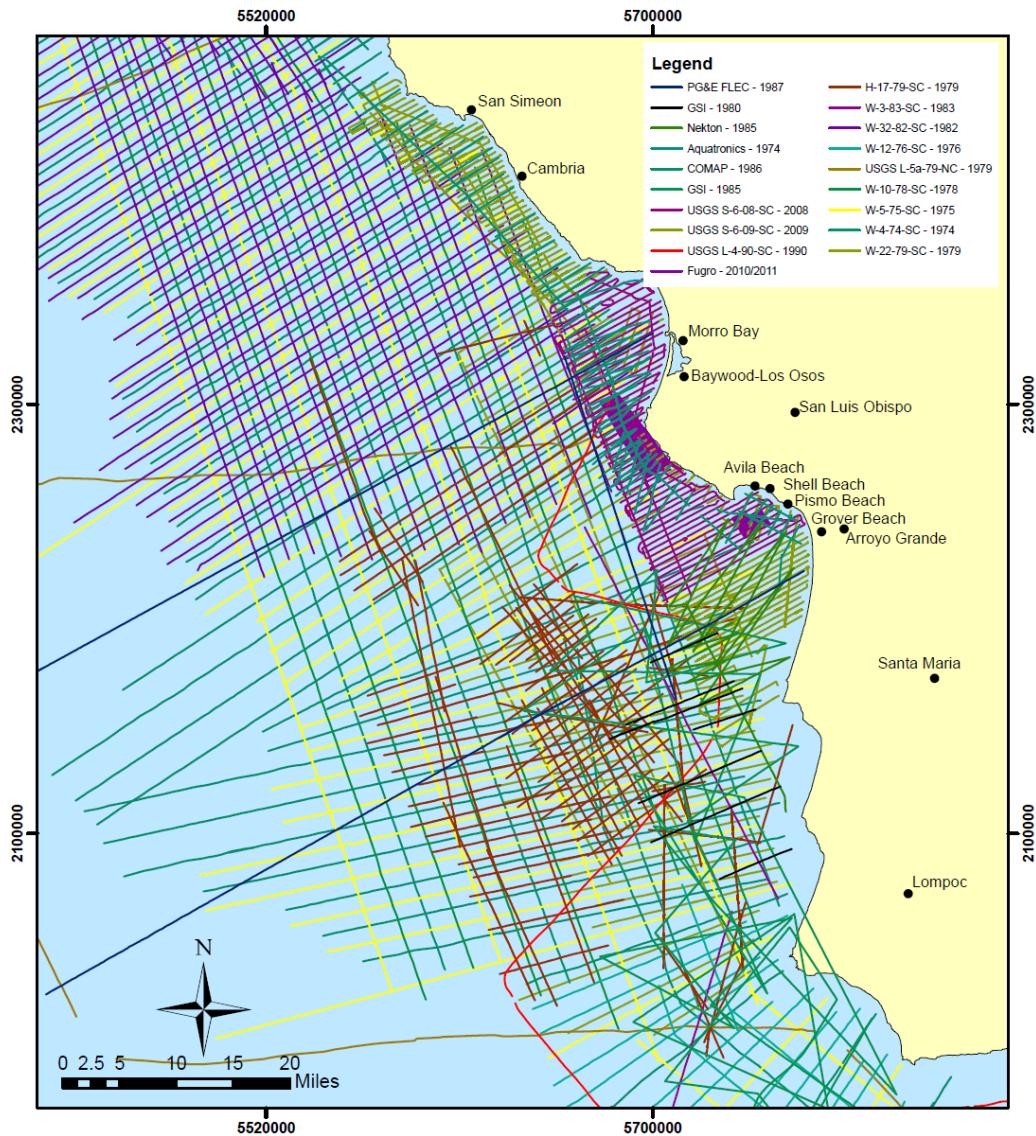


EXHIBIT 7a
Expected
Sound
Propagation
Distances



EXHIBIT 7b
Expected
Sound
Propagation
Distances

E-12-005 and CC-027-12
Pacific Gas and Electric Company



2D SEISMIC REFLECTION DATA LOCATION MAP
PG&E IHS Kingdom Legacy Archive Nuclear V&V Plan

Survey	Year Data Acquired	Survey Contractor	Sound Source	Record Length (two-way travel time)
W-4-74-SC	1974	Western Geophysical	Airgun	6.0 seconds
W-5-75-SC	1975	Western Geophysical	Airgun	6.0 seconds
W-12-76-SC	1976	Western Geophysical	Airgun	6.0 seconds
W-10-78-SC	1978	Western Geophysical	Airgun	6.0 seconds
W-22-79-SC	1979	Western Geophysical	Airgun	6.0 seconds
H-14-79-SC	1979	Chevron	Airgun	6.0 seconds
GSI-1980	1980	GSI	Airgun	3.0 seconds
W-32-82-SC	1982	Western Geophysical	Airgun	6.0 seconds
W-38-83-SC	1983	Western Geophysical	Airgun	6.0 seconds
Nek-1985	1985	Nekton	Airgun	3.5 seconds
GSI-1985	1985	GSI	Airgun	6.0 seconds
COMAP-1986	1986	COMAP Alaska	Airgun	2.0 seconds
FLEC	1987	Digicon	Airgun	10.0 seconds
L-4-90-SC	1990	USGS	Airgun	13.0 seconds
S-6-08-SC	2008	USGS	Sparker	0.5 seconds
S-6-09-SC	2009	USGS	Sparker	0.5 seconds
PG&E 3D Surveys	2010-2011	Fugro	Boomer	1.0 second

EXHIBIT 8
Previous
Seismic
Surveys