DRAFT
ENVIRONMENTAL IMPACT REPORT

Coast Seafoods Company
Humboldt Bay Shellfish Aquaculture
Permit Renewal and Expansion Project
Humboldt County, California

SCH #2015082051

OCTOBER 2015

Lead Agency:

Humboldt Bay Harbor, Recreation and Conservation District
601 Startare Drive
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Table of Contents

Section 4.0 Project Description

Section 5.0 Project Alternatives

Section 6.0 Environmental Analysis and Effects of Alternatives

List of Figures

List of Tables

Appendices

Section 1.0 Executive Summary

1.1 Introduction

This draft Environmental Impact Report (DEIR) addresses the environmental impacts associated with Coast Seafoods Company's (Coast) Humboldt Bay Shellfish Aquaculture: Permit Renewal and Expansion Project (Project or Preferred Alternative). The California Environmental Quality Act (CEQA) requires that local government agencies, prior to taking action on projects over which they have discretionary approval authority, consider the environmental consequences of such projects. An EIR is a public document designed to provide the public and government agency decision-makers with an analysis of potential environmental consequences to support informed decision-making. This environmental document focuses on those impacts determined to be potentially significant as discussed in the Final Initial Study (Final IS) completed for the Project (Appendix A).

This DEIR has been prepared pursuant to the requirements of CEQA (California Public Resources Code, Division 13, Section 21000, et seq.) and the State CEQA Guidelines (Title 14 of the California Code of Regulations, Division 6, Chapter 3, Section 15000, et seq.) to determine if approval of the discretionary actions requested and development of the Project could have significant impact on the environment. The Humboldt Bay Harbor, Recreation and Conservation District (Harbor District or District), as the CEQA Lead Agency, has reviewed and revised as necessary all submitted drafts, technical studies and reports to reflect its own independent judgment, including reliance on applicable technical personnel to review all technical subconsultant reports.

Information for this DEIR was obtained from on-site field observations; discussions with affected agencies; analysis of adopted plans and policies; review of available studies, reports, data and other similar literature in the public domain; specialized environmental assessments (e.g., biological resources, including avian resources and eelgrass habitat, Humboldt Bay Mariculture Carrying Capacity Analysis, and Eelgrass Monitoring Plan); and the Final IS. Environmental studies conducted specifically for the Project are included as appendices to this DEIR.

1.2 Environmental Procedures

This DEIR has been prepared pursuant to CEQA to assess the environmental effects associated with implementation of the Project. This document has six objectives under CEQA:

1. To disclose to decision makers and the public the significant environmental effects of the proposed projects;
2. To identify ways to avoid or reduce environmental damage;
3. To prevent environmental damage requiring implementation of feasible alternatives or mitigation measures;
4. To disclose to the public reasons for agency approval of projects with significant environmental effects;
5. To foster interagency coordination in the review of projects; and
6. To enhance public participation in the planning process.

An EIR is the most comprehensive form of environmental documentation identified in CEQA and the CEQA Guidelines provide the information needed to assess the environmental consequences of a proposed project, to the extent feasible. EIRs are intended to provide an objective, factually-supported, full-disclosure analysis of the environmental consequences associated with a proposed project that has the potential to result in significant, adverse environmental impacts.

An EIR is also one of various decision-making tools used by a lead agency to consider the merits and disadvantages of a project that is subject to its discretionary authority. Prior to approving a proposed project, the lead agency must consider the information contained in the EIR, determine whether the EIR was properly prepared in accordance with CEQA and the CEQA Guidelines, determine that it reflects the independent judgment of the lead agency, adopt findings concerning the project's significant environmental impacts and alternatives, and must adopt a Statement of Overriding Considerations if the proposed project would result in significant impacts that cannot be avoided.

This DEIR has been formatted as described below.

Section 1. Executive Summary: Summarizes the background and description of the Project, the format of the DEIR, project alternatives, and the potential environmental impacts and mitigation measures identified for the Project. It also includes a discussion of critical issues remaining to be resolved and areas of controversy.

Section 2. Introduction: Describes the background of the DEIR, background on the Project, the NOP and Final IS, certification of the DEIR, and mitigation monitoring requirements.

Section 3. Environmental Setting: Provides a detailed description of the Project area and location and regional environmental setting as they existed at the time the Notice of Preparation was published.

Section 4. Project Description: Detailed descriptions of Coast's existing aquaculture operations, the Project and its objectives, and the Project area and location. Also includes the necessary regulatory approvals for the Project.

Section 5. Project Alternatives: Provides a discussion of alternatives considered and rejected during Project planning and describes the four alternatives selected for further analysis in this DEIR.

Section 6. Environmental Analysis and Effects of the Alternatives: Analyzes the potential environmental impacts for each environmental parameter analyzed and, for each, provides: a description of existing conditions, pertinent laws and regulations, the thresholds used to determine significance, potential adverse and beneficial effects of the proposed Project, conservation measures incorporated into the Project, the level of significance before mitigation, mitigation measures incorporated into the Project, the level of significance of adverse impacts after mitigation, and the potential detrimental and beneficial effects associated with Project alternatives.

Section 7. Cumulative Impacts: For each environmental parameter analyzed in this DEIR, describes the potential cumulative impacts associated with the Project and other existing, approved, and proposed aquaculture developments in the Project area.

Section 8. **References:** A list of the technical reports, studies, and other documentation used in the preparation of this DEIR.

Section 9. **Preparers of the Draft EIR and Persons Consulted:** A list of preparers of the DEIR and persons consulted in preparing the DEIR.

Appendices. Appendices containing the following supplemental information are presented as attachments to the DEIR, as follows:

- Appendix A: Final IS & Notice of Preparation
- Appendix B: Initial Study Comments Received
- Appendix C: 1.5-Foot-Elevation Oyster Culture Feasibility Study
- Appendix D: Eelgrass Technical Report
- Appendix E: Biological Resources Technical Report
- Appendix F: Avian Resources Technical Report
- Appendix G: Humboldt Bay Mariculture Capacity Analysis
- Appendix H: Eelgrass Monitoring Plan
- Appendix I: 2015 Eelgrass Monitoring Plan Results
- Appendix J: Harbor District Protocol for Inadvertent Archaeological Discoveries for Ground Disturbing Project Permits, Leases and Franchises

1.3 Project Location

The Project site is located on intertidal and subtidal lands owned or leased by Coast in the north and central parts of Humboldt Bay, California. Humboldt Bay encompasses roughly 62.4 square kilometers (about 15,400 acres) at mean high tide in three geographic segments: South Bay, Entrance Bay, and Arcata Bay (North Bay).

1.4 Project Summary

The Project consists of discontinuing shellfish aquaculture on 5.5 of the acres currently farmed by Coast and renewing regulatory approvals for 294.5 acres of Coast's existing shellfish culture, including intertidal cultch- and basket-on longline culture, intertidal nurseries, subtidal FLUPSY rafts, subtidal wet storage floats, and subtidal clam rafts. In addition, the Project proposes to expand the culture of oysters on 622 intertidal acres in North Bay and to add 8 bins to the existing FLUPSY. On the expansion area acreage, Coast proposes to cultivate oysters using cultch-on-longline on up to 522 acres, basket-on-longline on up to 96 acres, and rack-and-bag on up to 4 acres; rack-and-bag culture will not be placed in eelgrass and will maintain a 10 foot (ft) buffer from existing eelgrass beds. In total, the Project would result in 916.5 acres of intertidal oyster culture, which represents 21% of Coast's owned and leased land.

1.5 Summary of Project Alternatives

The CEQA Guidelines (Section 15126.6[a]) state that an EIR must address "a range of reasonable alternatives to the project, or to the location of the project, which could feasibly attain the basic objectives of the project, but would avoid or substantially lessen any of the significant effects of the project and evaluate comparative merits of the alternatives." The alternatives were based, in part, on their potential ability to meet the Project objectives, as described in Section 4.5.1, Project Objectives.

As described in Section 5.0, Project Alternatives, four alternatives were identified and analyzed for relative impacts as compared to the Project:

- Alternative 1: 10-Foot Spacing Alternative
- Alternative 2: Reduced Footprint Alternative
- Alternative 3: Existing-Footprint Alternative
- Alternative 4: No-Project Alternative

The following presents a brief summary of each alternative; please refer to Section 5.0 for a more thorough discussion of alternative selection and to Section 6.0 for a complete discussion of relative impacts associated with each alternative.

1.5.1 Alternative 1: 10-Foot Spacing Alternative

Under Alternative 1, Coast would renew regulatory approvals for its existing shellfish culture activities and add an additional 955 acres of intertidal longline oyster culture using 10 ft spacing between longlines, for both cultch-on-longline and basket-on-longline culture methods. The amount of culture type within the expansion area would include 802 acres (84%) of cultch-on-longline, 149 acres (15.6%) of basket-on-longline, and 4 acres (0.04%) of rack-and-bag culture.

1.5.2 Alternative 2: Reduced Footprint Alternative

Under Alternative 2, Coast would renew regulatory approvals for its existing shellfish culture activities and seek regulatory approval to expand intertidal culture on 300 additional acres. The amount of culture type within the expansion area would include 200 acres (67%) of cultch-on-longline and 100 acres (33%) of basket-on-longline.

1.5.3 Alternative 3: Existing-Footprint Alternative

Under Alternative 3, Coast would renew regulatory approvals for its existing shellfish culture activities but would not seek to permit additional intertidal culture in Humboldt Bay.

1.5.4 Alternative 4: No-Project Alternative

The No-Project Alternative would prevent cultivation expansion by Coast under this Project and result in the non-renewal of Coast's existing permits for its existing cultivated area in Humboldt Bay, thereby requiring the removal of Coast's existing planted shellfish and shellfish gear.

1.5.5 Environmentally Superior Alternative

None of the proposed alternatives will result in significant and unavoidable impacts, however Alternative 2, Reduced Footprint Alternative is being identified as the environmentally superior alternative due to the fact that it will achieve some of the Project objectives while having a slightly reduced effect on the environment, as explained more fully in Section 6.0.

1.6 Issues to be Resolved

Section 15123(b)(3) of the CEQA Guidelines requires that an EIR contain issues to be resolved, including the choice among alternatives and whether or how to mitigate significant impacts. With regards to the Project, the major issues to be resolved include decisions by the Harbor District, as the lead agency, related to the following:

- Whether this DEIR adequately describes the environmental impacts of the Project.
- Whether the identified goals, policies, and mitigation measures should be adopted or modified.
- Whether there are other mitigation measures that should be applied to the Project besides those proposed in this DEIR.

1.7 Areas of Controversy

In accordance with Section 15123(b)(2) of the CEQA Guidelines, the EIR is to identify areas of controversy known to the lead agency, including issues raised by agencies and the public.
This DEIR takes into consideration the comments received on the Draft Initial Study (Draft IS), Final IS, and Notice of Preparation (NOP). Written comments received are contained in Appendix B to this DEIR and a summary of those responses is provided in Section 2.2, Notice of Preparation and Initial Study (Table 2.1), of this DEIR. Known areas of controversy include the Project's impacts on eelgrass; black brant and other bird species; herring and other fish species; and impacts to recreational users and hunters.

1.8 Summary of Environmental Impacts, Mitigation Measures, and Levels of Significance After Mitigation

Table 1.1 summarizes the conclusions of the environmental analysis contained in this DEIR and proposed mitigation measures. Level of significance after mitigation is also presented. Table 1.1 also identifies conservation measures (Conservation Measures) that have been incorporated into the Project. Conservation Measures are intended to ensure that the Project maintains a high standard that is environmentally responsible. Conservation Measures may also be applied to improve or provide a beneficial impact even where no significant impact has been identified. Conservation Measures are further discussed in relation to each environmental parameter analyzed in Section 6.0. Because the Conservation Measures have been made a part of the Project, they do not constitute mitigation measures by definition, although they have a mitigating effect. Given their critical importance in ensuring that significant impacts are avoided, conservation measures are treated similarly to mitigation measures and will be included in the Mitigation and Monitoring Plan for this DEIR.

Table 1.1 Summary of Environmental Impacts, Mitigation Measures and Levels of Significance After Mitigation.				
Impact	**Conservation Measure**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**
IMPACT CR-1: Placement of equipment.	None proposed.	Potentially significant.	MITIGATION CR-1: Coast will designate an authorized point of contact (Cultural Resources POC) in the event of inadvertent discovery of any cultural or archaeological resource or human remains or Native American grave goods during Project implementation; Coast will ensure that the Harbor District has the name and current contact information for its Cultural Resources POC. MITIGATION CR-2: Should an archaeological resource be inadvertently discovered during ground-disturbing activities, the Tribal Historic Preservation Officers (THPO) appointed by the Blue Lake Rancheria, Bear River Band of Rohnerville Rancheria and Wiyot Tribe shall be immediately notified and a qualified archaeologist with local experience retained to consult with the Harbor District, the three THPOs, Coast, and other applicable regulatory agencies to employ best practices for assessing the significance of the find, developing and implementing a mitigation plan if avoidance is not feasible, and reporting in accordance with the Harbor District's Standard Operating Procedures, as memorialized in this Mitigation Measure and as further laid out in the Harbor District Protocol. 1. Ground-disturbing activities shall be immediately stopped if potentially	Less than significant.

			significant historic or archaeological materials are discovered. Examples include, but are not limited to, concentrations of historic artifacts (e.g., bottles, ceramics) or prehistoric artifacts (chipped chert or obsidian, arrow points, groundstone mortars and pestles), culturally altered ash-stained midden soils associated with pre-contact Native American habitation sites, concentrations of fire-altered rock and/or burned or charred organic materials, and historic structure remains such as stone-lined building foundations, wells or privy pits. Ground-disturbing Project activities may continue in other areas that are outside the discovery locale. 2. An "exclusion zone" where unauthorized equipment and personnel are not permitted shall be established (e.g., taped off) around the discovery area plus a reasonable buffer zone by the District, or party who made the discovery. 3. The discovery locale shall be secured (e.g., 24-hour surveillance) as directed by the District if considered prudent to avoid further disturbances. 4. Coast's plant manager (located at 25 Waterfront Drive in Eureka) or party who made the discovery and initiated these protocols shall be responsible for immediately contacting by telephone the parties listed below to report the find: a. The Harbor District's authorized POC, as listed in the Harbor District Protocol; and b. Coast's Cultural Resources POC.	

			5. Upon learning about a discovery, the District's POC shall be responsible for immediately contacting by telephone the POCs listed below to initiate the consultation process for its treatment and disposition: a. THPOs with Blue Lake Rancheria, Bear River Band and Wiyot Tribe; and b. Other applicable agencies involved in Project permitting (e.g., U.S. Army Corps of Engineers [USACE], California Coastal Commission, etc.). 6. In cases where a known or suspected Native American burial or human remains are uncovered, the Humboldt County Coroner (707-445-7242) shall <u>also</u> be notified immediately, along with the property owner of the discovery site. In addition, Mitigation Measure CR-3 shall be followed. 7. Ground-disturbing Project work at the find locality shall be suspended temporarily while the District, the three THPOs, a consulting archaeologist and other applicable parties consult about appropriate treatment and disposition of the find. Ideally, a Treatment Plan will be developed within three working days of discovery notification. Where the Project can be modified to avoid disturbing the find (e.g., through project redesign), this may be the preferred option. Should human remains be encountered, the provisions of State laws shall apply and Mitigation Measure CR-3 followed. The Treatment Plan shall reference appropriate laws and include provisions for analyses, reporting, and final	

			disposition of data recovery documentation and any collected artifacts or other archaeological constituents. Ideally, the field phase of the Treatment Plan may be accomplished within five (5) days after its approval, however, circumstances may require longer periods for data recovery. 8. Any and all inadvertent discoveries shall be considered strictly confidential, with information about their location and nature being disclosed only to those with a need to know. The District's authorized representative shall be responsible for coordinating any requests by or contacts to the media about a discovery. 9. These Mitigation Measures shall be communicated to Coast's field work force (including contractors, employees, officers and agents) and such communications may be made and documented at safety briefings. 10. Ground-disturbing work at a discovery locale may not be resumed until authorized in writing by the District. 11. The plant manager or party who made the discovery and initiated these protocols, shall make written notes available to the Harbor District describing: the circumstances, date, time, location and nature of the discovery; date and time each POC was informed about the discovery; and when and how security measures were implemented. 12. The plant manager, Cultural Resources POC or party who made the discovery shall record how the discovery downtime affected the Project work schedule.	

			13. Treatment Plans and corresponding Data Recovery Reports shall be authored by professionals who meet the Federal criteria for Principal Investigator Archaeologist and reference the *Secretary of the Interior's Standards and Guidelines for Archaeological Documentation* (48 Fed. Reg. 44734-44737). 14. Final disposition of all collected archaeological materials shall be documented in a final Data Recovery report and its disposition decided in consultation with Tribal representatives. 15. Final Data Recovery Reports, along with updated confidential, standard California site record forms (DPR 523 series) shall be filed at the Northwest Information Center of the California Historical Resources Information System and the Harbor District, with report copies provided to the three identified THPOs. MITIGATION CR-3: In the event of inadvertent discovery of human remains or Native American grave goods during ground-disturbing activities, work at the discovery locale shall be halted immediately, the Harbor District and County Coroner contacted, and, consistent with State law, the following protocol followed (in addition to the protocol described under Mitigation Measure CR-2). 1. If human remains are encountered, they shall be treated with dignity and respect. Discovery of Native American remains is a very sensitive issue and serious concern of affiliated Native Americans. Information about such a discovery shall be held in	

			confidence by all Project personnel on a need-to-know basis. The rights of Native Americans to practice ceremonial observances on sites, in labs and around artifacts shall be upheld. 2. Violators of Section 7050.5 of the California Health and Safety Code may be subject to prosecution to the full extent of applicable law (felony offense). In addition, the provisions of California law (Section 7050.5 of the California Health and Safety Code and Section 5097.98 of the California Public Resources Code) will be followed: 1. The Coroner has two working days to examine the remains after being notified of the discovery. If the remains are Native American, the Coroner has 24 hours to notify the NAHC in Sacramento at (916) 653-4082. 2. The NAHC is responsible for identifying and immediately notifying the most likely descendant (MLD) of the deceased Native American. (Note: NAHC policy holds that the Native American Monitor will not be designated the MLD.) 3. Within 48 hours of their notification by the NAHC, the MLD will be granted permission by the property owner of the discovery locale to inspect the discovery site if they so choose. 4. Within 48 hours of their notification by the NAHC, the MLD may recommend to the owner of the property (discovery site) the means for treating or disposing, with	

			appropriate dignity, the human remains and any associated grave goods. The recommendation may include the scientific removal and non-destructive or destructive analysis of human remains and items associated with Native American burials. Only those osteological analyses (if any) recommended by the MLD may be considered and carried out. Whenever the NAHC is unable to identify a MLD, or the MLD identified fails to make a recommendation, or the property owner rejects the recommendation of the MLD and mediation between the parties by NAHC fails to provide measures acceptable to the property owner, he/she shall cause the re-burial of the human remains and associated grave offerings with appropriate dignity on the property in a location not subject to further subsurface disturbance.	
IMPACT BIO-1: Impacts associated with overwater structures.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-2: Changes to unstructured habitat from the addition of shellfish aquaculture gear.	CONSERVATION BIO-1: Coast will not cause the intentional deposition of shells or any other material on the seafloor. CONSERVATION BIO-4: Monthly inspection of aquaculture plots will occur to	Less than significant.	None proposed.	Less than significant.

	ensure that gear is properly maintained.			
IMPACT BIO-3 Calculation of eelgrass density reduction.	CONSERVATION BIO-2: Longline spacing for new shellfish culture plots would occur at 5-ft intervals. CONSERVATION BIO-3: Coast will implement in-kind and out-of-kind habitat restoration, as described below. CONSERVATION BIO-5: Rack-and-bag culture plots would not be planted within 10 ft of an existing eelgrass bed. CONSERVATION BIO-6: No anchoring of the longline harvester would be done so as to shade the same area of eelgrass for a period exceeding 12 hours. CONSERVATION BIO-7: Larger work boats would be anchored in the channel outside of eelgrass beds and smaller skiffs would be used to access longlines where eelgrass	Less than significant.	None proposed.	Less than significant.

	is present when the area is inundated. CONSERVATION BIO-8: Boats will be operated in such a way as to minimize the degree of sediment mobilization and avoid propeller scarring in areas of eelgrass. CONSERVATION BIO-9: No dredging, hydraulic harvesting, "bed cleaning," or any other activities with a hydraulic harvester would occur.			
IMPACT BIO-4: Potential trampling of eelgrass related to access and activities during shellfish aquaculture operations.	CONSERVATION BIO-5: Rack-and-bag culture plots would not be planted within 10 ft of an existing eelgrass bed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-5: Potential to contribute to habitat fragmentation by placing oyster longline aquaculture within patchy and continuous eelgrass beds and boat use.	CONSERVATION BIO-6: No anchoring of the longline harvester would be done so as to shade the same area of eelgrass for a period exceeding 12 hours. CONSERVATION BIO-7: Larger work boats would be anchored in the channel	Less than significant.	None proposed.	Less than significant.

	outside of eelgrass beds and smaller skiffs would be used to access longlines where eelgrass is present when the area is inundated. CONSERVATION BIO-8: Boats will be operated in such a way as to minimize the degree of sediment mobilization and avoid propeller scarring in areas of eelgrass. CONSERVATION BIO-9: No dredging, hydraulic harvesting, "bed cleaning," or any other activities with a hydraulic harvester would occur.			
IMPACT BIO-6: The potential to affect the development of floating eelgrass rafts and wrack within intertidal habitat of North Bay.	CONSERVATION BIO-2: Longline spacing for new shellfish culture plots would occur at 5-ft intervals.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-7: The potential to change sediment distribution and tidal circulation by placing oyster aquaculture	CONSERVATION BIO-8: Boats will be operated in such a way as to minimize the degree of sediment mobilization and avoid	Less than significant.	None proposed.	Less than significant.

structures within intertidal habitat of North Bay.	propeller scarring in areas of eelgrass. CONSERVATION BIO-9: No dredging, hydraulic harvesting, "bed cleaning," or any other activities with a hydraulic harvester would occur.			
IMPACT BIO-8: The potential to change nutrients and turbidity conditions within intertidal habitat of North Bay.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-9: The potential to exceed carrying capacity in Humboldt Bay.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-10: The potential to change the presence and persistence of contaminants within North Bay.	CONSERVATION HAZ-1, HAZ-2, and HAZ-3 would apply (see below).	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-11: The potential to change sediment quality underneath shellfish aquaculture gear due to	CONSERVATION BIO-1: Coast will not cause the intentional deposition of shells or any other material on the seafloor.	Less than significant.	None proposed.	Less than significant.

biodeposits from filter-feeding organisms.				
IMPACT BIO-12: The potential to change species composition through the addition of nutrients to the sediment or adding structure to unstructured habitat.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-13: The potential to change species composition through trampling during site access for shellfish aquaculture activities (e.g., planting, harvesting, and maintenance).	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-14: The potential to introduce non-indigenous species (NIS) to Humboldt Bay from commercial shellfish aquaculture operations.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-15: The potential to naturalize cultured oysters (that are NIS) into Humboldt Bay.	None proposed.	Less than significant.	None proposed.	Less than significant.

IMPACT BIO-16: Potential impacts to Dungeness crab from the expansion of oyster aquaculture in Humboldt Bay.	CONSERVATION BIO-2: Longline spacing for new shellfish culture plots would occur at 5-ft intervals. CONSERVATION BIO-4: Monthly inspection of aquaculture plots will occur to ensure that gear is properly maintained. CONSERVATION BIO-10: New shellfish culture plots will not be planted within 10 ft of a subtidal channel.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-17: Potential impacts to Pacific lamprey from the expansion of oyster aquaculture in Humboldt Bay.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-18: Potential impacts to sturgeon from the expansion of oyster aquaculture in Humboldt Bay.	CONSERVATION BIO-2: Longline spacing for new shellfish culture plots would occur at 5-ft intervals. CONSERVATION BIO-10: New shellfish culture plots will not be planted within 10 ft of a subtidal channel.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-19: Potential impacts to salmonids from the expansion of oyster	CONSERVATION BIO-2: Longline spacing for new	Less than significant.	None proposed.	Less than significant.

aquaculture in Humboldt Bay.	shellfish culture plots would occur at 5-ft intervals. CONSERVATION BIO-10: New shellfish culture plots will not be planted within 10 ft of a subtidal channel.			
IMPACT BIO-20: Potential impacts to special status forage fish (eulachon and longfin smelt) from the expansion of oyster aquaculture in Humboldt Bay.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-21: Potential impacts to Pacific herring from the expansion of oyster aquaculture in Humboldt Bay.	None proposed.	Potentially significant.	MITIGATION BIO-1: During the months of December through March, Coast will visually survey those beds to be worked on each day to determine whether herring have spawned on eelgrass, culture materials, or substrate. If herring spawn is observed, Coast will: (1) notify the CDFW's Eureka Marine Region office within 24 hours, and (2) postpone activities on those beds until all eggs have hatched.	Less than significant.
IMPACT BIO-22: Potential impacts to groundfish from the expansion of oyster aquaculture in Humboldt Bay.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-23: Potential impacts to	CONSERVATION BIO-10: New shellfish culture plots will	Potentially significant.	MITIGATION BIO-2: No activity involving human disturbance will occur within 100 m of	Less than significant.

marine mammals from the expansion of oyster aquaculture in Humboldt Bay.	not be planted within 10 ft of a subtidal channel. CONSERVATION BIO-11: Coast will not conduct any activity when a marine mammal is observed hauled out in or near a culture area ready for planting, scheduled maintenance, or harvesting until the mammal has left on its own and without provocation from Coast.		the area of Sand Island that is above mean higher high water to avoid the harbor seal haul-out location and nesting birds on Sand Island.	
IMPACT BIO-24: Potential impacts to special status bird species from the expansion of oyster aquaculture in Humboldt Bay.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-25: Potential impacts to black brant foraging from the expansion of oyster aquaculture in Humboldt Bay.	None proposed.	Potentially significant.	MITIGATION BIO-3: For new shellfish culture equipment, Coast will maintain a maximum longline height of 1-ft above the surface or lower for cultch-on-longline and 40-inches above the surface or lower for basket-on-longline culture.	Less than significant.
IMPACT BIO-26: Potential impacts to black brant associated with human disturbance from the expansion of oyster	None proposed.	Less than significant.	None proposed.	Less than significant.

aquaculture in Humboldt Bay.				
IMPACT BIO-27: Potential impacts to black brant associated with loss of grit sites from the expansion of oyster aquaculture in Humboldt Bay.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-28: Potential impacts to roosting birds from the expansion of oyster aquaculture in Humboldt Bay.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-29: Potential impacts to nesting birds from the expansion of oyster aquaculture in Humboldt Bay.	None proposed.	Potentially significant.	MITIGATION BIO-2: No activity involving human disturbance will occur within 100 m of the area of Sand Island that is above mean higher high water to avoid the harbor seal haul-out location and nesting birds on Sand Island.	Less than significant.
IMPACT BIO-30: Potential impacts to birds from artificial lighting.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-31: Potential impacts to birds from human disturbance.	None proposed.	Less than significant.	None proposed.	Less than significant.

IMPACT BIO-32: Potential impacts to waterfowl foraging from the expansion of oyster aquaculture in Humboldt Bay.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT BIO-33: Potential impacts to shorebird foraging from the expansion of oyster aquaculture in Humboldt Bay.	CONSERVATION BIO-10: New shellfish culture plots will not be planted within 10 ft of a subtidal channel.	Less than significant.	None proposed.	Less than significant.
IMPACT AV-1 Effect on scenic vistas and visual character from worker and vessel presence.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT AV-2 Effect on scenic vistas and visual character from shellfish culture equipment presence.	CONSERVATION AV-1: Reflective materials such as shiny metals will not be used.	Less than significant.	None proposed.	Less than significant.
IMPACT AV-3 Effects of glare and artificial lighting.	CONSERVATION AV-1: Reflective materials such as shiny metals will not be used.	Less than significant.	None proposed.	Less than significant.
IMPACT AQ-1: Contribution to PM_{10} levels.	None proposed.	Potentially Significant.	MITIGATION AQ-1: Coast shall comply with the requirements of all adopted air quality plans, including plans covering particulate emissions, and shall implement all actions required by the AQMD for Coast's mariculture operations.	Less than significant.

IMPACT GHG-1: Generation of GHGs.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT GHG-2: Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT WQ-1: Water Quality.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT WQ-2: Sedimentation.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT HAZ-1: Hazard to people or the environment through the routine transport, use, emission, or release of hazardous materials.	CONSERVATION HAZ-1: Coast will not discharge any feed, pesticides, or chemicals (including antibiotics and hormones) into Humboldt Bay waters. CONSERVATION HAZ-2: Coast will implement an equipment maintenance program for all vessels used in mariculture activities in order to limit the likelihood of release of fuels, lubricants, paints, solvents, or other potentially toxic materials associated with vessels as a result of accident, upset, or other unplanned events.	Less than significant.	None proposed.	Less than significant.

	CONSERVATION HAZ-3: Coast will continue to fuel boats at commercial fuel dock facilities, carry oil spill absorption pads and seal wash decks or isolate fuel areas prior to fueling so as to prevent contaminants from entering the water.			
IMPACT HAZ-2: Hazard from the abandonment or loss of marine debris.	None identified.	Potentially significant.	MITIGATION HAZ-1: Following storm or adverse weather events, Coast will patrol mariculture areas for escaped or damaged mariculture equipment, promptly retrieve any equipment encountered and, if it cannot be repaired and placed back into service, properly dispose of the escaped equipment on land. In addition, Coast will retrieve or repair any escaped or damaged mariculture equipment that it encounters while conducting routine daily and/or monthly maintenance activities associated with shellfish culture (e.g. bed inspections, shellfish grading and sorting). If the escaped gear cannot be repaired and replaced on the shellfish bed, it will be properly disposed of on land. MITIGATION HAZ-2: Within 30 days of harvest on any area that is being discontinued or taken out of production for one year or more, Coast will remove all shellfish culture apparatus from the area, including but not limited to, stakes, racks, baskets, and pallets. MITIGATION HAZ-3: Coast will implement annual employee training regarding marine debris issues and how to identify loose culture	Less than significant

			gear and proper gear repair and removal methods. MITIGATION HAZ-4: Coast will conduct quarterly bay cleanups in coordination with other interested parties or organizations, which will include walking portions of the bay and shorelines to pick up escaped shellfish gear and other trash (regardless of whether it is generated by the Project). The volume of shellfish gear collected shall be recorded. MITIGATION HAZ-5: Coast will not leave tools, loose gear, or construction materials on its owned and leased tidelands or surrounding areas for longer than one tide cycle. All gear installed in the Project area will be kept neat and secure.	
IMPACT HAZ-3: Health hazard from bioaccumulation of dioxins in shellfish meat.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT REC-1: Effects on recreational facilities.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT REC-2: Effects on recreational users of the bay.	CONSERVATION REC-1: Between November 15 through December 15, Coast shall avoid operations in the East Bay Management Area from midnight until sunset, on Wednesdays, Saturdays, and Sundays. This conservation measure shall not apply in the case of emergency conditions or other operations, such as marine debris removal,	Less than significant.	None proposed.	Less than significant.

	required by Coast to comply with other conditions of approval or mitigation measures, or ensure the safety of its operations. CONSERVATION REC-2: By December 1 of each year, Coast will submit to the Harbor District a map describing the locations of each longline bed within its operational footprint.			
IMPACT NOISE-1: Generation of noise levels in excess of established standards.	None proposed.	Less than significant.	None proposed.	Less than significant.
IMPACT TRANS-1: Effects of intertidal culture operations and equipment on watercraft (e.g. boats, kayaks) navigation.	CONSERVATION REC-1 and REC-2 would also apply to this impact.	Less than significant.	None proposed.	Less than significant.

Section 2.0 Introduction

2.1 Purpose of Environmental Impact Report

CEQA requires that all state and local government agencies consider the environmental consequences of projects over which they have discretionary authority prior to taking action on those projects. Approval of the Project is a discretionary action by the Harbor District. Pursuant to CEQA Section 21067, the lead agency means "the public agency which has the principal responsibility for carrying out or approving a project which may have a significant effect upon the environment." As the first public agency to act on the Project, the Harbor District is the lead agency for the Project and has the responsibility for determining the method of CEQA compliance, preparing and certifying an EIR that describes potential environmental impacts of the revised project, and adopting a Mitigation Monitoring Plan to ensure that all required mitigation measures are implemented during the course of the Project.

The intent of this DEIR is to provide the Harbor District with sufficient information on the potential environmental impacts of the Project to allow the District to make an informed decision regarding approval of the Project. Specific discretionary actions to be reviewed by the District and potential project permits and approvals required from other regulatory agencies are described in Section 4.6, Project Approvals.

2.2 Notice of Preparation and Initial Study

A Draft IS was previously prepared for the Project and was distributed for review and comment on January 23, 2015. A Scoping Meeting was conducted on February 17, 2015. Based on the Draft IS and comments received, it was determined that an EIR would be prepared. A Final IS was prepared that (1) identified the effects determined not to be significant and therefore screened from further review in the EIR, and (2) identified potentially significant impacts that are further analyzed in this DEIR. Together with an NOP, the Final IS was filed with the California Office of Planning and Research on August 20, 2015 and distributed to interested public agencies, organizations, and individuals for a 30-day public review period. The Final IS & NOP are included as Appendix A of this EIR.

Twenty-five agencies/persons responded in writing to the Draft IS.[1] Copies of the written comments received during the public review period, which extended from January 23 to February 23, 2015, are contained in Appendix B (see Table 2.1). Eight agencies/persons responded in writing to the Final IS & NOP.[2] Copies of the written comments received during the public review period, which extended from August 21 through September 21, 2015, are also contained in Appendix B (see Table 2.1). This EIR has taken into consideration the comments received from the various commenters in response to the Draft IS and Final IS & NOP. Table 2.1 summarizes the issues identified by the commenting agencies and provides a reference to the section of the DEIR where the issues are addressed.

[1] This represents the number of individual entities commenting; in some cases, comment letters received were signed by more than one commenter. One comment letter contains what appear to be electronic signatures of hundreds of individuals; this letter is counted as one comment.
[2] *See* Footnote 1.

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		Comments on Draft IS	
California Coastal Commission	General, Biological Resources, Visual Resources	General: • Stated that the Project may have significant effects on the environment and requested preparation of an EIR. • Recommended that the District consider convening a Joint Review Panel of relevant "responsible agencies."	Section 1.0, Executive Summary; Section 2.0, Introduction
		Biological Resources: • Stated that 2.5 ft to 3 ft spacing of shellfish longlines would not prevent adverse impacts to eelgrass. • Stated that the EIR should include a more accurate and science-based analysis of potential eelgrass impacts, including avoidance and minimization efforts, and mitigation. • Stated that proposed BMP-9, pre-work visual surveying for herring spawn, was ineffective. • Stated that the effectiveness of BMP-9 should be evaluated and requested consideration of adaptations or modifications to ensure minimization of impacts. • Stated that the EIR should include a thorough discussion of longfin smelt. • Stated that the EIR should include discussion of quantity and species composition of biofouling organisms, including discussion of potential release into the environment.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project; Section 6.5.5, Conservation Measures; 6.5.7, Mitigation Measures); Appendices D, E, F, H, I
		Hazards/Hazardous Substances • Stated that EIR should include analysis and discussion of potential adverse environmental impacts associated with marine debris.	Section 6.10, Hazards and Hazardous Materials
		Visual Resources: • Stated that the EIR should include a figure indicating the number and location of scenic vista points.	Section 6.6, Aesthetic and Visual Resources

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		• Stated that the EIR should include visual simulations of the Project sites from the nearest vista points.	
Humboldt Baykeeper; Northcoast Environmental Center; Ecological Rights Foundation	Biological Resources, Recreation, Aesthetics, Hazards and Hazardous Materials, Cumulative Effects, Alternatives	General: • Stated that avoidance and minimization should be analyzed. Biological Resources: • Stated that eelgrass impacts vary with culture method. • Stated that key herring spawning sites should be avoided. • Stated that the East Bay Management Area should be avoided consistent with Special Condition 2 of Coast's existing CDP. • Stated that shorebird foraging habitat may be reduced and that the Draft IS does not contemplate mitigation for species likely affected. • Stated that the Draft IS's discussion of black brant impacts is speculative and that the impacts conclusion was not justified. • Stated that potential impacts to nesting birds should be addressed and mitigation included if appropriate. • Stated that seal haulout areas should be identified and avoided and that direct and indirect impacts should be considered. • Stated that impacts to benthic organisms from trampling should be addressed. Mitigation: • Stated that it is unclear how the Project is consistent with the 2007 mitigation measure reducing cultivation to 300 acres. • Stated that relying on monitoring and adaptive management constitutes delayed mitigation. Recreation: • Stated that impacts to water-based recreation should be assessed and avoided.	Section 5.0, Project Alternatives Section 5.0, Project Alternatives; Section 6.5, Biological Resources, (6.5.4, Effects Analysis of Project; 6.5.5, Conservation Measures; 6.5.7, Mitigation Measures); Appendices D, E, F Section 6.5, Biological Resources (6.5.5, Conservation Measures, 6.5.7, Mitigation Measures); Appendices H, I Section 6.11, Recreation

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		Aesthetics: • Stated that visual impacts from scenic coastal areas should be more thoroughly assessed to include reflections. • Stated that special attention should be given to designated scenic areas.	Section 6.6, Aesthetic and Visual Resources
		Hazards: • Stated that loss of plastic gear and debris should be addressed. • Stated that potential dioxin contamination should be discussed.	Section 6.10, Hazards and Hazardous Materials
		Cumulative Impacts: • Stated that cumulative impacts should be addressed.	Section 7.0, Cumulative Impacts
		Alternatives: • Stated that the use of higher sites without eelgrass should be analyzed. • Stated that a smaller footprint alternative should be analyzed.	Section 5.0, Project Alternatives
California Department of Fish and Wildlife	General, Biological Resources, Carrying Capacity Analysis, Mitigation, Cumulative Impacts.	General: • Stated that there are potentially significant impacts to public trust resources. • Recommended that an EIR be prepared.	Section 2.0, Introduction
		Biological Resources: • Stated that the proposal should be revised to avoid impacts to eelgrass and mudflat habitats. • Stated that significant impacts to eelgrass habitats from longlines have been noted in the Bay. • Stated that 1.5 ft, 2.5 ft and 5 ft spacing of longlines has been shown to cause moderate to significant eelgrass impacts. • Stated that the project should include a 10-ft buffer between eelgrass and expansion areas.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project; 6.5.5, Conservation Measures; 6.5.7, Mitigation Measures); Appendices D, E, F, G, H, I

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		• Stated that oyster aquaculture has been specifically noted to have negative impacts on eelgrass and black brant. • Stated that human disturbance related to aquaculture could impact brant. • Stated that the Project would impact 24% of all habitats in North Bay between -0.5m and +0.5m. • Stated that eelgrass habitat impacts likely constitute a significant impact to brant. • Stated that the impacts to shorebirds from disturbance and habitat loss may be significant. • Stated that potential impacts to eelgrass in the East Bay Management Area could significantly impact herring spawning. • Stated that there is uncertainty about survival of herring spawn on aquaculture gear. • Stated that there could be a significant impact to longfin smelt through food shortage. • Stated that nighttime lighting could impact shorebirds.	
		Carrying Capacity Analysis: • Stated that the Carrying Capacity analysis suggests that the proposed increase in shellfish culture could reduce available food resources. • Stated that the Carrying Capacity Analysis should be re-run using different values.	Appendix G
		Mitigation: • Stated that the mitigation measures proposed in the Final IS were inadequate. • Stated that areas part of previous mitigation measures should be avoided. • Stated that oyster farming is an identified conservation issue in Humboldt Bay.	Section 6.5, Biological Resources (6.5.5, Conservation Measures; 6.5.7, Mitigation Measures)

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		• Stated that mitigation measures should be developed for potential shorebird impacts. Cumulative Impacts: • Stated that the assessment of cumulative impacts was not sufficient. • Stated that future CEQA documents should include shore-based expansion and expansion by the Harbor District.	Section 7.0, Cumulative Impacts
Oceana; Audubon California; Earthjustice; Redwood Region Audubon Society	General, Biological Resources, Mitigation and Monitoring, Cumulative Impacts	General: • Stated that a full EIR should be prepared. • Stated that a marine spatial planning framework should be used. • Stated that the Project would have significant, unavoidable adverse impacts on the environment. Biological Resources: • Stated that it disagreed with the Draft IS's conclusions regarding eelgrass impacts. • Stated that eelgrass density is reduced in areas with aquaculture. • Stated that the Project would have significant impacts on eelgrass. • Stated that there was insufficient support for the proposed longline spacing regime. • Stated that Rumrill and Poulton (2004) was not peer reviewed and contained errors in experimental design. • Stated that the Project would overlap with known herring spawning sites. • Stated that artificial surfaces provide a lower quality of herring spawning sites. • Stated that herring holding and spawning would be impacted by human disturbance. • Stated that herring would be significantly impacted through impacts to eelgrass.	Section 2.0, Introduction Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project; 6.5.5, Conservation Measures; 6.5.7, Mitigation Measures); Appendices D, E, F, G, H, I

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		• Stated that the Project would reduce salmonid food sources, including herring. • Stated that a reduction in herring would impact fish and wildlife dependent on herring for food. • Stated that there was a lack of evidence to support brant habituation to culture activities. • Stated that reliance on the Pacific Brant Management Plan would not avoid impacts to brant. • Stated that reducing winter food availability has the potential to decrease the size of the Pacific brant population. • Stated that the project may have significant impacts on threatened and endangered species and that individual and cumulative effects on these species should be analyzed. Mitigation and Monitoring • Stated that the monitoring proposed in the Draft IS fails to implement the CEMP. • Stated that there was no explanation to explain how expanding beyond the 300-acre footprint was not a significant impact. Cumulative Impacts: • Stated that the Project's impacts and impacts from the proposed Harbor District project were cumulatively considerable.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project; 6.5.5, Conservation Measures; 6.5.7, Mitigation Measures); Appendices D, H, I Section 7.0, Cumulative Impacts
North Coast Regional Water Quality Control Board (RWQCB)	Regulatory Approvals, Biological Resources	Regulatory Approvals: • Stated that the RWQCB should be identified as an agency whose approval is required. • Stated that stakes, posts, and other equipment placed into the sediment is a "fill" and requires review by the RWQCB. • Stated that regulatory approvals may include a Section 401 Water Quality Certification. Biological Resources:	Section 4.0, Project Description Section 6.5, Biological Resources (6.5.4, Effects

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		• Stated that the addition of 1.03 acres of benthic footprint may impact benthic functions and necessitate mitigation. • Stated that it disagreed that the Project would have less than significant impacts without mitigation.	Analysis of Project; 6.5.5, Conservation Measures; 6.5.7, Mitigation Measures)
National Marine Fisheries Service; CAPES Program, National Ocean Service	General, Project Description, Biological Resources, Monitoring Plan, Mitigation Measures, Aquacultural Carrying Capacity Analysis.	General: • Stated that characterization of the CEMP should be clarified. Project Description • Stated that additional information on Coast's existing culture operations should be included. • Stated that additional information on benthic footprint, stocking rate and other metrics should be provided for the Project. • Stated that the maximum number of rack-and-bag structures should be identified. • Stated that more detailed bed information should be included. • Stated that biomass estimates for the expansion area should be clarified. Biological Resources: • Stated that existing eelgrass habitat should be characterized and Project effects evaluated regardless of the eelgrass bed's classification. • Stated that the conclusion that eelgrass is at carrying capacity should be explained. • Stated that a description of aquaculture, disease, and non-native Japanese eelgrass effect on eelgrass should be included. • Stated that conclusions regarding longline spacing and potential eelgrass impacts should be clarified. • Stated that additional information about ecosystem function and value of eelgrass and shellfish aquaculture habitat should be provided.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project); Appendices D, H, I Section 4.0, Project Description Section 6.5, Biological Resources, (6.5.4, Effects Analysis of Project, 6.5.5, Conservation Measures, 6.5.7, Mitigation Measures); Appendices D, E, F, G, H, I

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		• Stated that additional information should be provided regarding eelgrass impacts. • Stated that the discussion of effects should include physical processes. • Stated that the effects analysis should be evaluated at several spatial scales. • Stated that the area under the nursery pallets should be considered when discussing benthic impacts. • Stated that aquaculture structures in the intertidal area should be considered in the effects analysis for fish, including for rearing, passage, and feeding. • Stated that the discussion of potential impacts to prey species should be expanded. Monitoring Plan: • Stated that the CEMP guidelines should be considered in establishing an adaptive management and monitoring approach. Mitigation Measures: • Stated that the source of marine mammal protocols should be identified as well as seal haulout and pupping locations. Carrying Capacity Analysis: • Stated that use of the Gibbs model would be strengthened by providing additional support for the model's sustainability indicators. • Stated that the analysis should be expanded to use the daily prism volume of Arcata Bay. • Stated that the filtration pressure in the analysis should be reconsidered. • Stated that recalculation of the regulation ratio should be considered.	Section 6.5, Biological Resources, (6.5.5, Conservation Measures); Appendices D, H, I Section 6.5, Biological Resources, (6.5.5, Conservation Measures; 6.5.7, Mitigation Measures) Appendix G

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		• Stated that the Gibbs model should be field tested in Arcata Bay. • Stated that there are existing models with good performance records. • Stated that the Gibbs model lacks published field validation studies and sensitivity analysis. • Stated that variations in culture methods should be identified. • Stated that clearance rates specific to species proposed for cultivation should be used. • Stated that calculations could be completed based on the seston-based diet. • Stated that the Cranford review lacked studies with domesticated or poluploid shellfish. • Stated that methods for determining average chlorophyll concentration should be described. • Stated the concern that the clearance efficiency exceeded the flushing rate. • Stated that there remains uncertainty with regards to clearance rate. • Stated that the Harbor District should consider using a dynamic modelling platform.	
Ducks Unlimited	Biological Resources	Biological Resources • Stated that the Project's impacts on brant are likely dependent on three factors: 1) eelgrass declines, 2) disturbance from feeding, 3) current surplus of eelgrass in the Bay. • Stated that the conclusion that the Project would have less than significant impacts on eelgrass is not convincing. • Stated that additional analysis on disturbance impacts to brant is needed. • Stated that a recent study suggests that Humboldt Bay eelgrass surplus is not large compared to brant needs.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project); Appendices D, F
Frank J. Shaughnessy, PhD; Joe Tyburczy,	Biological Resources	Biological Resources	Section 6.5, Biological Resources (6.5.4, Effects

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
PhD; Jeffrey M. Black, PhD, Humboldt State University		• Stated that the Project will negatively affect functions of eelgrass beds and that further study is needed to assess degree of impact. • Stated that the project may result in changes to the benthic community • Stated that seagrasses have multiple ecosystem functions. • Stated that shading and trampling would impact eelgrass. • Stated that a monitoring study should be designed. • Stated that the Rumrill and Poulton 2004 study had limitations, including replication of treatments and use of control sites. • Recommended that a monitoring study address hypotheses, including: eelgrass shoot densities are lower under longlines and between longlines, different brant and wigeon use of control and mariculture sites, and changes in shoot density between years on a landscape scale. • Stated that monitoring should be done independently.	Analysis of Project); Appendices D, E, F, H, I
Steven Grantham	Recreation, hazards and hazardous materials	Biological Resources: • Stated that waterfowl shy away from oyster gear and workboats, impacting loafing, foraging, and gritting. Recreation: • Stated that the Draft IS did not sufficiently analyze impacts to recreational waterfowl hunting. • Stated that mitigation for waterfowl hunting impacts may be necessary. • Stated that portions of the Project are in areas important for waterfowl hunting. Hazards and Hazardous Materials: • Stated that oyster gear may impact boater safety, including by entanglement.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project), Appendix F Section 6.11, Recreation Section 6.10, Hazards and Hazardous Materials
Stephen Rosenberg	General, Biological Resources, Mitigation	General:	Section 5.0, Project Alternatives

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		• Stated that the goal should be to reduce operations in east bay, not expand them. • Stated that areas away from the east bay should be used for mariculture. Biological Resources • Stated that new oyster production would be concentrated in the Bay's east side. • Stated that the Project could damage eelgrass beds. Mitigation: • Stated that protection of South Bay is not adequate mitigation.	Section 6.5, Biological Resources (6.5.4 Effects Analysis of Project), Appendices D, E, F. Section 6.5, Biological Resources (6.5.5, Conservation Measures; 6.5.7, Mitigation Measures)
Stan Brandenburg	General, Biological Resources, Hazards and Hazardous Materials, Recreation, Traffic/Transportation	General: • Stated that Coast's Project should not be allowed. • Stated that the Project is not sustainable. • Stated that alternative locations are available for the Project. Biological Resources: • Stated that the Project would have impacts on herring, migratory birds, and eelgrass. • Stated that the Project may impact food resources in the Bay. Hazards and Hazardous Materials: • Stated that above-ground aquaculture is a hazard to navigation. Recreation: • Stated that above-ground aquaculture impacts recreational hunting, fishing and boating.	Section 4.0, Project Description; Section 5.0, Project Alternatives Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project); Appendices D, E, F, G Section 6.10, Hazards and Hazardous Materials Section 6.11, Recreation

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		Traffic/Transportation: • Stated that above-ground aquaculture is a hazard to navigation.	Section 6.13, Traffic/Transportation
Mark Hennelly, California Waterfowl Association	General, Biological Resources, Recreation, Cumulative Impacts	General: • Stated that an EIR should be prepared. Biological Resources: • Stated that the literature shows that aquaculture negatively affects brant. • Stated that disturbance may cause brant to change seasonal use patterns. • Stated that impacts to eelgrass would also impact herring and multiple bird species that forage on herring. Recreation: • Stated that the Project may impact waterfowl hunting and reduce and degrade hunting opportunities. • Stated that the Draft IS's statement that hunting has a greater effect on waterfowl populations is incorrect. • Stated that habitat quality and quantity has the greatest impact on waterfowl and other game species. • Disagreed that the impact to brant would be less than significant. Cumulative Impacts: • Stated that the Project could have cumulative impacts with other proposed projects.	Section 2.0, Introduction Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project); Appendices D, E, F Section 6.11, Recreation Section 7.0, Cumulative Impacts
Carol Ross & Walter Moorehead	Biological Resources	Biological Resources: • Stated that the Project would impact migrating brant and other waterfowl and shorebirds.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project); Appendices D, E, F
James S. Sedinger	Biological Resources	Biological Resources: • Stated that the Project would impact eelgrass and therefore black brant.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project); Appendices D, F

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		• Stated that the Project could impact brant through human disturbance.	
Multiple Commenters (Help Protect Migratory Birds)	General, Biological Resources	General: • Stated that the Project should be denied. Biological Resources: • Stated that the Project will impact eelgrass, brant and other bird species.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project); Appendices D, F
Public Comment Meeting Attendees	Aesthetics, Biological Resources, Greenhouse Gas Emissions, Recreation, Transportation/Traffic, Cumulative Impacts	Aesthetics: • Stated there are pipes sticking out of the ground in abandoned areas that could potentially cause harm or break loose. Biological Resources: • Stated there are important areas to black brant and herring. • Stated we don't know what the phytoplankton residence time is. • Stated that the quality of information available on residence time and flush rate is inadequate. • Stated that carrying capacity needs to be addressed. • Stated that existing structures must be impacting eelgrass due to loss of light and would like to see effects on eelgrass quantified in scientific study. • Stated that the Draft IS did not sufficiently address mitigation for eelgrass. • Stated that new culture will impact brant and wigeon. Greenhouse Gas Emissions: • Stated concerns about ocean acidification and that oysters and eelgrass may be compatible. Recreation: • Stated Draft IS did not fully address impacts to recreation and waterfowl hunting.	Section 6.6, Aesthetic and Visual Resources Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project; 6.5.5, Conservation Measures; 6.5.7, Mitigation Measures); Appendices D, E, F, G Section 6.8, Greenhouse Gas Emissions Section 6.11, Recreation

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		Transportation/Traffic: • Stated above ground culture could present a hazard to navigation. Cumulative Impacts: • Stated cumulative impacts need to be analyzed.	Section 6.13, Transport Section 7.0, Cumulative Impacts
Comments on Final IS & NOP			
Oceana; Audubon California; Earthjustice	General, Project Description, Biological Resources, Cumulative Impacts, Alternatives Analysis, Mitigation Measures	General: • Stated that the proposed Project is likely to have significant adverse impacts on sensitive habitats and fish and animal species. • Stated that a full EIR should be prepared. • Incorporated prior comments by reference. • Stated that the Pacific Fishery Management Council commented on the Project by stating that shellfish habitats are not functionally equivalent to eelgrass habitats. Project Description: • Stated the Projects described in the Draft and Final IS' are largely the same and are likely to have similar significant adverse impacts. Biological Resources: • Stated that the 2004 Rumrill and Poulton study is flawed and does not support a finding that the proposed Project design does not result in less than significant impacts to eelgrass. • Stated that the EIR must analyze the environmental effects occurring both within California and outside of it on an "ecosystem" basis. • Stated that the Project's impacts must be analyzed in terms of the regional setting as well as the Pacific Flyway and California Large Marine Ecosystem.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project; 6.5.5, Conservation Measures; 6.5.7, Mitigation Measures) Section 4.0, Project Description Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project; 6.5.5, Conservation Measures, 6.5.7; Mitigation Measures); Appendices D, E, F

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		Cumulative Impacts: • Stated that the EIR must identify all existing and likely future projects that contribute to the same cumulative impacts as the Project. • Stated that the cumulative impact analysis must address the severity of impacts and their likelihood of occurring. Alternatives Analysis: • Stated that a reasonable range of alternatives must be considered, including a no project alternative. Mitigation Measures: • Stated that CEQA and the California Endangered Species Act require mitigation of significant impacts. • Stated that a project proponents' prior shortcomings may be considered in reviewing adequacy of proposed mitigation.	Section 7.0, Cumulative Impacts Section 5.0, Project Alternatives Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project; 6.5.5, Conservation Measures; 6.5.7, Mitigation Measures)
Pacific Flyway Council	Biological Resources; Recreation; Cumulative Impacts	Biological Resources: • Stated that the Project would have significant negative impacts on eelgrass and eelgrass-dependent species, including black brant. • Stated that the DEIR should quantify the increase in the number and magnitude of disturbance events from boat traffic and human activities from the Project. • Stated that the DEIR should describe and quantify the significant impacts to eelgrass from all activities associated with harvest, maintenance and gear placement. Recreation: • Stated that the Project would likely impact waterfowl hunting. • Stated that the DEIR should include decreases in waterfowl available for harvest, loss of hunting opportunities from	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project); Appendices D, E, F Section 6.11, Recreation; Section 6.13, Transportation/Traffic

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		disturbance, loss of hunting due to physical obstruction, and increases in hazards to boaters and dogs. Cumulative Impacts: • Stated that the DEIR should assess cumulative impacts, particularly for black brant and migratory birds.	Section 7.0, Cumulative Impacts
Humboldt Baykeeper	General; Biological Resources; Alternatives Analysis; Cumulative Impacts; Mitigation Measures	General: • Incorporated previous comments by reference. Biological Resources: • Stated that the DEIR should assess avoidance and mitigation. • Stated that the Project should be revised to avoid impacts to eelgrass. Alternatives Analysis: • Stated that the DEIR should assess alternatives to the Project. Cumulative Impacts: • Stated that the DEIR should assess cumulative impacts. Mitigation Measures: • Stated a concern with the proposal to adopt monitoring and adaptive management as mitigation.	Section 5.0, Project Alternatives; Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project; 6.5.5, Conservation Measures; 6.5.7, Mitigation Measures); Appendices D, F Section 5.0, Project Alternatives Section 7.0, Cumulative Impacts Section 6.5, Biological Resources (6.5.5, Conservation Measures; 6.5.7, Mitigation Measures); Appendices H, I
Pacific Fishery Management Council	General, Biological Resources, Cumulative Impacts	General: • Stated that the Council has had insufficient time to review materials and requested an extension of the DEIR public comment period. • Attached previous comment letter regarding the Project and incorporated by reference. Biological Resources:	Section 2.0, Introduction Section 6.5, Biological Resources (6.5.4, Effects

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		• Stated that it was unclear how eelgrass impacts would be avoided. • Stated that the CEMP's and the Pacific Fishery Management Council's recommendations should be followed. • Stated that shellfish do not provide the same ecosystem services as eelgrass. • Stated that sedimentation-related impacts to fish have not been analyzed. Cumulative Impacts: In appended comment letter, expressed concern regarding the Project's potential cumulative impacts.	Analysis of Project; 6.5.5, Conservation Measures; 6.5.7, Mitigation Measures); Appendices D, E Section 7.0, Cumulative Impacts
California Department of Fish and Wildlife	Project Description, Biological Resources, Alternatives, Cumulative Impacts, Recreation, Mitigation, Monitoring	Project Description: • Stated that the DEIR should include a description of maintenance and inspection of basket-on-longline culture plots. • Stated that the DEIR should include a description of gear placement, gear required, and methods of removal. • Stated that anchoring location and frequency should be described. • Stated that bushel tubs should be described. • Stated that PVC pipes used to demarcate sites should be described. Biological Resources: • Stated that the Project could eliminate or degrade eelgrass habitat. • Stated that the Project could reduce floating eelgrass rafts and beach wrack. • Stated that the Final IS did not address impacts to habitat alteration and fragmentation. • Stated that artificial habitats in estuarine and nearshore environments are "poor surrogates" for natural habitats. • Stated that the DEIR should describe and quantify eelgrass impacts. • Stated that the Project should incorporate a 10-ft buffer to eelgrass. • Stated that the Project could have significant impacts on mudflats and recommended that the DEIR analyze this impact.	Section 4.0, Project Description Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project; 6.5.5, Conservation Measures, 6.5.7 Mitigation Measures); Appendices D, E, F, G

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		• Stated that the DEIR should analyze disturbance-related impacts to migratory shorebirds, waterfowl, brant and marine mammals. • Stated that disturbance impacts should be discussed over a range of temporal scales and should incorporate published buffer distances. • Stated that impacts to herring should be evaluated in the DEIR and stated that survival of spawn on different substrates should be discussed. • Stated that the DEIR should analyze the possibility of desiccation in relation to herring spawn on aquaculture gear. • Stated that impacts to black brant should be analyzed in the DEIR, including loss of eelgrass food resources. • Stated that the DEIR should evaluate impacts to salmon and trout species, including loss of eelgrass habitat and change in habitat structure. • Stated that the DEIR should use a threshold of significance for eelgrass impacts that meets the Department's "no net loss" policy.	
		Alternatives: • Stated that the DEIR should analyze an eelgrass avoidance alternative.	Section 5.0, Project Alternatives
		Cumulative Impacts: • Stated that the DEIR should assess cumulative impacts related to disturbance of migratory shorebirds, waterfowl, brant and marine mammals. • Stated that cumulative impacts associated with disturbance and loss of food resources should be evaluated in the DEIR. • Stated that cumulative impacts to brant and salmonid species should be evaluated in the DEIR.	Section 7.0, Cumulative Impacts; Appendix G
		Recreation: • Stated that the DEIR should analyze recreational impacts including loss of hunting opportunities and increased hazards to boaters.	Section 6.11, Recreation; Section 6.13, Transportation

Table 2.1 Summary of Comments on Draft IS and Final IS & NOP.			
Commenting Agency/Person	**Comment Type**	**Comment Summary**	**Issue Addressed in:**
		Mitigation: • Stated that the DEIR should include an acre-by-acre analysis of eelgrass and mudflat wetland habitat impacts and of feasibility and timing of mitigation. Monitoring: • Stated that ongoing annual monitoring should be performed that is sufficient to detect Project-related changes and impacts to fish and wildlife resources. • Stated that a multi-agency group should be formed to assist in the development of a monitoring program.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project; 6.5.5, Conservation Measures, 6.5.7, Mitigation Measures); Appendices D, E, F Appendices H, I
Mark A. Colwell, Professor, Humboldt State University	General, Biological Resources	General: • Stated that he is in general agreement with other commenters regarding the value of eelgrass habitat. Biological Resources: • Stated that this comment focuses on the value of tidal flats to shorebirds. • Stated that there is insufficient information to evaluate whether expanding oyster culture would have less than significant impacts on shorebirds; information is also insufficient to evaluate impacts to shorebirds from loss of mudflat habitat. • Stated that little is known about the abundance and availability of invertebrate populations for shorebird foraging in Humboldt Bay. • Stated that impacts to shorebirds from increased disturbance should be evaluated. • Stated that loss and degradation of habitat is likely driving shorebird decline. • Stated that Humboldt Bay is a critical link in the chain for many species of migratory shorebirds. • Stated that there is a lack of evidence to support achievement of Project goals of sustainable seafood sourcing.	Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project); Appendix D Section 6.5, Biological Resources (6.5.4, Effects Analysis of Project); Appendices E, F

2.3 Scope of the DEIR

The scope of this EIR was determined based upon the Draft IS, Final IS and NOP, and comments received. Pursuant to Sections 15126.2 and 15126.4 of the CEQA Guidelines, this EIR identifies any potentially significant adverse impacts and recommended mitigation that would reduce or eliminate these impacts to levels of insignificance. The information contained in Section 4.0, Project Description, establishes the basis for analyzing future project-related environmental impacts.

2.3.1 Impacts Considered Less Than Significant

In accordance with CEQA Guidelines Section 15128, the Final IS (Appendix A) explains why each of the following environmental categories were determined not to be significantly affected by the Project and are therefore not analyzed further in the EIR.

- Agricultural Resources
- Geology and Soils
- Land Use and Planning
- Mineral Resources
- Population and Housing
- Public Services
- Utilities and Service Systems

2.3.2 Potentially Significant Adverse Impacts

Based on the Draft IS, Final IS and comments received during the NOP comment period, ten environmental categories were identified as potentially significant impacts if the Project is implemented. They are:

- Cultural and Archaeological Resources
- Biological Resources
- Aesthetics and Visual Resources
- Air Quality
- Greenhouse Gas Emissions
- Hydrology and Water Quality
- Hazards and Hazardous Materials
- Recreation
- Noise
- Transportation/Traffic

The EIR addresses each of these environmental issues in Section 6.0, Environmental Analysis and Effects of Alternatives. The analysis identifies potentially significant environmental impacts; evaluates the direct, indirect, and cumulative impacts; and recommends feasible mitigation measures, where appropriate, that would serve to reduce or eliminate the Project's identified adverse environmental effects.

2.3.3 Unavoidable Significant Adverse Impacts

No unavoidable significant adverse impacts have been identified.

2.4 Impact Terminology

The following general terms are used in the EIR to describe the significance of impacts that could result from the Project:

- The Project is considered to have *no impact* if the analysis concludes that the Project could not affect a particular resource topic.
- An impact is considered *less than significant* if the analysis concludes that the Project would cause no substantial adverse change to the environment and mitigation is not required.
- An impact is considered *less than significant with mitigation* if the analysis concludes that the proposed Project would cause no substantial adverse change to the environment with the inclusion of mitigation measures identified by the lead agency.
- An impact is considered *environmentally significant* if the analysis concludes that the proposed Project would cause substantial adverse change to the environment that could not be reduced to less-than significant levels by the inclusion of identified mitigation measures.

2.5 Final EIR Certification

This DEIR is being circulated for public review for a period of 45 days. A notice will be sent to affected agencies and interested parties indicating that the DEIR is available for review in accordance with CEQA Guidelines Section 15087. During the 45-day public review period, the DEIR will be available at the Harbor District Office, 601 Startare Drive, Eureka, California 95501 and on the Harbor District's website (http://humboldtbay.org). Written comments on the DEIR should be submitted to:

> Adam Wagschal, Deputy Director
> 601 Startare Drive, Eureka, CA 95501
> Fax: (707) 443-0800
> Email: awagschal@humboldtbay.org

The DEIR comments, and responses will be combined into the Final EIR, which will be presented to the District Board of Commissioners for consideration as they review the proposed Project. All persons who commented on the DEIR will be notified of the availability of the Final EIR and the date of any public hearing before the Board of Commissioners.

2.6 Intended Uses of this EIR

This DEIR documents the potential environmental effects of the Project and is to be used by the District to satisfy CEQA requirements and to support assessments by other agencies, including responsible and trustee agencies. The Project conditions described in this DEIR (e.g., mitigation measures and thresholds) as well as any other conditions contained in other Project approvals will be required of Coast as part of Project approval. Table 2.2 depicts the agencies expected to use the EIR in their decision making processes and the related environmental laws, approvals, permits and/or consultations.

Table 2.2 Agencies Expected to Use this DEIR in their Decision Making Processes and the Related Environmental Laws, Approvals, Permits and/or Consultations

Agency	Law(s)	Type of Approval, Permit or Consultation
U.S. Army Corps of Engineers (USACE)	Rivers and Harbors Act Section 10	Individual Permit
Humboldt Bay Harbor, Recreation and Conservation District	State of California Harbor and Navigation Code	Use Permit
City of Eureka	City of Eureka Code	Conditional Use Permit
California Coastal Commission	California Coastal Act	Coastal Development Permit and Coastal Zone Management Consistency Determination
National Marine Fisheries Service	Magnuson Stephens Fishery Conservation and Management Act, Endangered Species Act, Marine Mammal Protection Act	Primarily through consultation with USACE
U.S. Fish and Wildlife Service	Endangered Species Act	Primarily through consultation with USACE
California Department of Fish and Wildlife	California Endangered Species Act and California Fish and Game Code Section 1802	Primarily through consultation with the Harbor District and California Coastal Commission

2.7 Mitigation Monitoring

Public Resources Code Section 21081.6 requires that agencies adopt a monitoring or reporting program for any project for which it has prepared an EIR or a Mitigated Negative Declaration. Such a program is intended to ensure that the implementation of all mitigation measures adopted through the preparation of an EIR. The Mitigation Monitoring Program for the Project will be completed as part of the Final EIR and will be completed prior to consideration of the Project by the Board of Commissioners.

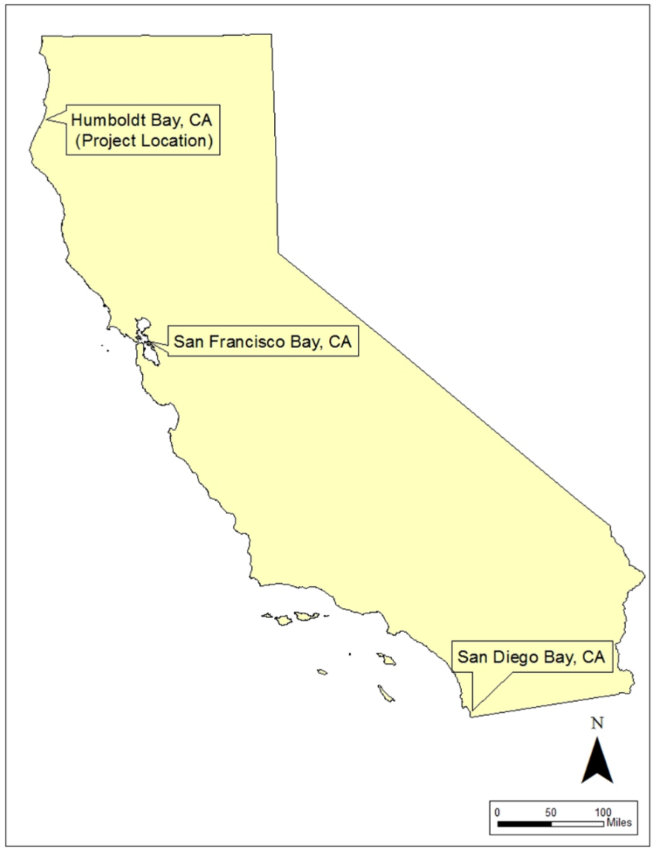
Section 3.0 Environmental Setting

3.1 Introduction

The Project is intended to provide a comprehensive plan for management of Coast's owned and leased area and expansion of its shellfish farm in Humboldt Bay. This DEIR discloses possible environmental impacts from approving the Project and identifies ways to minimize adverse environmental impacts. Baseline conditions, applicable regulations, standards, and thresholds are described under each topical section in DEIR Section 6.0, Environmental Analysis and Effects of the Alternatives.

3.2 Regional Environmental Setting

Humboldt County is located on the north coast of California, approximately 200 miles north of San Francisco. Humboldt County contains a diversity of plant and animal species, with significant forest and coastal habitats. Humboldt Bay is located on the coast at approximately the midpoint of the County. Highway 101 runs adjacent to the eastern shore, and State Route 255 surrounds the northern and western shores of North Bay. The population settled around Humboldt Bay represents the largest population center on the West Coast between Portland and San Francisco. The largest nearby urban concentrations are in the cities of Arcata (population approximately 16,651) and Eureka (population approximately 25,866).



3.3 Local Environmental Setting

Humboldt Bay

Humboldt Bay encompasses roughly 62.4 square kilometers (about 15,400 acres) at mean high tide in three geographic segments: South Bay, Entrance Bay, and North Bay (Figure 3.1). As California's second-largest natural bay and the largest estuary on the Pacific Coast between San Francisco Bay and Oregon's Coos Bay, Humboldt Bay is a complex ecosystem and valuable resource for California and the nation because of its natural resources, aesthetic appeal and recreational

Figure 3.1 Major landmarks in North Bay, Humboldt Bay, California.

opportunities, ecological services, economic benefits, and vital transportation links. Visitors and Humboldt County residents value Humboldt Bay for its natural and anthropogenic attributes. Humboldt Bay biota is diverse and ecologically important locally and globally, with both local fisheries, including oyster farms, and habitat for long-distance shorebird and waterfowl migrants. The Humboldt Bay area hosts more than 400 plant species, 300 invertebrate species, 100 fish species, and 260 bird species, including those that rely on the bay as they travel the Pacific Flyway. Humboldt Bay is also important in the life cycles of commercially and recreationally important fish species, including shellfish, crustaceans, and finfish. Portions of the diked former tidelands around Humboldt Bay, particularly in the Arcata Bottoms, are used for agriculture, primarily livestock grazing.

In the late nineteenth and early twentieth centuries, the bay was diked and filled, reducing salt marshes from an estimated 9,000 acres to the 900 acres present today. Habitat has been further impacted by discharges of agricultural and urban runoff, industrial and recreational activities, sedimentation from the bay's watershed and other sources, colonization by the invasive grass, *Spartina*, and other stressors.

The oyster and clam culture industry in the bay produces about 70% of the oysters grown in California. Three species of mollusk are cultured in Humboldt Bay: Kumamoto oysters (*Crassostrea sikamea*), Pacific oysters (*C. gigas*) and Manila clams (*Tapes philippinarum*). There are five companies currently farming shellfish in the bay, using various methods to culture clams in subtidal areas and oysters in both subtidal and intertidal areas.

Project Location and Land Uses

The Project site is located in the north and central parts of Humboldt Bay. Coast's aquaculture operations are located on intertidal and subtidal lands of North Bay and Central Bay that are owned or leased by Coast, including approximately 1,827 acres owned or held in trust by the City of Eureka, approximately 1,452 acres owned or held in trust by the Harbor District, approximately 515 acres owned by Karamu Corporation, approximately 6 acres owned by the Manila Community Service District ("MCSD"), approximately 5.5 acres owned by Joanne Sprague, and approximately 514 acres owned by Coast (Figure 4.2, Project Description).

The areas surrounding Coast's operations are dominated by tidal flats, tidal channels and open water. The project area is located within tidal and submerged lands granted to the Harbor District and City of Eureka by the State Lands Commission. The Project area within unincorporated Humboldt County is zoned as Natural Resources with Coastal Wetlands and Water Conservation. Areas of the Project within the City of Eureka's jurisdiction are zoned Water Conservation and Water Development. The Harbor District's Humboldt Bay Management Plan classifies the area as Combined Water Use – Mariculture. Surrounding areas are similarly classified Combined Water Use – Mariculture or Bay Conservation by the Harbor District; zoned Natural Resources – Coastal Wetland by Humboldt County; and zoned Water Conservation and Water Development by the City of Eureka.

3.4 Environmental Resources

The following is a summary of environmental resources in the Project area. Existing conditions, regulations, and an analysis of potential Project impacts are further discussed under each topical sub-section in DEIR Section 6.0, Environmental Analysis and Effects of the Alternatives.

3.4.1 Cultural and Archeological Resources

Humboldt Bay is the ancestral heartland of the Wiyot Indians, whose native language is affiliated with the Algonquian language family and who had occupied the bay area for at least 2,000 years by the time the first European maritime explorers entered the bay and the first American towns were established in 1850. There are hundreds of known and undiscovered archaeological sites around Humboldt Bay that evidence Wiyot history and prehistory. Today, citizens of Wiyot ancestry are affiliated with three federally-recognized tribes located in the ancestral homeland: Blue Lake Rancheria; Bear River Band of the Rohnerville Rancheria; and the Wiyot Tribe at Table Bluff Reservation.

3.4.2 Biological Resources

The Project area includes intertidal and subtidal habitats. Intertidal mudflats are exposed during lower tides and are submerged during higher tides. Channels cut across the mudflats. In some areas, eelgrass forms dense beds, and, in other areas, eelgrass is sparsely distributed or absent. Species of algae also occur on mudflats including red alga, rockweed and sea lettuce. During high tides, fish can occur on mudflats and some may utilize them as foraging habitat. Various invertebrate species including the commercially and recreationally important Dungeness crab can occur on mudflats during high tides and low tides. Bird and marine mammal species also utilize intertidal areas. The subtidal community in Humboldt Bay is comprised of plant and animal species that are always inundated by water. Numerous fish, bird, and marine mammal species utilize subtidal areas.

3.4.3 Aesthetic and Visual Resources

Visual resources and scenic views occur in a diverse array of environments in the Humboldt Bay area, ranging in character from views of all-natural aesthetic features to views that mainly consist of the built environment. Views of the natural aquatic environment provide much of the Bay's visual quality, including views of areas such as the National Wildlife Refuge Complex, the City of Arcata's Marsh and Wildlife Sanctuary, and the California Department of Fish and Wildlife Areas. The built environment that is visible from the Project area includes industrial development, billboards, residential housing, wharfs/marinas, pilings, bridges, mariculture, roads, highways, farmland, and ranch land.

3.4.4 Climate and Air Quality

The coastal zone of Humboldt County experiences wet, cool winters and dry, mild foggy summers. Coastal summer highs range from the mid-60s to 70's, with lows from the upper 40's to mid-50's. In the winter, highs range from the low 40's to high 50's, with lows in the 30's and 40's. The coastal zone experiences a number of frosty nights in winter and early spring, though snowfall and hard freezes are rare.

The Project area is located in the North Coast Air Basin and is under the jurisdiction of the North Coast Unified Air Quality Management District. The North Coast Air Basin generally experiences good air quality and is in attainment of all federal and state air quality standards except for particulate matter smaller than 10 microns in diameter (PM_{10}) under California regulations. PM_{10} pollutants may be generated by transportation sources (tire wear, emissions, etc.); by construction-generated dust or smoke; and by smoke from appliances like woodstoves, barbecues, or fireplaces.

3.4.5 Hydrology and Water Quality

North Humboldt Bay generally consists of channels through mudflats. The ambient water quality in Humboldt Bay is good, with quality determined based on the general quality of water entering the Bay from the nearshore Pacific Ocean. On average, bay water is slightly warmer than incoming Pacific water. There are also seasonal and geographic variations in water quality in the Bay, with North Bay being both fresher and colder in winter and warmer and saltier in summer than Entrance Bay.

3.4.6 Hazards and Hazardous Materials

There are relatively few hazards or hazardous materials in Humboldt Bay, which is dominated by natural landscapes. However, Humboldt Bay has historically been used for industrial processes such as bleaching of paper pulp, pesticide and herbicide manufacturing and waste incineration, which likely contributed chemicals such as dioxins to the Bay (Pacific Shellfish Institute 2007). In addition, the Bay is frequently transited by recreational and commercial watercraft with internal combustion engines, which pose a hazard associated with the potential release of fuel and lubricants into the Bay.

3.4.7 Recreation

Recreation activities in and around North Bay include boating, paddling (e.g., kayaks, canoes and stand-up paddle boards), fishing, clamming, birdwatching, and hunting. Hunting for waterfowl is conducted on the bay, sloughs, marshes, and adjacent agricultural and other uplands. Hunting (regulated by the California Department of Fish and Wildlife) is allowed at several locations around the bay.

3.4.8 Noise

Although local conditions vary widely, the Humboldt Bay area is generally a relatively quiet setting, where sound created by human activities is added to a largely natural ambient acoustic setting, which varies according to location, topographic features, local meteorological conditions, and the proximity to sound sources. Representative noise sources in the Humboldt Bay area include both stationary and mobile sources:

- Traffic noise from highways (Highway 101 and State Route 255, including the bridges over Humboldt Bay) and other traffic corridors.
- Activities associated with commercial, industrial, and recreational uses (including those associated with the Eureka waterfront, Woodley Island, the Samoa Peninsula, and the North Spit).
- Motorized watercraft, boats, ships, navigation aids, and marine-related equipment.
- Aircraft, including small planes and helicopters.

However, the overall, time-averaged noise levels appear to be relatively low throughout the area (HBMP 2007).

3.4.9 Transportation/Traffic

Humboldt Bay is regularly transited by commercial and recreational boat traffic. Humboldt Bay serves as a working port handling ocean-going vessels with both domestic and international cargoes. It is the only deepwater shipping port between San Francisco and Coos Bay, Oregon. The Harbor also houses non-cargo commercial uses including a commercial fishing fleet and mariculture activities. Recreational traffic in Humboldt Bay includes non-motorized vessels such as kayaks, stand-up paddle boards, and canoes. Recreational hunters and fishers also transit the bay in both motorized and unmotorized vessels. Except for small vessels with shallow drafts, most commercial and recreational boat traffic utilizes the deepwater channels (see Figure 6.5.4) (e.g. Arcata Channel, North Bay Main).

Section 4.0 Project Description

4.1 Project Location

The Project site is located in the north and central parts of Humboldt Bay, California. Humboldt Bay encompasses roughly 62.4 square kilometers (about 15,400 acres) at mean high tide in three geographic segments: South Bay, Entrance Bay, and North Bay. The leased area includes approximately 1,827 acres owned or held in trust by the City of Eureka, approximately 1,452 acres owned or held in trust by the Harbor District, approximately 515 acres owned by Karamu Corporation, approximately 6 acres owned by the MCSD, approximately 5.5 acres owned by Joanne Sprague, and approximately 514 acres owned by Coast.[1] Figure 4.1 depicts the Project site within Humboldt Bay and North Bay. Figure 4.2 depicts the boundaries of Coast's leased and owned area in North Bay. Figure 4.3 depicts the area historically and currently farmed by Coast. Figure 4.4 depicts the acreage currently farmed by Coast and the additional 622 intertidal acres proposed for cultivation as part of this Project.

4.2 Surrounding Land Use Settings

Coast's aquaculture operations are located on intertidal and subtidal lands of North Bay and Central Bay that are owned or leased by Coast. The areas surrounding Coast's operations are dominated by tidal flats, tidal channels and open water. The project area is located within tidal and submerged lands granted to the Harbor District and City of Eureka by the State Lands Commission. Because the project is located within Humboldt Bay tidelands, the Harbor District has permitting authority. The entire project area is zoned "Natural Resources – Wetland" by Humboldt County. The Harbor District's Humboldt Bay Management Plan classifies the area as "Combined Water Use – Mariculture" (HBMP 2007). Surrounding areas are either classified "Combined Water Use – Mariculture" or "Bay Conservation" by the Harbor District and zoned "Natural Resources – Wetland" by Humboldt County.

[1] Coast is in the process of finalizing the leases with the MCSD and Joanne Sprague. While a portion of Coast's existing culture is located on the proposed lease area, none of the proposed expansion area would be included in the MCSD or Sprague leases.

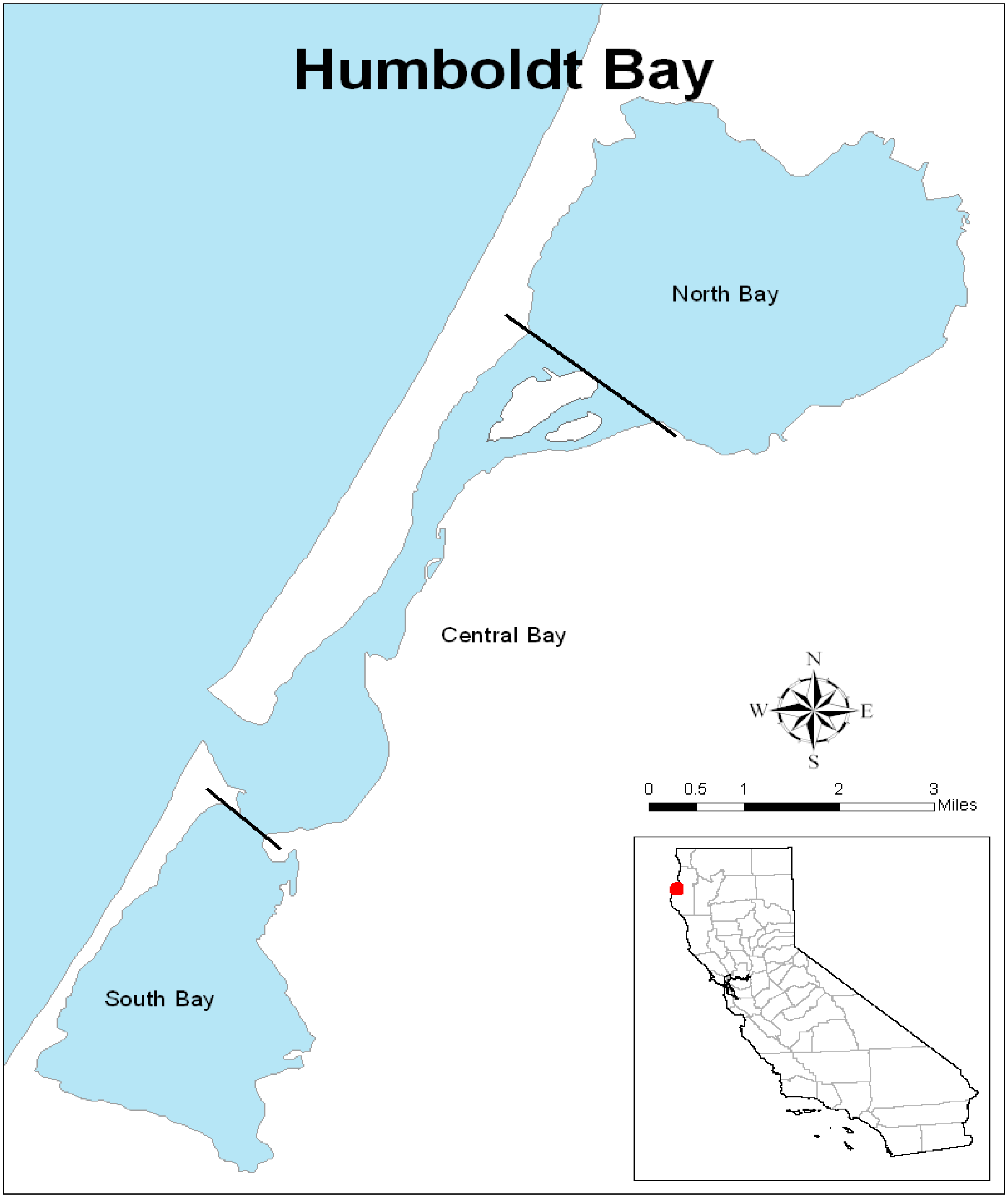


Figure 4.1 Map of Humboldt Bay depicting South, Central and North Bays. The Project is located in North Bay and Central Bay.

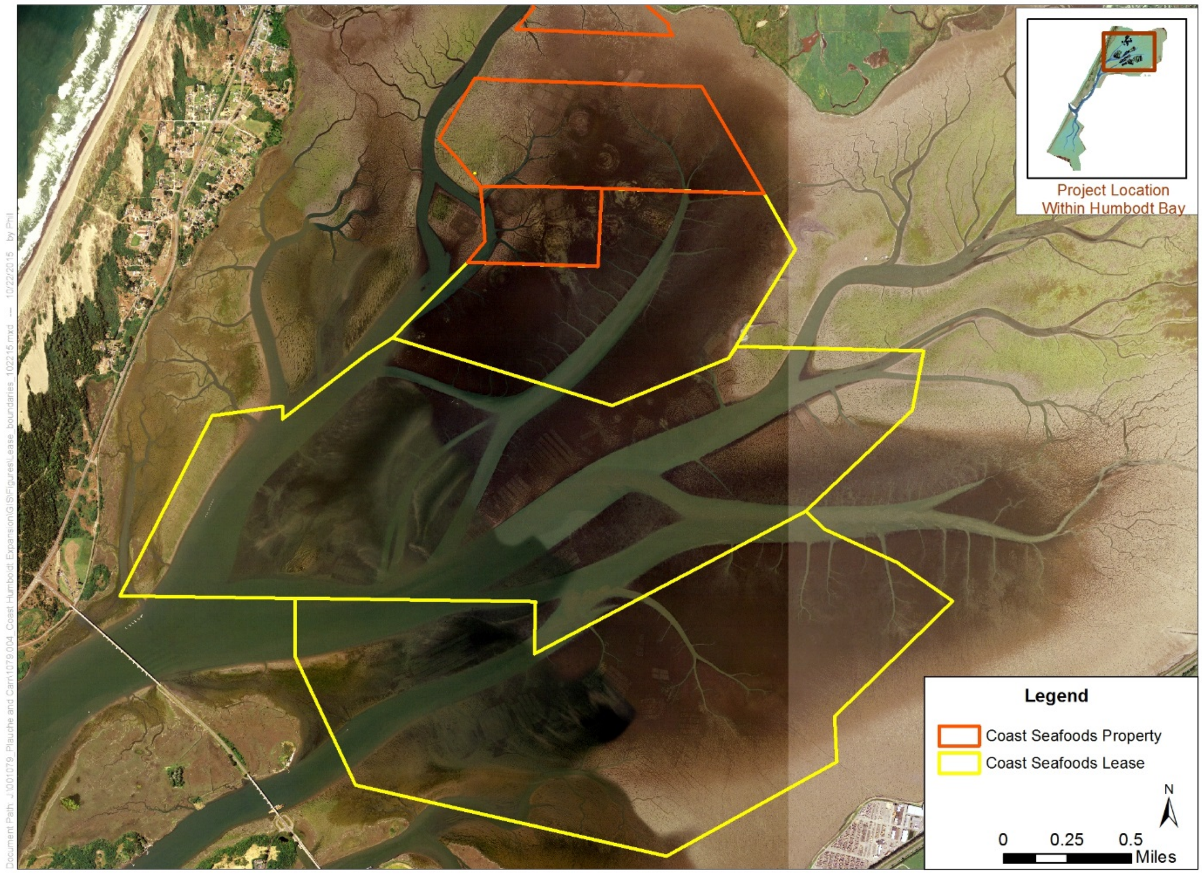


Figure 4.2 Coast's shellfish culture leases and ownership in Humboldt Bay, California.

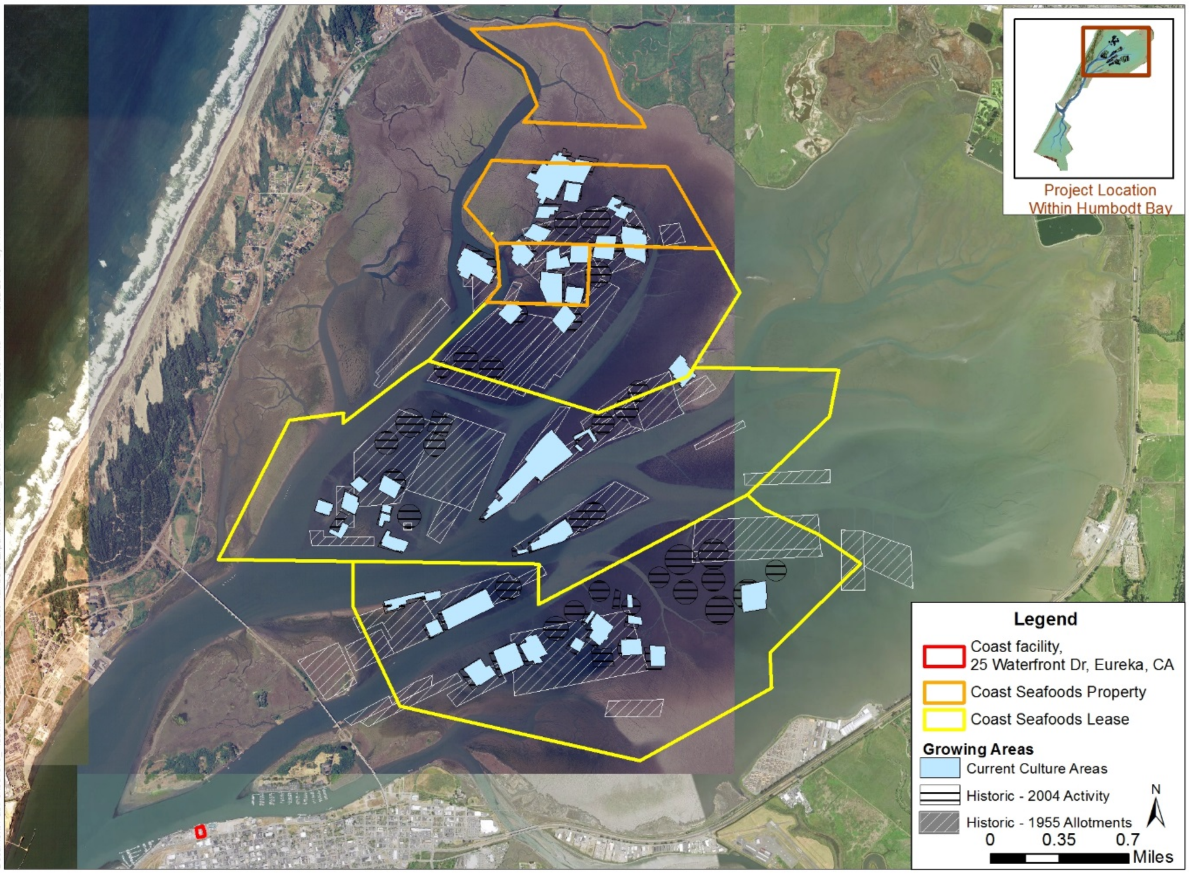


Figure 4.3 Map of Coast's historical and current culture footprint within North Bay and of the boundaries of Coast's current owned and leased area.

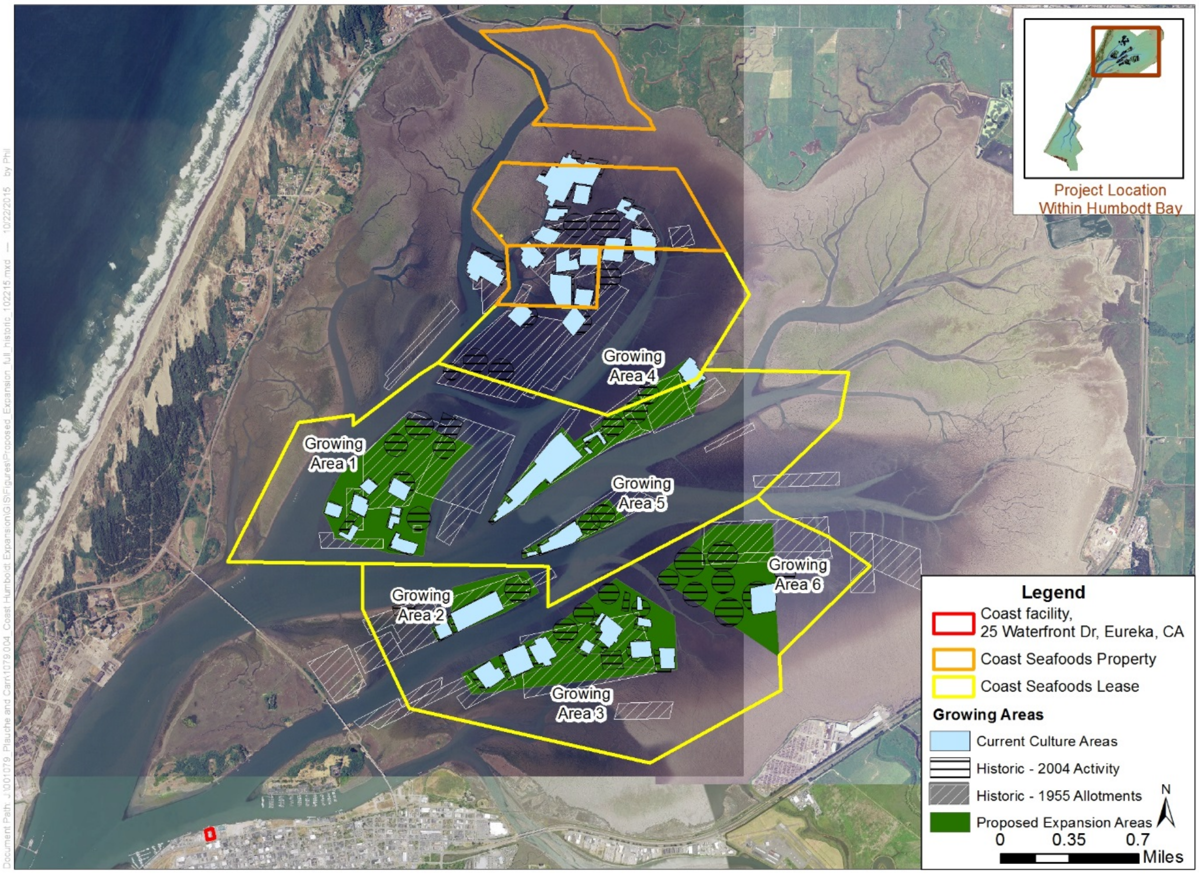


Figure 4.4 Areas proposed for continued and expanded shellfish culture in North Bay.

4.3 Project Background and Existing Operations

Coast has been culturing shellfish in Humboldt Bay, California since the early 1950's. Coast's predecessors in interest cultured shellfish in Humboldt Bay since the early 1900s. Historically, Coast cultured as much as 1000 acres of tidelands for oyster culture within its owned and leased footprint. Coast traditionally cultured shellfish using bottom culture methods, which entailed growing oysters directly on the bay bottom and harvesting them with an oyster dredge. In the mid to late 1990s, in response to requests from regulatory agencies, Coast began to transition its operations to more environmentally sustainable off-bottom culture methods.

In 2006, Coast reduced its operational farm footprint to 300 acres within North Bay and Central Bay using exclusively off-bottom culture methods (longline and rack and bag) to cultivate Pacific and Kumamoto oysters. Coast's cultivated footprint boundaries have not changed since its 2006 approvals. The off-bottom culture methods were approved pursuant to a Mitigated Negative Declaration (SCH 99062069), Harbor District Permit 04-03, USACE Permit No. 26912N, and Coastal Commission Coastal Development Permit E-06-003. These approvals also permitted 10 clam rafts, a FLUPSY, intertidal nursery, and wet storage areas. Coast also received approval for an additional 20 clam rafts within its leased area in 2012, pursuant to a Negative Declaration, Harbor District Permit Amendment 04-03-1, USACE Permit No. 2011-00428, and Coastal Commission Permit E-02-005-A2. This DEIR incorporates by reference the analysis presented in the prior Mitigated Negative Declarations and accompanying Initial Studies. Figures 4.5 and 4.6 depict the locations of Coast's existing culture activities in Humboldt Bay.

Coast currently uses approximately 294 acres of its existing beds to cultivate Pacific and Kumamoto oysters using longline culture (cultch-on-longline and basket-on-longline). The existing footprint includes approximately 35,174 longlines (509 basket-on-longline and 34,665 cultch-on-longline). These culture methods, which will also be utilized in the proposed expansion area, are discussed below.

The remaining acreage within the existing operational footprint is apportioned as follows: approximately 4.8 acres utilized as a nursery area; approximately 0.04 acres utilized for the FLUPSY; approximately 0.04 acres utilized for wet storage floats; and approximately 0.93 acres utilized for clam rafts.[2] Other than slightly reducing the existing planted footprint, as described below, Coast does not propose any changes to the existing cultivated area.

[2] While Coast's existing permits allow for one 20-ft-wide by 27-ft-long floating work platform associated with the clam rafts, Coast currently does not moor a permanent work platform to the clam raft operations. The work platform may be moored to the clam rafts on a temporary basis as needed.

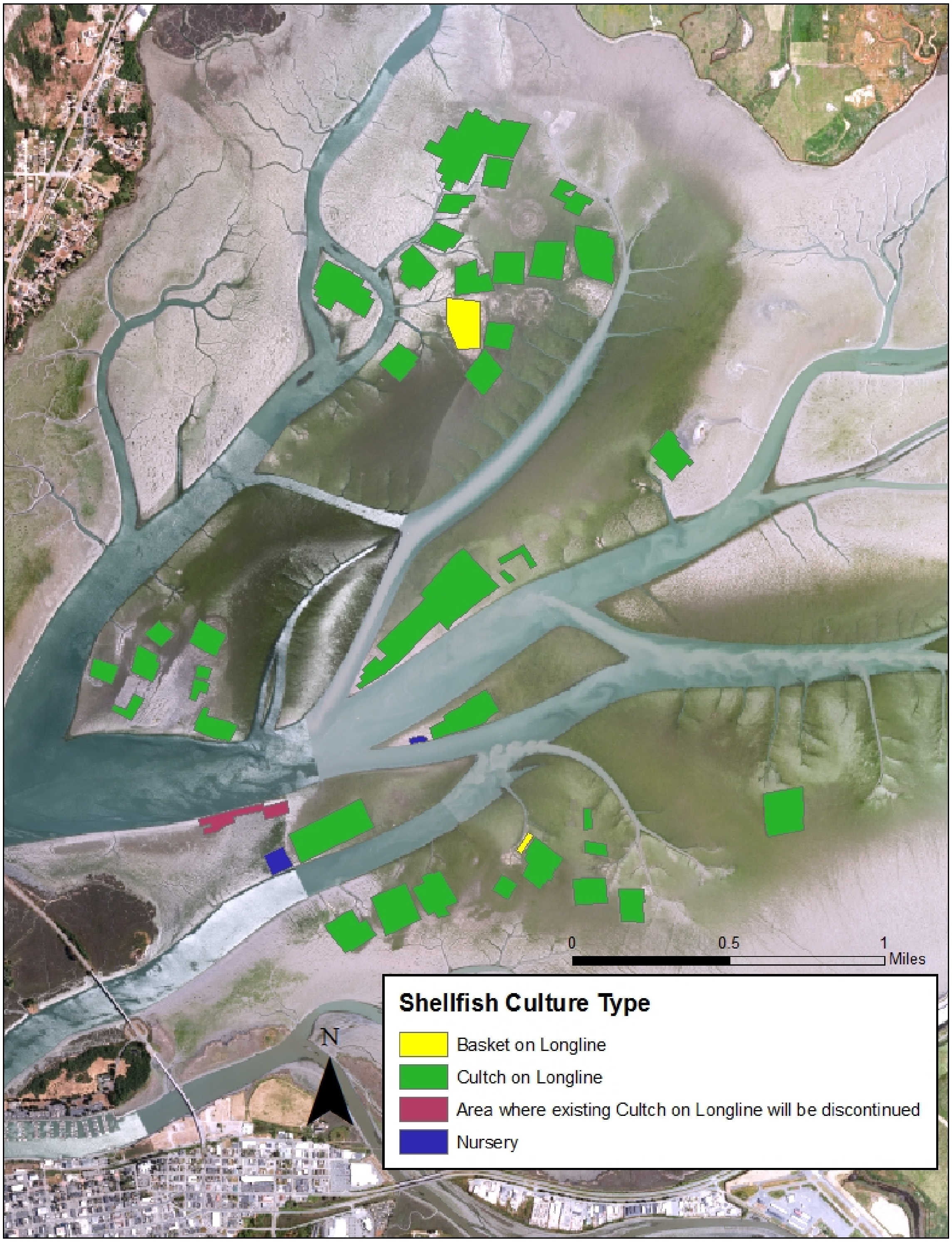


Figure 4.5 Coast's existing intertidal shellfish culture footprint and methods, including a 5.5-acre area where existing culture will be discontinued.

Figure 4.6 Coast's existing subtidal shellfish culture footprint and methods.

4.3.1 Intertidal Nurseries

Figure 4.7 Seed bags at a nursery.

Long-line culture utilizes cultch set with spat attached, collectively referred to as seed. Coast transports the seed by truck from Quilcene, Washington. Each year a representative sample of each type of seed is examined by a United States Department of Agriculture/Animal Plant Health Inspection Service certified veterinarian and the results of this examination are sent to the California Department of Fish and Wildlife (CDFW) with an application for import of seed. Once appropriate results are verified, CDFW issues a certification for the import of oyster seed. Upon arrival, Coast places the bags of seed in the intertidal nursery on Gunther Island. Coast stacks the seed on pallets in order to prevent the bottom of the stack from becoming silted in, which suffocates the seed (Figure 4.7). After a period of time, which varies due to seasonal conditions (usually 2-3 months) the seed is removed from the nursery in small batches daily and is brought to the processing plant. At the plant, individual pieces of cultch are braided into the long-line rope and rebagged. Once the cultch has been braided into the rope and bagged, it is put into the bay and placed on either a bed or on Coast's Arcata Channel nursery to await planting.

The seed is transported by boat to nursery areas located in Humboldt Bay on mudflats north of Gunther Island and along Arcata Channel. At these nursery areas the seed is allowed to grow to a less fragile size and age. This process, called beach hardening, is needed to allow the seed to gain size and strength prior to planting. The seed is allowed to beach harden for 3 to 8 months depending on time of year, growth and condition of the seed.

4.3.2 Intertidal Cultch-on-Longline Culture

Kumamoto oysters and Pacific oysters are grown using the cultch-on-longline method. Planting is accomplished by placing the seeded long-line on notched PVC stakes that are arranged in rows on the mudflats. The longlines are strung through notches on top of the PVC stakes, suspending the oyster seed approximately 1 ft above the bay bottom (Figures 4.8 & 4.10). Longline spacing within Coast's existing operational footprint varies, with most spaced 2.5 ft apart, with 10 ft between each group of 5 lines (Figure 4.9). Some beds have 2.5 ft spacing over the entire bed.

Long-lines are planted by crews of six at tides low enough to allow for walking on the planting bed. Bags from the nursery are gathered with a skiff and a hook during a high tide, to plant during the subsequent low tide. Alternatively, the planting crew can pull the skiff into the nursery by hand when the tide is coming in and manually throw the bags into the skiff. Bags are then transported to the bed and placed along the edge of a row of empty long-line pipe. At low tide, the longlines are cut and pulled out alongside the empty pipe. Each bag is clipped to the long-line on the notch of each pipe. This continues until all bags are planted. Due to the infrequency of adequately low tides, the planting crew typically works every available low tide.

Planted beds are inspected monthly, with virtually no other activity occurring on the bed until harvest. Inspection involves walking on the bed at low tide to make sure that the lines are in the notches.

Oysters are harvested when they reach harvestable size (18 to 36 months) subject to seasonal conditions and consumer demand. Two long-line harvest methods are used. Hand picking involves placing round 20-bushel tubs on the bed at high tide using an oyster scow. Bushel tubs are round, galvanized steel or aluminum tubs that sit 32" high and have a 42" diameter. Tubs are hand filled at low tide. Longlines are cut into manageable single clusters and placed in the tub with a floating ball attached. At high tide, tubs are placed in the oyster scow, unloaded, then placed back on the bed to be refilled. The long-line harvester method involves pulling individual lines onto a scow at high tide, either by hand or with a hydraulically operated roller. Hand-pulled lines are cut into individual clusters, usually at the plant. Mechanically pulled lines are run through a breaker that strips the clusters from the line.

Figure 4.8 Cultch-on-longline oyster culture.

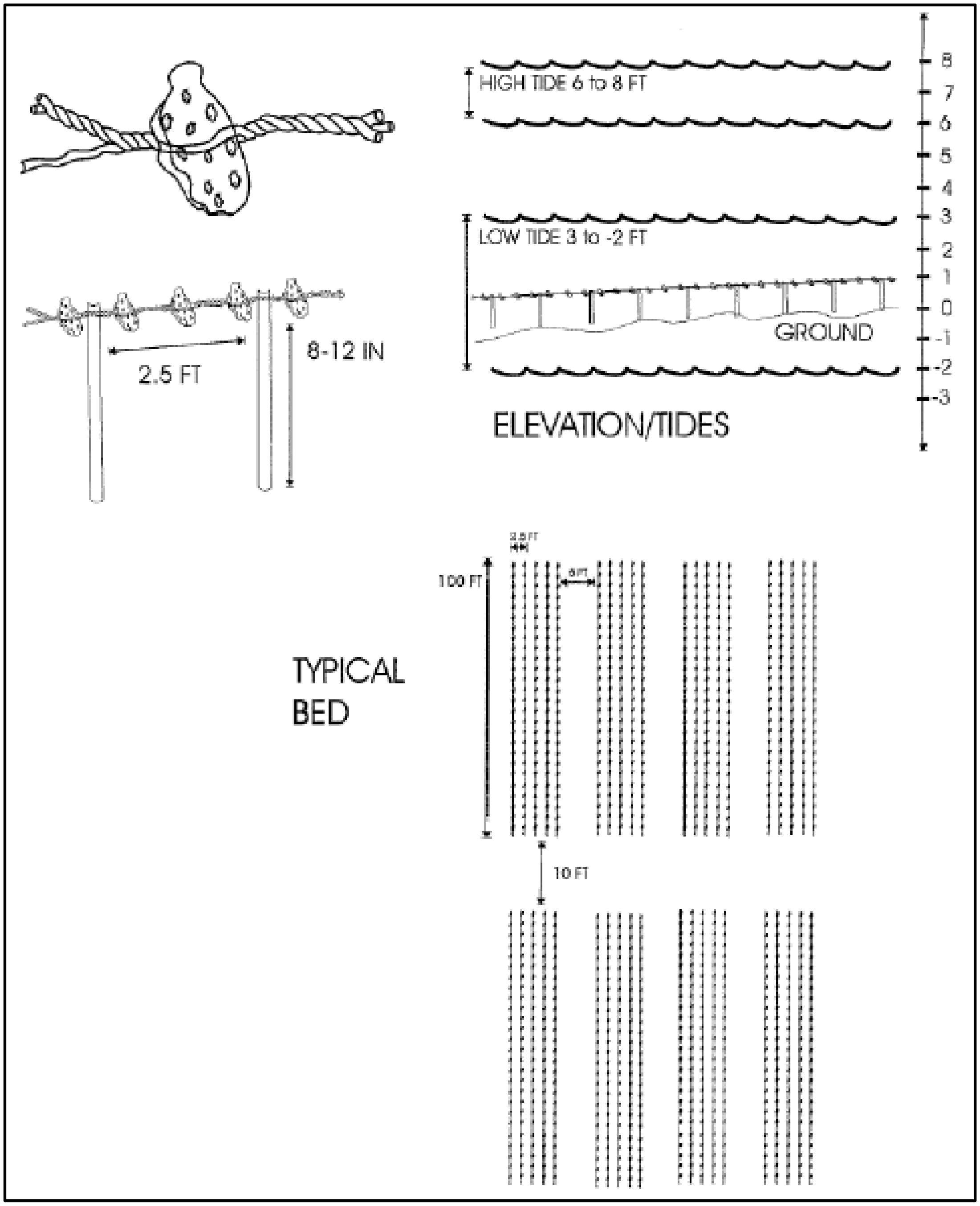


Figure 4.9 Configuration of cultch-on-longline oyster culture within Coast's existing culture area.

Figure 4.10 Cultch-on-longline culture at 2.5 ft spacing.

4.3.3 Intertidal Basket-on-Longline Culture

Kumamoto oysters are grown using the basket-on-longline culture method which utilizes baskets suspended on monofilament line tied between 2-inch diameter schedule 80 PVC pipes (Figure 4.11).

A 3/8" polyethylene sleeve encases the 5 mm diameter monofilament line. The baskets are approximately 24" x 10" x 6" in size and held on the line with plastic clips. A float, approximately 2.5" in diameter and 5.5" long, is often attached to the baskets so they float up during high tides. The line is positioned approximately 26" to 40" off the bottom, making the baskets roughly 1' from the bottom during low tides.

Basket-on-longline lines within Coast's existing culture areas use 3-ft spacing between groups of three lines, with an open row of 20 feet between groups of three lines. Basket-on-longline spacing in the existing culture area is shown in Figure 4.12.

Figure 4.11 Basket-on-longline culture.

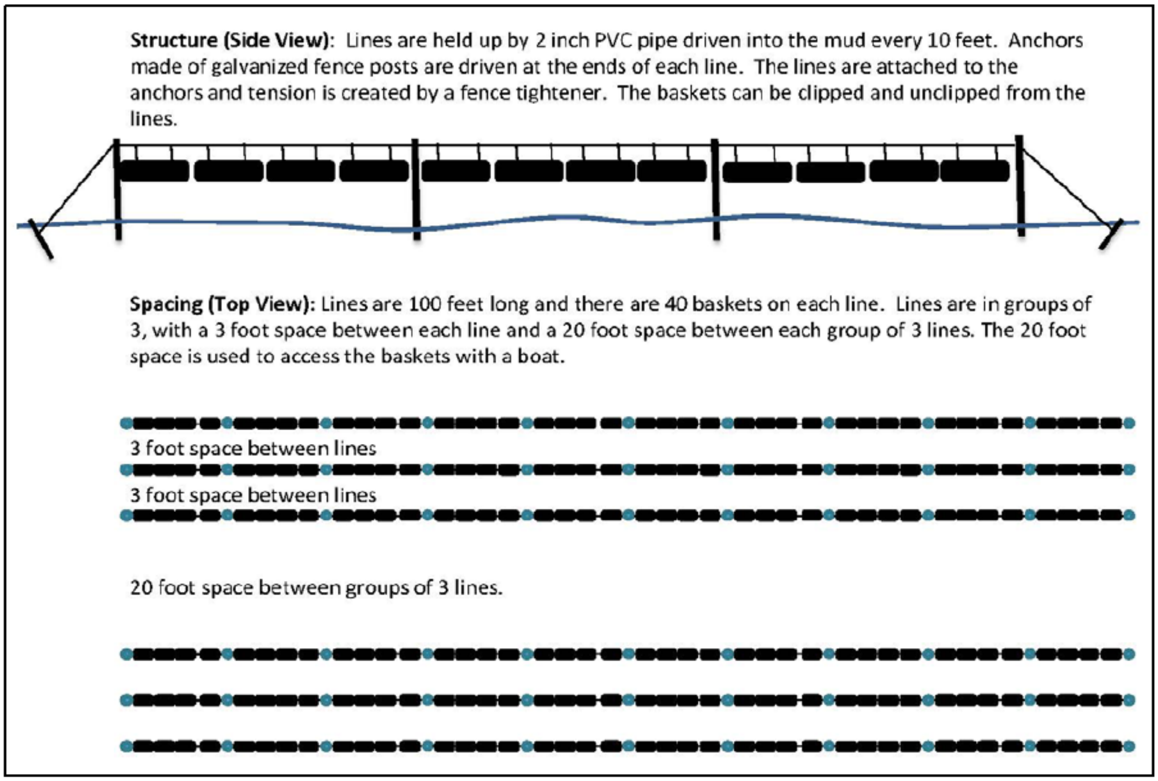


Figure 4.12 Basket-on-longline culture configuration within Coast's existing cultivated acreage. Line length maximum: 100'.

4.3.4 Subtidal Floating Upwelling System

Manila clams, Kumamoto and Pacific oyster seeds are matured in the FLUPSY. The FLUPSY is located on the west side of the entrance channel south of the Simpson wood chip loading dock in Fairhaven, 200 yards from the shoreline in 20 ft of water. The FLUPSY is tied to the dock at the Eureka Boat yard. The FLUPSY is constructed of aluminum with poly-encapsulated floats with a submerged trough containing a paddle wheel (Figure 4.13). This trough is surrounded by 16 open wells containing upwelling bins. The paddle wheel moves the water out of the trough. For the trough to fill, the water must pass through the upwelling bins containing shellfish seed. The bins are removable for seed maintenance. The seed is about 1.4 mm long when it arrives and matured to roughly 6 mm before being placed in bags. FLUPSY activities include maintaining the seed by rinsing off bins with water, and seed grading based on size.

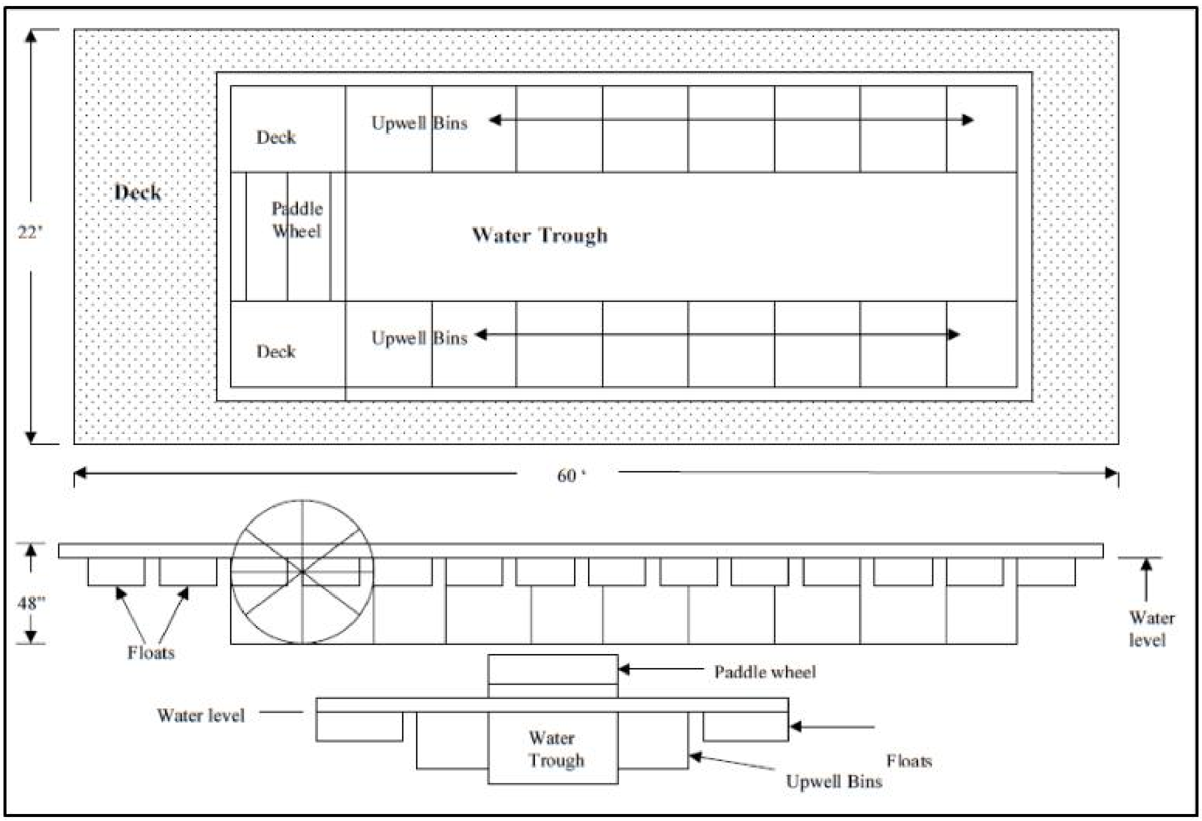


Figure 4.13 FLUPSY Configuration.

4.3.5 Subtidal Clam Rafts

Manila clam seed is matured in clam rafts (Figure 4.14). The clam rafts are located along the west side of the entrance to Mad River Slough Channel opposite Bird Island, approximately ½ mile north of the Samoa/Hwy 255 bridges. Rafts are attached to steel navy anchors in approximately 20 ft of water and accessed by skiff. There are 30 floating rafts arrayed in two groups of fifteen, each raft is 12 ft wide by 20 ft long. Rafts are constructed from aluminum and use polyethylene encapsulated Styrofoam for floatation. Each raft has 24 tray wells containing seed nursery trays in stacks of 20 suspended in each well. The rafts only contain seed, which are shipped elsewhere for grow-out and harvest. The activities at the clam rafts include placing and removing stacks of trays daily, cleaning and routine maintenance. Twice each year, anchors and ground tackle are examined and repaired as necessary by divers using scuba, skiffs and an oyster barge.

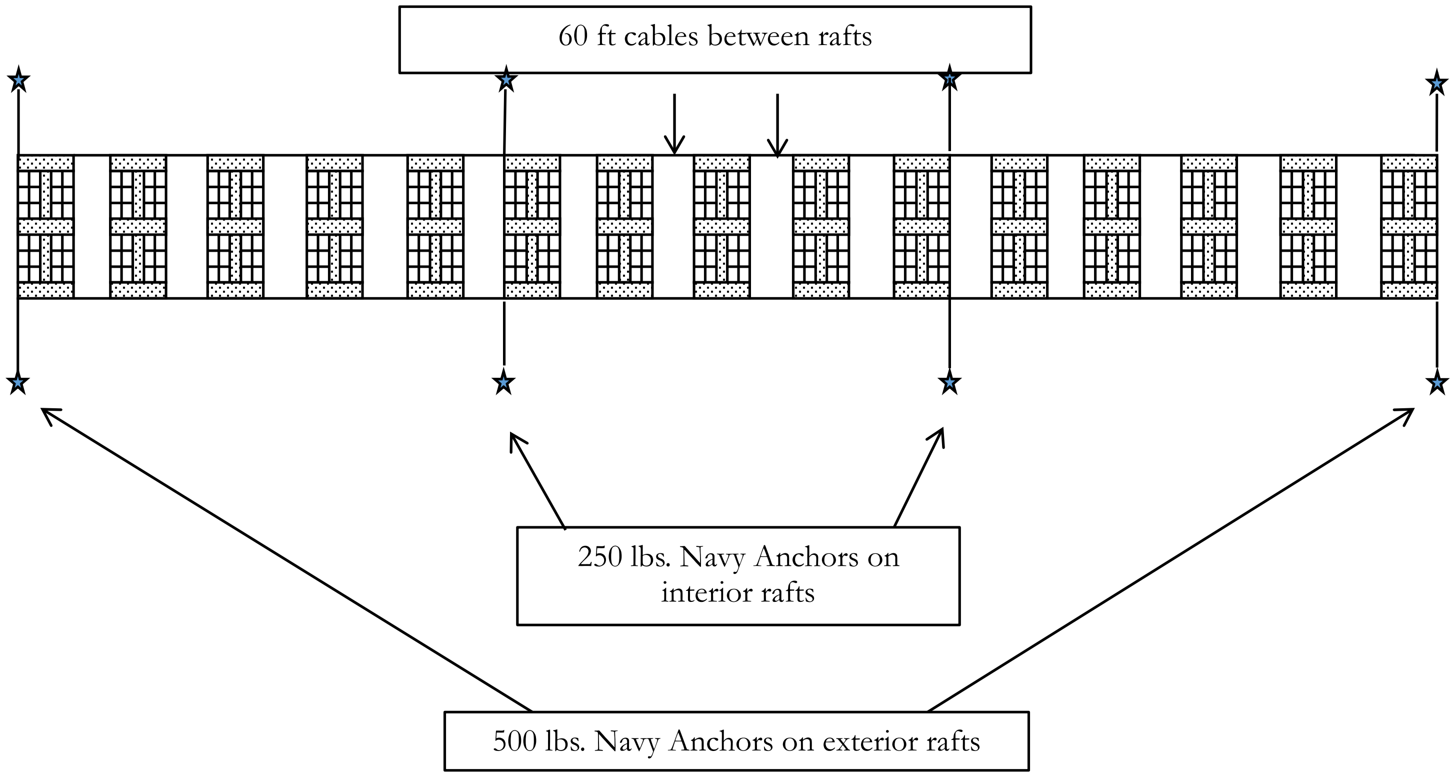


Figure 4.14 Configuration of clam rafts.

4.3.6 Subtidal Wet Storage Floats

The wet storage floats are located in the "cut across" channel between Bird Island and Mad River. The floats are anchored in approximately 20 ft of water in a series of four 20-ft by 20-ft square wood frames, with 60 ft between floats (Figure 4.15); clam rafts in the same array or smaller may also be used as wet storage floats. Bags of mature oysters recently harvested and ready for distribution to wholesalers are temporarily placed in the floats to maintain the oysters' fresh condition. Bags of oysters are placed and removed by hand and transported by boat.

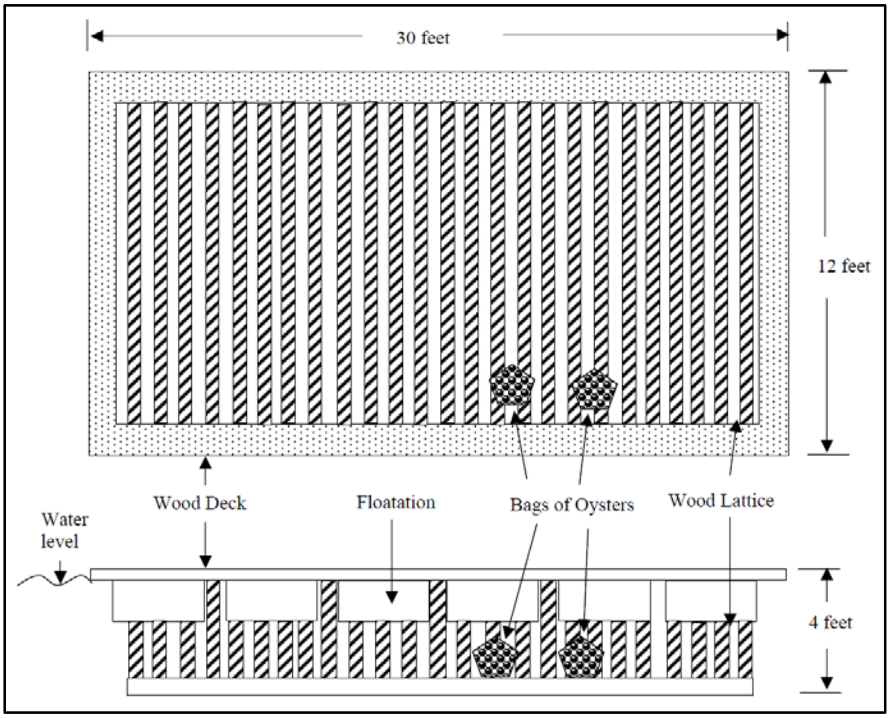


Figure 4.15 Configuration of wet storage floats.

4.3.7 Maintenance and Operation of Existing Culture Areas

Coast maintains a fleet of 6 small watercraft and three larger vessels to operate and maintain its existing culture footprint in North and Central Bay (Table 4.1). Four skiffs operate throughout the bay, with each skiff making an average of one 4-hour trip per day, five days per week. Three of the skiffs are staffed by crews of five while the fourth carries a smaller two-person crew. Because all skiffs do not operate on the same day, skiffs are typically active 7 days a week. Coast also maintains two small scows, which each make an average of two 4-hour trips per day, 5 times a week. Scows are staffed by crews of five. As with skiffs, one or both scows are likely active 7 days a week.

Coast also operates three larger vessels: a clam boat (the Pantherotti), a Kumamoto oyster harvester (Mary Elizabeth) and a harvest scow for hand-picked oysters (Elusive). The Pantherotti makes two 2-hour trips to Coast's clam rafts 5 times a week carrying a crew of five. The Mary Elizabeth is active 5 days a week, typically making one 6-hour trip in a day with a crew of four. The Elusive is active just 2 days a week, typically making one 4-hour trip in a day with a crew of four.

Table 4.1 Summary of Coast's Activity on the Bay under Existing Conditions.*						
Vessel Name	Trips/ day	Hours/ trip	Days/ week	Trip/ week	Hours/ week	# of crew
Skiff 1	1	4	5	5	20	5
Skiff 2	1	4	5	5	20	5
Skiff 3	1	4	5	5	20	5
Skiff 4	1	4	5	5	20	2
Scow 1	2	4	5	10	40	5
Scow 2	2	4	5	10	40	5
Pantherotti[1]	2	2	5	10	20	5
Mary Elizabeth[2]	1	6	5	5	30	4
Elusive[3]	1	4	2	2	8	4
Totals				**57**	**218**	**40**

** Activity may be vary depending on weather conditions, crew availability, and other factors.*
[1] Clam vessel
[2] Kumamoto oyster harvester
[3] Harvest scow for hand-picked oysters

When working on beds,[3] larger vessels are anchored in deeper channels outside of tidal flats and eelgrass habitat. Smaller skiffs are anchored at the edge of the bed being worked; where possible anchors are dropped in sloughs without eelgrass. When anchoring over a tidal flat is necessary, the anchor is dropped on mudflats or on the edges of channels/sloughs where feasible in order to avoid eelgrass. All vessels use Danforth anchors: skiffs use 10 lbs. anchors and harvest vessels have 25-50 lbs. anchors; heavier anchors are carried for safe anchoring in the event of breakdown. Anchor chains on skiffs are approximately 7 ft and, on harvest vessels, 33 ft.

The frequency of visits to any one shellfish bed varies by the culture method employed and the type of activity being conducted (Table 4.2). Visits to cultch-on-longline beds are the least frequent. Outside of the harvest and planting cycles, which occur every 1.5-3 years, depending on culture method, species of oyster, and other variables, cultch-on-longline plots receive an average of one visit per month for maintenance and inspection. Basket-on-longline plots are visited more frequently to repair baskets, grade seed, and perform other tasks. Typically, crews are out on different areas of each basket-on-longline plot on an almost daily basis; however, a single longline within a basket-on-longline bed will typically be visited (e.g. for grading and sorting the shellfish; repairing baskets) only once every 4 months. Visits to subtidal rafts are more frequent, occurring daily in most cases.

[3] Culture beds are marked by 10-ft long, white PVC pipe. Demarcation pipe is 1.5-2 inches in diameter and is buried in the substrate 1.5-2 ft deep.

Table 4.2 Frequency of worker activity by culture method.*		
Culture Method	**Type of visit**	**Frequency**
Cultch-on-longline	Harvesting/Planting	1/1.5-3 years. Harvest occurs over an approximately 2-day per acre period. Planting occurs over an approximately 2-day per acre period.
	Maintenance and Inspection	1/month
Basket-on-longline	Harvesting/Planting	3/year. A crew will work through an entire bed in 4 months at a rate of 12 days/acre and will pull and replace baskets in a different part of the bed each day. Work will take place on a 5-6 day per week schedule. A single area of any one bed is typically visited only once every 4 months.
	Maintenance and Inspection	Crews typically perform maintenance and inspection activities while on the beds for harvesting/planting, as described above. Occasionally, more frequent visits are necessary to make repairs.
Intertidal nursery	Maintenance and Inspection	Daily, depending on tides.
FLUPSY	Maintenance and Operation	Daily
Clam Rafts	Maintenance and operation	Twice daily
Wet Storage Floats	Maintenance and operation	Daily
** Frequency of visits will depend on weather, low tides, crew availability and other factors.*		

4.4 Project Overview

Coast is proposing to extend regulatory approvals for 294.5 of the 300 acres it currently farms in North Bay and to discontinue farming on 5.5 of its existing acres (Figure 4.4). Coast is also proposing to increase shellfish aquaculture production by planting an additional 622 intertidal acres and increasing the capacity of its already-permitted FLUPSY by adding eight new culture bins. In total, the Project would result in 916.5 acres of intertidal oyster culture, which represents 21% of Coast's owned and leased land.

4.5 Project Characteristics

4.5.1 Project Objectives

The overall purpose of the project is to provide a comprehensive plan for management of Coast's owned and leased area and expansion of its shellfish farm to meet the increasing demand for its product. The project is guided by several major objectives that will aid decision makers in their review of the project and associated environmental impacts:

- To expand Coast's shellfish farm to increase future oyster production and meet Coast and Pacific Seafood's increasing customer demand for raw and shucked oysters.
- To conduct comprehensive eelgrass monitoring and develop sustainable oyster cultivation practices that can be adapted to documented site conditions.
- To create additional job opportunities and sustainable economic development for Humboldt Bay and local jurisdictions.
- To enhance a source of local sustainable seafood and reduce Humboldt County's and California's reliance on imported seafood.
- To provide comprehensive planning of Coast's owned and leased areas in Humboldt Bay.
- To develop a flexible farming plan that can adapt to Coast's operational and management needs, environmental conditions, and farm conditions.
- To utilize Coast's existing historic leased and owned areas while maintaining undeveloped areas for habitat and recreational uses.
- To locate oyster beds in areas with optimal growing conditions to maximize efficiency and limit the spatial footprint of the farm.

4.5.2 Species Cultivated

The species proposed for cultivation are Kumamoto oysters, Pacific oysters, and Manila clams, which are already cultivated by Coast on its existing acreage.

4.5.3 Culture Methods

Coast will use the same general culture methods in the 622-acre expansion area that are currently being utilized within its existing footprint described above (intertidal cultch-on-longline and basket-on-longline), as well as a limited amount of and rack and bag culture.

4.5.3.1 Intertidal Cultch-on-Longline Culture

Coast will grow Kumamoto and Pacific oysters using cultch-on-longline culture on a maximum of 522 acres of the expansion area, utilizing 5 ft spacing between longlines with a 10 ft row between shellfish beds. Figure 4.16 depicts the spacing regime for cultch-on-longline that will be used in the expansion area. The expanded area will include approximately 43,848 additional cultch-on-longlines.[4] The frequency of visits to cultch-on-longline plots in the expansion area will be as described in Table 4.2.

[4] This estimate is based on Coast's conceptual planting design incorporating the proposed longline spacing. The final planting design will be based on Coast's operational needs, farm conditions, environmental factors, and conditions of approval and mitigation measures. Coast reserves the right to modify the planting design as needed to respond to such factors, provided that it is consistent with the overall project description and regulatory permits.

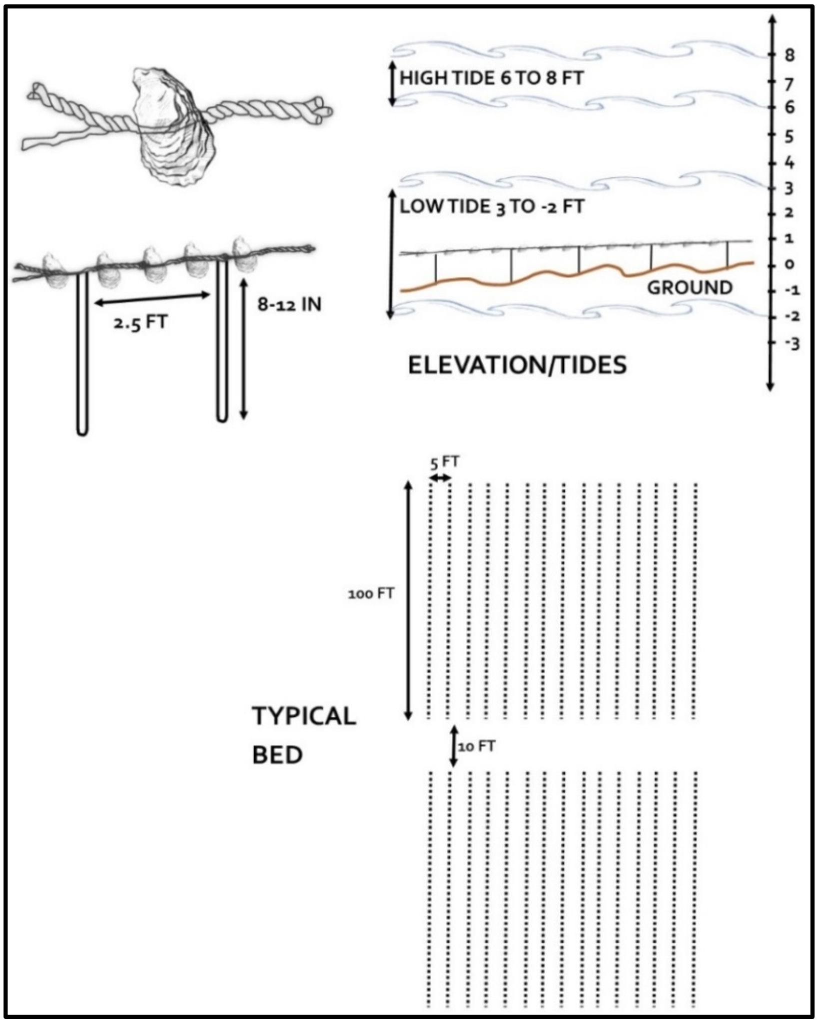


Figure 4.16 Proposed configuration of cultch-on-longline within Coast's expanded culture area.

4.5.3.2 Intertidal Basket-on-Longline Culture

Coast will plant Kumamoto oysters using basket-on-longline culture on a maximum of 96 acres of the expansion area, utilizing groups of three lines spaced 5 ft apart with an open row of 20 ft between groups of 3 longlines and 10 ft between shellfish beds. Figure 4.17 depicts the spacing regime for basket-on-longline that will be used in the expansion area. The expanded area will include approximately 4,608 additional basket-on-longlines.[5] The frequency of visits to basket-on-longline plots in the expansion area will be as described in Table 4.2.

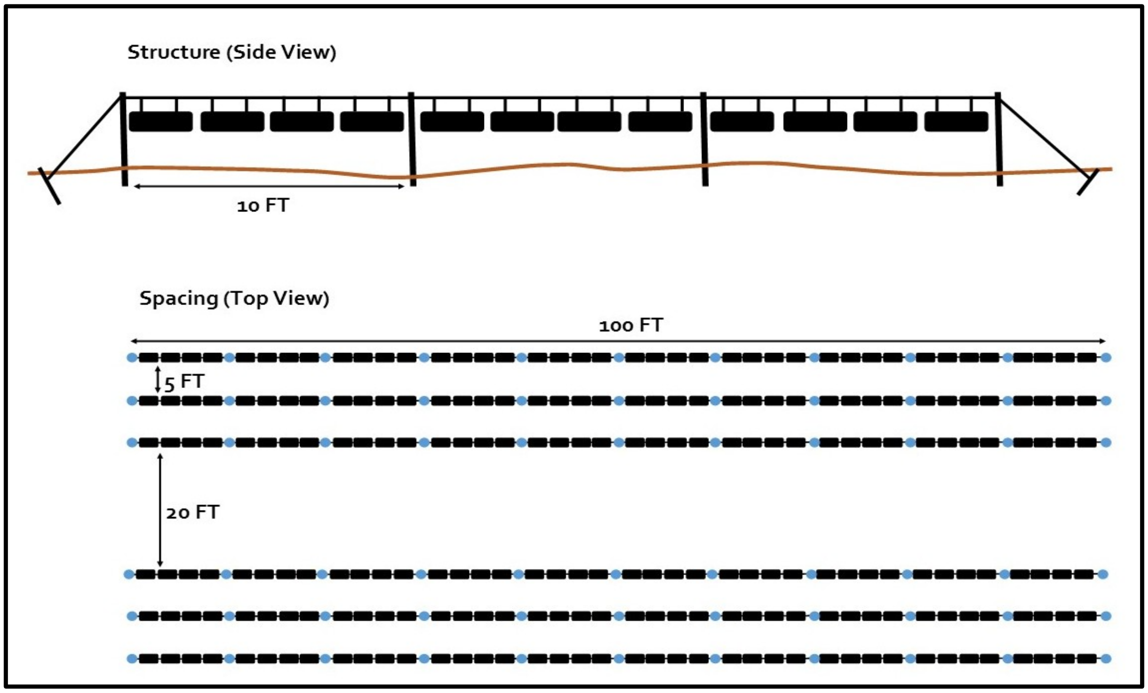


Figure 4.17 Proposed configuration for basket-on-longline culture within Coast's expanded culture area. Line length maximum: 100'.

4.5.3.3 Intertidal Rack and Bag Culture

Coast will plant rack and bag culture on a maximum of 4 acres of the expansion area to grow Kumamoto and Pacific oysters. The oysters are grown as "singles", not attached to any structure or to each-other, in polyethylene mesh bags on rebar frames. Each frame is 3 ft x 12 ft and supports 3-6 bags attached to the frame via industrial rubber bands (Figure 4.18). A bag is initially seeded with oysters and placed in intertidal areas. The bags are inspected up to three times per week and flipped approximately once every two weeks. Oyster seeds grow to market size in one-two years, depending on tidal height and primary productivity. Bags are harvested by hand (lifted from the racks into a skiff), processed and brought to market. Three rows of rack and bag structures are spaced 3 ft apart with an open row of 10 ft between groups of three racks lines, as illustrated in Figure 4.19. Any rack and bag culture placed within the expanded area will be placed at least 10 ft away from existing eelgrass beds. Operating and maintaining rack-and-bag plots is more intensive, and culturists typically visit rack-and-bag plots on an almost daily basis (Table 4.3).

[5] *See* Footnote 4.

Table 4.3 Frequency of worker activity on rack-and-bag plots.*		
Culture Method	**Type of visit**	**Frequency**
Rack-and-bag	Harvesting/Planting	3/year. A crew will work through an entire bed in 4 months at a rate of 12 days/acre and will pull and replace beds in a different part of the bed each day. Work will take place on a 5-6 day per week schedule. A single area of any one bed is typically visited only once every 4 months.
	Maintenance and Inspection	Crews typically work through a bed planted with rack-and-bag culture on an almost daily basis; on some days, crews might visit the whole bed and on others work may be limited to certain areas of a bed.
** Frequency of visits will depend on weather, low tides, crew availability and other factors.*		

Figure 4.18 Rack and bag culture in Humboldt Bay.

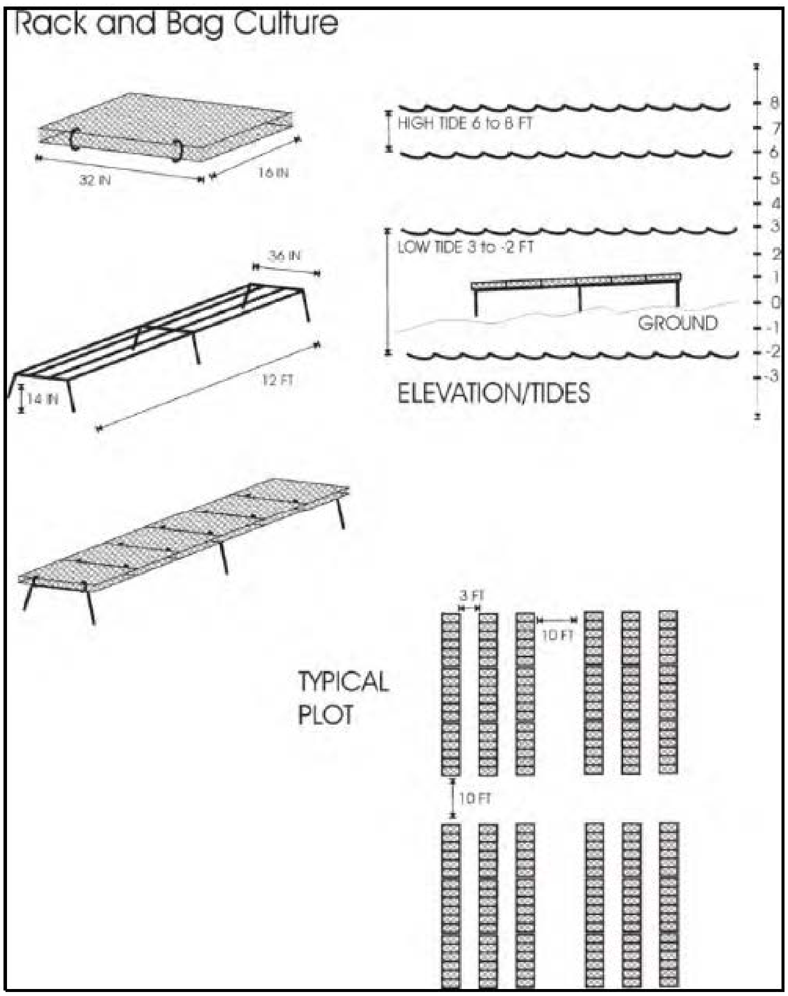


Figure 4.19 Rack and bag culture configuration.

4.5.3.4 Subtidal Floating Upwelling System

As part of the Project, eight upwell bins would be added to the FLUPSY as described in Section 4.3.4 above. Each bin will be 3 ft long x 3 ft wide x 3 ft deep. The frequency of visits to the FLUPSY will remain as described in Table 4.2.

4.5.4 Project Operation and Maintenance

In order to operate and maintain intertidal culture in the expansion area, Coast would add up to two small watercraft to its fleet (one scow and one skiff) and operate its existing harvest vessels more frequently (Table 4.4). The additional small watercraft would operate with the same frequency as Coast's existing vessels (one 4-hour trip, 5 days a week for the skiff and two 4-hour trips, 5 days a week for the scow). However, with the exception of one skiff, all skiffs and scows would carry a crew of seven rather than five workers. The Mary Elizabeth, used to harvest Kumamoto oysters, would operate on one additional day a week but maintain an average of one 6-hour trip per day. Coast's harvest scow for hand-picked oysters, the Elusive, would operate two additional days per week but maintain an average of one 4-hour trip per day. The number of crew on harvest vessels would not change. In total, the Project would result in an additional 18 boat trips throughout the bay per week, or an additional 74 boat hours.

Table 4.4 Summary of Coast's Activity on the Bay under the Preferred Alternative.*

Vessel Name	Trips/ day	Hours/ trip	Days/ week	Trip/ week	Hours/ week	# of crew
Skiff 1	1	4	5	5	20	7
Skiff 2	1	4	5	5	20	7
Skiff 3	1	4	5	5	20	7
Skiff 4	1	4	5	5	20	2
Skiff 5	1	4	5	5	20	7
Scow 1	2	4	5	10	40	7
Scow 2	2	4	5	10	40	7
Scow 3	2	4	5	10	40	7
Pantherotti[1]	2	2	5	10	20	5
Mary Elizabeth[2]	1	6	6	6	36	4
Elusive[3]	1	4	4	4	16	4
Totals				**75**	**292**	**64**

** Totals represent maximum activity on the bay in a given week. Activity may be less than represented depending on variables including weather conditions, crew availability, and market activity.*

[1] Clam vessel

[2] Kumamoto oyster harvester

[3] Harvest scow for hand-picked oysters

4.6 Project Approvals

This EIR examines the environmental impacts of Coast's Project and is also being prepared to address various actions by the City of Eureka, Harbor District and others. The anticipated approvals required for the Project include but are not limited to those shown in Table 4.5.

Table 4.5 Required Project Approvals.

Agency	Permit Type
Humboldt Bay Harbor, Recreation & Conservation District	Use Permit
City of Eureka	Conditional Use Permit
United States Army Corps of Engineers	Section 10 Rivers and Harbors Act
California Coastal Commission	Coastal Development Permit and Coastal Zone Management Consistency Determination
North Coast Regional Water Quality Control Board[6]	Section 401 Water Quality Certification

[6] There is uncertainty as to whether certification from the North Coast Regional Water Quality Control Board will be needed. This is currently being assessed by Coast and NCRWQCB.

Section 5.0 Project Alternatives

5.1 Purpose and Scope

5.1.1 Purpose

Section 15126.6(a) of the CEQA Guidelines states that an EIR must address "a range of reasonable alternatives to the project, or to the location of the project, which should feasibly attain the basic objectives of the project, but would avoid or substantially lessen any of the significant effects of the project and evaluate the comparative merits of the alternatives."

Key provisions of the CEQA Guidelines on alternatives are summarized below to explain the foundation and legal requirements for the alternatives analysis in the EIR.

- "[T]he discussion of alternatives shall focus on substantially lessening any significant effects of the project, even if these alternatives would impede to some degree the attainment of the project objectives, or would be more costly" (CEQA Guidelines 15126.6(b)).
- "The specific alternative of 'no project' shall also be evaluated along with its impact . . . The no project alternative analysis is not the baseline for determining whether the proposed project's environmental impacts may be significant, unless it is identical to the existing environmental setting analysis which does establish the baseline" (CEQA Guidelines 15126.6(e)(1).
- "The 'no project' analysis shall discuss the existing conditions at the time the notice of preparation is published, or if no notice of preparation is published, at the time environmental analysis is commenced, as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans . . ." (CEQA Guidelines 15126.6(e)(2).
- "The range of alternatives required in an EIR is governed by a 'rule of reason' that requires the EIR to set forth only those alternatives necessary to permit a reasoned choice. The alternatives shall be limited to ones that would avoid or substantially lessen any of the significant effects of the project. Of those alternatives, the EIR need examine in detail only the ones that the Lead Agency determines could feasibly attain most of the basic objectives of the project" (CEQA Guidelines 15126.6(f).
- "Among the factors that may be taken into account when addressing the feasibility of alternatives are site suitability, economic viability . . . other plans or regulatory limitations, jurisdictional boundaries . . . and whether the proponent can reasonably acquire, control or otherwise have access to the alternative site . . ." (CEQA Guidelines 15126.6(f)(1).
- For alternative locations, "only locations that would avoid or substantially lessen any of the significant effects of the project need be considered for inclusion in the EIR" (CEQA Guidelines 15126.6(f)(1)(A).

5.1.2 Scope of Alternatives Analysis

This section describes four proposed project alternatives. The effects of the proposed alternatives are analyzed in conjunction with the effects of the Preferred Alternative in Section 6.0. The environmentally superior alternative is identified in Section 5.4, below. Each alternative is evaluated concerning its ability to meet the following project objectives:

- To expand Coast's shellfish farm to increase future oyster production and meet Coast and Pacific Seafood's increasing customer demand for raw and shucked oysters.
- To conduct comprehensive eelgrass monitoring and develop sustainable oyster cultivation practices that can be adapted to documented site conditions.
- To create additional job opportunities and sustainable economic development for Humboldt Bay and local jurisdictions.
- To enhance a source of local sustainable seafood and reduce Humboldt County's and California's reliance on imported seafood.
- To provide comprehensive planning of Coast's owned and leased areas in Humboldt Bay.
- To develop a flexible farming plan that can adapt to Coast's operational and management needs, environmental conditions, and farm conditions.
- To utilize Coast's existing historic leased and owned areas while maintaining undeveloped areas for habitat and recreational uses.
- To locate oyster beds in areas with optimal growing conditions to maximize efficiency and limit the spatial footprint of the farm.

5.2 Alternatives Considered and Rejected During Project Planning

Under CEQA, an EIR must include a discussion of alternatives to the project or its location that are capable of avoiding or substantially lessening any significant effects of the project while feasibly attaining most of the basic project objectives. Based on the Project objectives and potential significant impacts of the revised plan, the following discusses alternatives considered during the scoping and planning process and the reasons why they were not selected for detailed analysis in the DEIR.

5.2.1 Eelgrass Avoidance

During the scoping and planning process for the Project, an alternative to expand shellfish culture in areas without eelgrass (Eelgrass Avoidance Alternative) was considered and rejected due to its inability to meet the Project's basic objectives.

Under the Eelgrass Avoidance Alternative, Coast would only expand intertidal shellfish culture in areas within its existing leased and owned footprint that do not currently support dense or patchy eelgrass. This alternative was considered infeasible because it would severely restrict Coast's ability to expand shellfish production in Humboldt Bay. Coast's leased and owned footprint includes 644 acres of patchy eelgrass beds (15% of total footprint) and 1,428 acres of continuous eelgrass habitat (33% of Coast's total footprint). An additional 1,038 acres are not suitable for intertidal oyster cultivation, given that these areas are characterized by primarily tidal and subtidal channels. The total combined acreage occupied by subtidal or tidal areas and eelgrass is 3,110 acres, or 72% of Coast's total footprint.

In addition, very little of Coast's leased and owned footprint is both at tidal elevations suitable for shellfish aquaculture and in areas that do not support existing eelgrass beds. As explained more fully below, areas within Coast's available acreage that are at higher tidal elevations and without existing eelgrass beds are unsuitable for shellfish aquaculture. Restricting Coast's expansion to areas without existing eelgrass would thus severely limit Coast's ability to increase its production of shellfish in Humboldt Bay, a primary Project objective.

Special Condition No. 5 of Coast's existing Coastal Development Permit (CDP No. E-06-003) required Coast to evaluate the feasibility of planting and harvesting oysters at elevations typically unsuitable for eelgrass growth. The resulting study, attached here as Appendix C, measured the differences in growth, biofouling, survival and quality of oysters grown above 1.5' MLLW and in control plots at 1.5'-2.0' above MLLW. The major results of the elevation study indicate that oysters grown at the lower tidal elevations (+0.5 to +1.0 ft MLLW) had significantly higher productivity compared to those grown at higher elevations (+1.5 ft to +2.0 ft MLLW). Oyster weight was also significantly different at higher tidal elevations: Kumamoto oyster weight was 51% lower and Pacific oyster weight was 65% lower at the higher elevations compared to the control. Finally, the number per cluster of Kumamoto oysters was 52% lower at the higher elevations. The study results indicate that oysters grown above an elevation of +1.5 ft MLLW are less viable than those grown in the ranges that overlap with eelgrass habitat. These decreases in production at higher tidal elevations are commercially untenable. Not only would shellfish plots placed at higher elevations fail to meet the Project's basic objectives, it would require a greater farm footprint, given that the cultivated ground would be significantly less efficient for farming. As shown in Figure 5.1, the vast majority of Coast's leased and owned area is either above +1.5 MLLW, in areas occupied by eelgrass, or in subtidal and tidal areas of the bay. There is very little, if any, available acreage at productive elevations for oyster cultivation within Coast's leased and owned footprint that is not occupied by eelgrass.

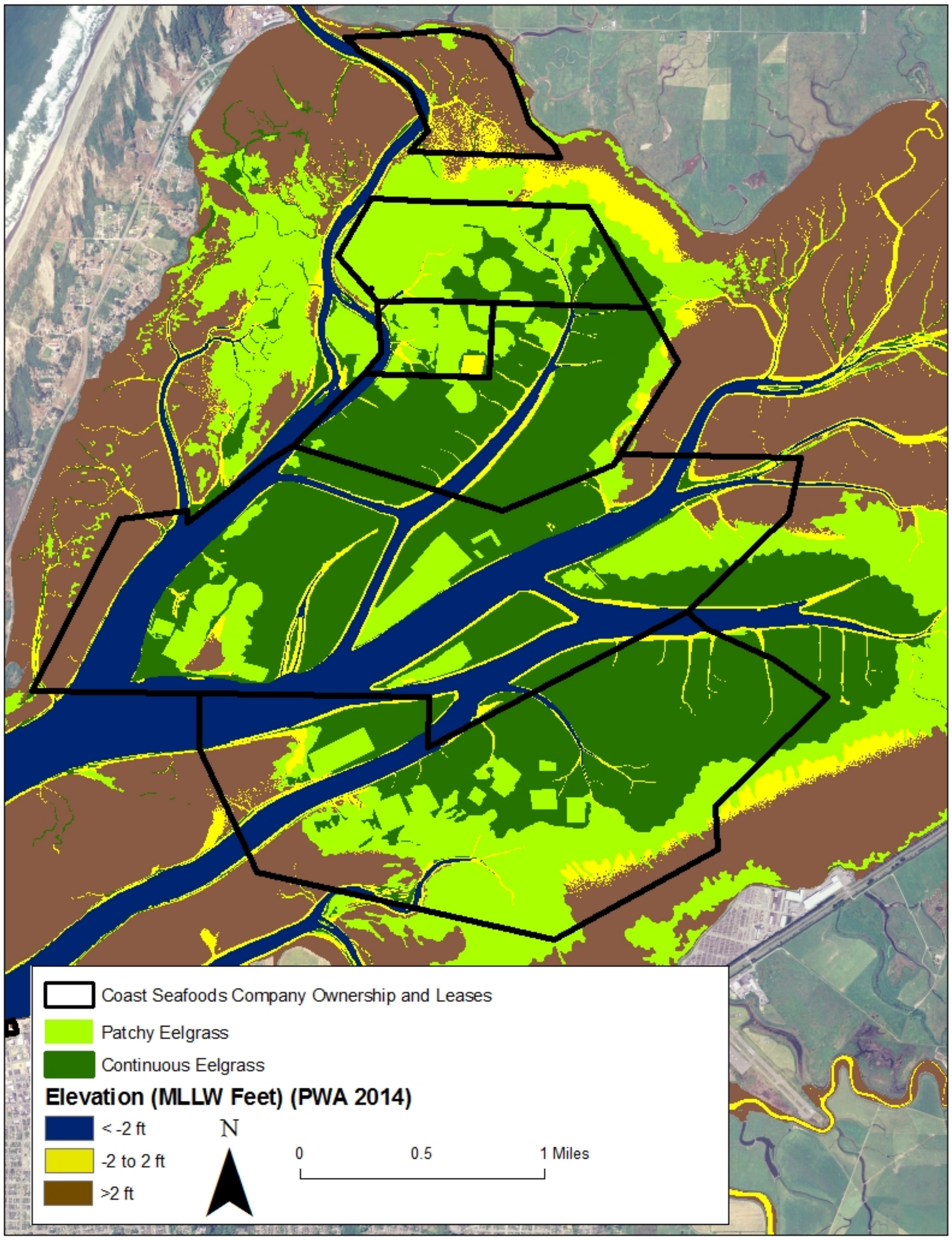


Figure 5.1 Tidal elevation and eelgrass cover within Coast's leased and owned footprint in Humboldt Bay, California. In addition to Coast's owned and leased area boundaries, this map depicts two layers of information—tidal elevation and eelgrass coverage (light and dark green). The layer depicting tidal elevation is "underneath" the layer depicting eelgrass such that elevation is only depicted in areas without eelgrass coverage.

Pacific Watershed Associates (PWA). 2014. Humboldt Bay Sea Level Rise Vulnerability Assessment: DEM Development Report, Final Draft. Prepared for Northern Hydrology & Engineering. PWA, McKinleyville, CA. PWA Report No. 14100351, February 2014.

This alternative would not meet the Project's basic objectives and would not be economically feasible given the costs of implementing Coast's proposed expansion. For this reason and for the reasons discussed above, Coast has no practicable choice but to cultivate shellfish at elevations also suitable for eelgrass growth. The Eelgrass Avoidance Alternative was thus screened from further review in this EIR.

5.2.2 Avoidance of East Bay Management Area

Certain comments received in the draft Initial Study recommended avoiding planting in the East Bay Management Area ("East Bay Avoidance Alternative"), noting that the Coastal Commission had requested avoidance of the area as part of CDP No. E-06-003 issued for the existing footprint. It is worth noting that the prior CDP was issued without a full environmental analysis provided by an EIR or the level of analysis regarding herring, bird, and brant impacts associated with this Project. An alternative similar to the East Bay Avoidance Alternative has been incorporated into the DEIR as the reduced footprint alternative described in Section 5.3.2, although under that alternative Coast would still be permitted to plant in a portion of the East Bay Management Area. The primary reason that this alternative was screened from further review is that it would not avoid or substantially reduce a significant impact identified in the DEIR. The primary reason that the East Bay Avoidance Alternative was suggested is that the East Bay provides ground for herring spawn and is used by brant and other shorebirds. As further addressed in Section 6.0, the DEIR has evaluated those impacts and determined that the Project, including the proposed footprint in the East Bay Management Area, would result in a less than significant impact to such species. Therefore, this alternative was screened from further evaluation.

5.3 Alternatives Selected for Further Analysis

The alternatives described below were screened primarily on their potential to reduce or eliminate the effects of the Project on eelgrass (see Section 6.5, Biological Resources). These alternatives may not achieve the most basic Project objectives; however, for the purposes of providing a full range of alternatives for the public and decision makers, this analysis is provided. Based on these criteria, four project alternatives were identified that would: 1) continue Coast's current shellfish culture activities in Humboldt Bay and increase intertidal oyster culture by 955 acres using 10-ft spacing between longlines; 2) continue Coast's current shellfish culture activities in Humboldt Bay and reduce the expansion area to 300 acres using five-ft spacing between longlines; 3) continue Coast's current shellfish culture activities in Humboldt Bay without expanding intertidal oyster culture; 4) discontinue Coast's existing shellfish culture operations in Humboldt Bay and remove associated infrastructure.

Each alternative's environmental impacts are compared to the proposed Project in Section 6.0 and determined to be environmentally superior, neutral, or inferior. However, only those impacts found significant and unavoidable are used in making the final determination of whether an alternative is environmentally superior or inferior to the proposed Project.

5.3.1 Alternative 1: 10-Foot Spacing Alternative

Under Alternative 1, Coast would renew regulatory approvals for its existing shellfish culture activities and add an additional 955 acres of intertidal longline oyster culture using 10-ft spacing between longlines (Figure 5.2). The amount of culture type within the expansion area would include 802 acres (84%) of cultch-on-longline, 149 acres (15.6%) of basket-on-longline and 4 acres (0.04%) of rack-and-bag culture. In total, there would be a maximum of 38,864 longlines planted under Alternative 1—up to 35,288 cultch-on-longline and 3,576 basket-on-longline.[1] Similar to the Preferred Alternative, rack-and-bag culture would not be placed within 10 ft of existing eelgrass beds. Coast would also seek regulatory approval to add eight new upweller bins to its existing FLUPSY.

This alternative would allow Coast to increase its oyster production to a level almost equal to that anticipated under the Preferred Alternative while using a more conservative longline spacing regime. However, it is expected that some oyster production would be sacrificed by adopting a 10-ft spacing regime as Coast would not be able to install as many longlines as under the Preferred Alternative. Further, the additional planted acreage may not be as suitable for oyster cultivation due to tidal elevation and other variables and thus may be less productive than areas identified for expansion under the Preferred Alternative. Therefore, while this alternative would meet Coast's Project objectives, it would not further the objectives as much as the Preferred Alternative. In addition, while 10-ft spacing would be more protective of eelgrass, the expansion area would be 333 acres larger than under the Preferred Alternative and the majority of this additional cultivated acreage would overlap with patchy and continuous eelgrass beds.

Alternative 1 would also require additional boats to service the expanded culture footprint and, consequently more boat trips and boat hours on the bay (Table 5.1). Coast would add two skiffs and two scows to its operations under Alternative 1. The additional skiff and scow would run with the same frequency as Coast's existing vessels: an average of one 4-hour trip per day, 5 days a week for the skiffs and an average of two 4-hour trips per day, 5 days a week for the scow. Skiff and scows would be staffed by seven crew as under the Preferred Alternative. Coast's harvest vessels would be run at the same frequency and with the same crew as under the Preferred Alternative.

The impacts associated with the expanded footprint are discussed in greater detail in Section 6.0.

[1] This estimate is based on Coast's conceptual planting design incorporating the proposed longline spacing. The final planting design will be based on Coast's operational needs, farm conditions, environmental factors, and conditions of approval and mitigation measures. Coast reserves the right to modify the planting design as needed to respond to such factors, provided that it is consistent with the overall project description and regulatory permits.

Table 5.1 Summary of Coast's Activity on the Bay under Alternative 1, 10-ft Spacing.*						
Vessel Name	Trips/ day	Hours/ trip	Days/ week	Trip/ week	Hours/ week	# of crew
Skiff 1	1	4	5	5	20	7
Skiff 2	1	4	5	5	20	7
Skiff 3	1	4	5	5	20	7
Skiff 4	1	4	5	5	20	2
Skiff 5	1	4	5	5	20	7
Skiff 6	1	4	5	5	20	7
Scow 1	2	4	5	10	40	7
Scow 2	2	4	5	10	40	7
Scow 3	2	4	5	10	40	7
Scow 4	2	4	5	10	40	7
Pantherotti[1]	2	2	5	10	20	5
Mary Elizabeth[2]	1	6	6	6	36	4
Elusive[3]	1	4	4	4	16	4
Totals				**90**	**352**	**78**

** Activity may be vary depending on weather conditions, crew availability, and other factors.*

[1] Clam vessel

[2] Kumamoto oyster harvester

[3] Harvest scow for hand-picked oysters

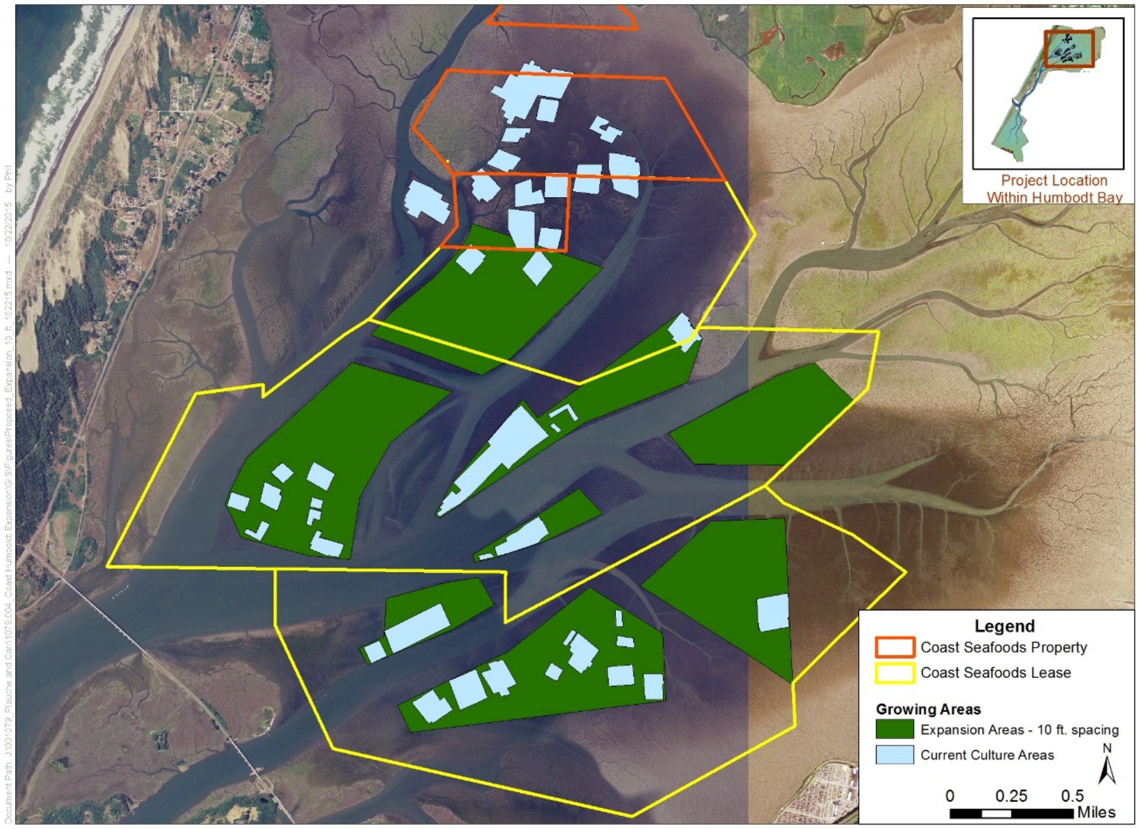


Figure 5.2 Areas Proposed for Continued and Expanded Shellfish Culture under Alternative 1: 10-Foot Spacing.

5.3.2 Alternative 2: Reduced Footprint Alternative

Under Alternative 2, Coast would renew regulatory approvals for its existing shellfish culture activities and seek regulatory approval to expand intertidal culture on 300 additional acres (Figure 5.3). The amount of culture type within the expansion area would include 200 acres (67%) of cultch-on-longline and 100 acres (33%) of basket-on-longline. In total, there would be a maximum of 21,600 longlines planted under Alternative 2—up to 16,800 cultch-on-longline and 4,800 basket-on-longline.[2] Because the expansion area footprint would be reduced compared to the Preferred Alternative, there would be slightly fewer boat trips needed throughout the bay (Table 5.2). While Coast would still require two additional small watercraft, existing harvesters would be run less often than under the Project.

Coast would also seek regulatory approval to add eight new upweller bins to its existing FLUPSY. As with the Preferred Alternative, Coast would utilize 5 ft spacing between longlines in the proposed expansion areas. No additional culture would be placed in Indian Island and culture in all other proposed expansion areas would be reduced. While this alternative would partially meet the Project objectives, it would not fulfill the objectives to the same extent as the Preferred Alternative due to the reduced expansion footprint. Because this alternative uses 5 ft spacing on a reduced expansion footprint, it would restrict Coast's ability to increase oyster production consistent with market demand and would significantly decrease the economic benefits of the Project.

[2] *See* Footnote 1.

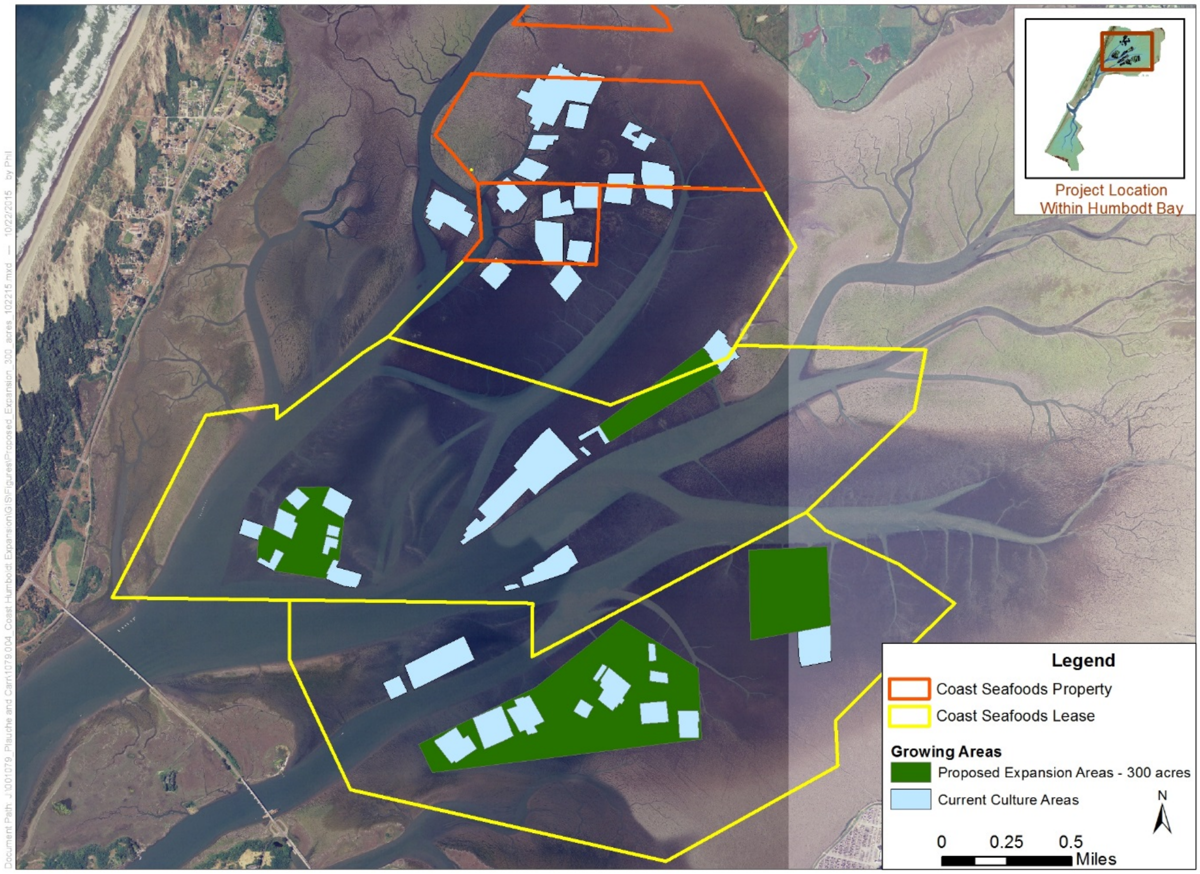


Figure 5.3 Areas Proposed for Continued and Expanded Shellfish Culture under Alternative 2 (Reduced Footprint).

Table 5.2 Summary of Coast's Activity on the Bay under Alternative 2, Reduced Footprint.*						
Vessel Name	Trips/ day	Hours/ trip	Days/ week	Trip/ week	Hours/ week	# of crew
Skiff 1	1	4	5	5	20	5
Skiff 2	1	4	5	5	20	5
Skiff 3	1	4	5	5	20	5
Skiff 4	1	4	5	5	20	2
Skiff 5	1	4	5	5	20	5
Scow 1	2	4	5	10	40	5
Scow 2	2	4	5	10	40	5
Scow 3	2	4	5	10	40	5
Pantherotti[1]	2	2	5	10	20	5
Mary Elizabeth[2]	1	6	5	5	30	4
Elusive[3]	1	4	4	4	16	4
Totals				**74**	**286**	**50**

** Activity may be vary depending on weather conditions, crew availability, and other factors.*

[1] Clam vessel

[2] Kumamoto oyster harvester

[3] Harvest scow for hand-picked oysters

5.3.3 Alternative 3: Existing-Footprint Alternative

Under Alternative 3, Coast would renew regulatory approvals for its existing shellfish culture activities but would not seek to permit additional intertidal culture in Humboldt Bay (Figure 5.4). As such, the environmental baseline for the Project would not change. While this alternative would be more protective of eelgrass, it would not meet the Project objectives. The frequency of activity on the bay would not change under Alternative 3 (Table 4.1, Project Description).

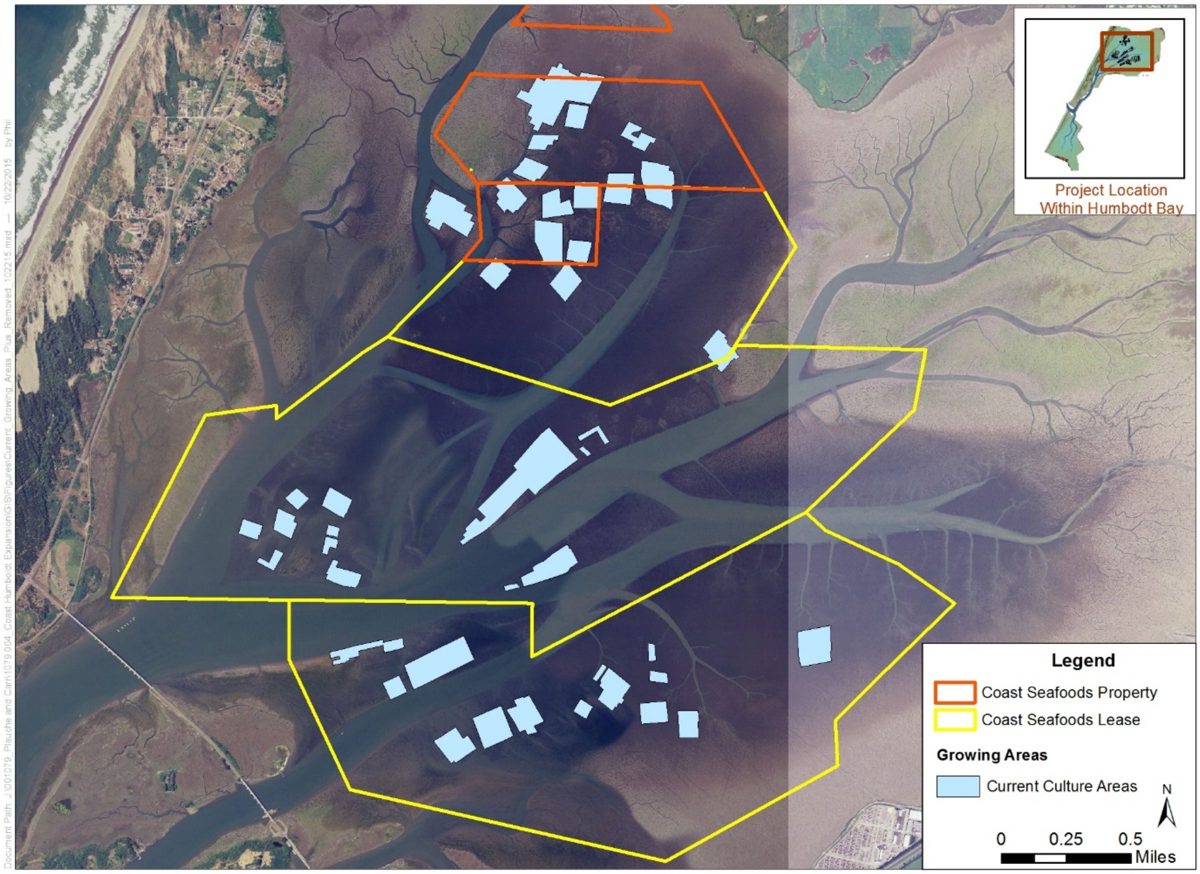


Figure 5.4 Areas for Continued Cultivation under Alternative 3.

5.3.4 Alternative 4: No-Project Alternative

The No-Project Alternative would prevent cultivation expansion by Coast under this Project and result in the non-renewal of Coast's existing permits for its existing cultivated area in Humboldt Bay. Cessation of all related cultivation activities would occur and all existing infrastructure on its owned and leased tidelands would be removed. This alternative would not accomplish any of the Project objectives. In addition, as discussed more fully in Section 6.0, removal of existing culture equipment would have potentially significant impacts on existing eelgrass beds and on other biological resources.

5.4 Environmentally Superior Alternative

Generally, CEQA requires a lead agency to identify the "environmentally superior alternative" to avoid or substantially lessen identified environmental impacts. If the "No Project" alternative is the environmentally superior alternative, the CEQA Guidelines require that another alternative be identified. As described more fully in Section 6.0, Environmental Analysis and Effects of Alternatives, neither the Project nor any of the identified Alternatives would result in significant unavoidable adverse impacts. Table 5.3 provides a comparison of the potential environmental impacts of the Project and Alternatives.

Because no significant unavoidable adverse impact has been identified for the Project or any of the proposed Alternatives, there is no alternative that is "environmentally superior," as defined by CEQA. However, for the benefit of the public, this DEIR identifies Alternative 2: Reduced Footprint, as the environmentally superior alternative because it has less potential environmental impacts but still accomplishes some of the Project's objectives. Alternative 1: 10-Foot Spacing, accomplishes more of the Project objectives than any other proposed Alternative, but has potentially greater environmental impacts due to the greater acreage proposed for expansion of intertidal oyster culture. Alternative 3: Existing Footprint, has the least potential impacts to the environment, but achieves none of the Project objectives. Alternative 4: No Project, has less potential impacts to the environment than the Project but similarly does not achieve any Project objectives.

Table 5.3 Summary Comparison of Impacts by Alternatives.

Impact Categories	Alternative 1: 10-Foot Spacing	Alternative 2: Reduced Footprint	Alternative 3: Existing Footprint	Alternative 4: No Project
Cultural and Archaeological Resources	Greater	Less	Less	Less
Aesthetics	Greater	Less	Less	Less
Biological Resources	Greater	Less	Less	Less
Air Quality	Greater	Substantially Similar	Less	Less
Greenhouse Gases	Greater	Substantially Similar	Less	Less
Hydrology and Water Quality	Greater	Less	Less	Less
Hazards and Hazardous Substances	Greater	Substantially similar	Less	Less
Recreation	Greater	Less	Less	Less
Noise	Greater	Less	Less	Less
Transportation and Traffic	Greater	Less	Less	Less

Section 6.0 Environmental Analysis and Effects of Alternatives

6.1 Introduction

This chapter describes existing conditions, pertinent laws and regulations, standards of significance, analyzes the environmental impacts, identifies conservation measures, and proposes mitigation measures for the following topics:

- Cultural and Archaeological Resources
- Biological Resources
- Aesthetics and Visual Resources
- Air Quality
- Greenhouse Gas Emissions
- Hydrology and Water Quality
- Hazards and Hazardous Materials
- Recreation
- Noise
- Transportation/Traffic

Potential impacts of the Project Alternatives are also evaluated.

6.2 Impacts Found Not to Be Significant

California Public Resources Code Section 21003(f) states: "it is the policy of the state that …[a]ll persons and public agencies involved in the environmental review process be responsible for carrying out the process in the most efficient, expeditious manner in order to conserve the available financial, governmental, physical and social resources with the objective that those resources may be better applied toward the mitigation of actual significant effects on the environment." This policy is reflected in the CEQA Guidelines Section 15126.2(a), which states that "[a]n EIR shall identify and focus on the significant environmental impacts of the proposed project" and Section 15143, which states that [t]he EIR shall focus on the significant effects on the environment. Section 15063[a] of the CEQA Guidelines allow the use of an Initial Study to document project effects that are less than significant.

In accordance with CEQA Guidelines Section 15128, the Final IS explains why each of the following environmental issues were determined not to be significant and are, therefore, not analyzed further in the DEIR. Please refer to Appendix A for an explanation of the basis of these conclusions.

- Agricultural Resources
- Geology and Soils
- Land Use and Planning
- Mineral Resources
- Population and Housing
- Public Services
- Utilities and Service Systems

6.3 Growth Inducing Impacts

The purpose of the Project is to provide a comprehensive plan for management of Coast's owned and leased area and expansion of its shellfish farm to meet increasing demand for its product. The Project would allow for an expansion of commercial mariculture activities in Humboldt Bay, create jobs, and improve the local economy, while also increasing local and sustainable seafood production. CEQA Guidelines Section 15126.2(d) includes fostering economic growth as a consideration when evaluating the Project's potential growth-inducing effects. A focus of the Humboldt Bay Management Plan (HBMP 2007) is to encourage economic activity; the legislature included an explicit direction to adopt this focus when creating the Harbor District.

The Project would not increase the local population but would employ up to 50 additional local people. It is likely that these jobs would be filled by people already living in the region. The Project would stimulate local economic activity, including for transport of the product and manufacturing of shellfish culture equipment. The growth inducing aspect of the Project (i.e., revitalizing the local economy) is considered to have a less than significant impact on the environment.

6.4 Cultural and Archeological Resources

6.4.1 Existing Conditions

Humboldt Bay is the ancestral heartland of the Wiyot Indians, whose native language is affiliated with the Algonquian language family and who had occupied the bay area for at least 2,000 years by the time the first European maritime explorers entered the bay and the first American towns were established in 1850. There are hundreds of known and undiscovered archaeological sites around Humboldt Bay that evidence Wiyot history and prehistory. Today, citizens of Wiyot ancestry are affiliated with three federally-recognized tribes located in the ancestral homeland: Blue Lake Rancheria; Bear River Band of the Rohnerville Rancheria; and the Wiyot Tribe at Table Bluff Reservation.

General information on the cultural and archeological resources in the vicinity of the Project area is found in a number of sources, including:

- Humboldt Bay Historic and Cultural Resource Characterization and Roundtable. October 2008. Planwest Partners and the Cultural Resources Facility, Center for Indian Community Development, Humboldt State University.
- Humboldt County General Plan. Chapter 10, Section 10.6, Cultural Resources. November 20, 2008. Humboldt County Department of Community Services Development.
- Humboldt Bay Management Plan Draft EIR. April 2006. Humboldt Bay Harbor, Recreation and Conservation District.
- Marina Center Mixed Use Development Project Draft Environmental Impact Report. November 2008. ESA.

6.4.2 Pertinent Laws and Regulations

A number of state and federal historic preservation laws, regulations and policies address the need to manage potentially significant and/or sensitive (e.g., human remains) archaeological and Native American resources identified during advance project or permit review or discovered inadvertently and in “post-review” settings. These include:

- CEQA: Requires analysis by the Lead Agency to determine if the Project will cause a significant impact to “historical resources” and “tribal cultural resources,” including archaeological and Native American sites. Project approval may be conditional, for example, avoidance or mitigation (data recovery) of known archaeological resources, monitoring of ground disturbing activities in identified sensitive areas by local Tribal Representatives and/or professional archaeologists, and implementation of protocols for inadvertent archaeological discoveries.
- Section 106 of the National Historic Preservation Act: Requires analysis by the Lead Federal Agency (that provides funding or a permit for the “undertaking”) and consultation with the California State Historic Preservation Officer, Advisory Council on Historic Preservation, culturally affiliated Native American Tribes, and others, as appropriate, to “resolve adverse effects” on “historic properties” including archaeological and Native American sites. Section 106 is the key Federal historic preservation law, and final approval of the undertaking may be conditional as specified in a legally binding Agreement among the parties.

Several laws and their implementing regulations spell out evaluation criteria to determine what constitutes a significant 'site' or a significant 'discovery' during construction:

- California Register of Historical Resources (RHR) criteria (California Code of Regulations, Title 14, Chapter 3, CEQA Guidelines § 15064.5), for archaeological and Native American resources qualifying for consideration under CEQA.
- National Register of Historic Places criteria (36 CFR § 63), qualifying for consideration under Section 106 review and the National Environmental Policy Act.

State laws call for specific procedures and timelines to be followed in cases when human remains are discovered on private or non-federal public land in California. It includes penalties (felony) for violating the rules for reporting discoveries, or for possessing or receiving Native American remains or grave goods:

- Section 7050.5 of the California Health and Safety Code and Section 5097.98 of the Public Resources Code outline requirements for handling inadvertent discoveries of human remains, including those determined to be Native American and associated grave goods found on private or state lands (i.e., the Project area), and Public Resources Code 5097.99 (as amended by SB 447) specifies penalties for illegally possessing or obtaining Native American remains or associated grave goods.

Another California law imposes strong civil penalties for maliciously digging, destroying or defacing a California Indian cultural or sacred site:

- California Native American Historic Resource Protection Act of 2002 (SB 1816, adding Chapter 1.76 to Division 5 of the Public Resources Code), imposes civil penalties including imprisonment and fines up to $50,000 per violation, for persons who unlawfully and maliciously excavate upon, remove, destroy, injure, or deface a Native American historic, cultural, or sacred site that is listed or may be listed in the California Register of Historic Resources.

In addition, the Harbor District adopted a Protocol for Inadvertent Archaeological Discoveries for Ground Disturbing Project Permits, Leases and Franchises (Harbor District Protocol) on April 22, 2015 (attached as Appendix J). Mitigation Measures CR-1, CR-2 and CR-3, below, are based on the Harbor District Protocol.

6.4.3 Definition of Significance and Baseline Conditions

Significance criteria are those listed in the CEQA checklist. A project's effects on cultural resources are significant if the project will:

1. Cause a substantial adverse change in the significance of an historical resource as defined in CEQA Guidelines § 15064.5.
2. Cause a substantial adverse change in the significance of an archaeological resource pursuant to CEQA Guidelines § 15064.5.

3. Cause a substantial or adverse change in the significance of a tribal cultural resource.[1]
4. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.
5. Disturb any human remains, including those interred outside of formal cemeteries.

"Substantial adverse change" in the significance of an historical resource means physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired (CEQA Guidelines § 15064.5). Further, material impairment can happen when a project demolishes or materially adversely alters a historical resource's physical characteristics such that:

- It affects the resource's inclusion or eligibility for the California RHR.
- It affects the resource's inclusion or eligibility for a local RHRs.

The California Office of Historic Preservation lists the following four criteria for resources to be listed in the California Register of Historic Resources:

- Associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States (Criterion 1).
- Associated with the lives of persons important to local, California or national history (Criterion 2).
- Embodies the distinctive characteristics of a type, period, region or method of construction or represents the work of a master or possesses high artistic values (Criterion 3).
- Has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California or the nation (Criterion 4).

6.4.4 Effects Analysis of Proposed Project

Protection of historic, archeological and tribal cultural resources will be based on protocols that would be implemented when resources are inadvertently discovered. Potentially significant impacts and related mitigation measures are described below.

IMPACT CR-1: Placement of equipment.

There are no identified or known historic, archaeological, or cultural resources on the Project site. While such resources are unlikely given the intertidal location of the Project, posts and stakes placed in the substrate to secure shellfish culture equipment could potentially disturb previously undiscovered or unknown historic, archaeological or tribal cultural resources. Additionally, such resources could be discovered by culturists when working in intertidal areas. Coast and the Harbor District met with representatives of the Wiyot Tribe in Spring 2014 to discuss how the Project might impact historic, archaeological and tribal cultural resources of interest to the Tribe; while the Tribe did not identify any known cultural or archaeological sites within the Project, it requested inclusion of the below mitigation measures to protect such resources if they are discovered during Project activities.

[1] As of the time of writing, the CEQA Guidelines (14 Cal. Code Reg. § 15000 *et seq*.) and CEQA Checklist had not been updated to include discussion of tribal cultural resources, as mandated by the 2014 passage of AB 52.

6.4.5 Conservation Measures

There are no proposed Conservation Measures.

6.4.6 Level of Significance Before Mitigation

IMPACT CR-1 is potentially significant without mitigation.

6.4.7 Mitigation Measures

Mitigation Measures CR-1, CR-2 and CR-3 provide protocols for actions that will occur if historic, archaeological or tribal cultural resources are discovered.

> **Mitigation Measure CR-1:** Coast's authorized point of contact for inadvertent archaeological discovery.

Coast will designate an authorized point of contact (Cultural Resources POC) in the event of inadvertent discovery of any cultural or archaeological resource or human remains or Native American grave goods during Project implementation; Coast will ensure that the Harbor District has the name and current contact information for its Cultural Resources POC.

> **Mitigation Measure CR-2:** Protocols for inadvertent discovery of any cultural or archeological resource.

Should an archaeological resource be inadvertently discovered during ground-disturbing activities, the Tribal Historic Preservation Officers (THPO) appointed by the Blue Lake Rancheria, Bear River Band of Rohnerville Rancheria and Wiyot Tribe shall be immediately notified and a qualified archaeologist with local experience retained to consult with the Harbor District, the three THPOs, Coast, and other applicable regulatory agencies to employ best practices for assessing the significance of the find, developing and implementing a mitigation plan if avoidance is not feasible, and reporting in accordance with the Harbor District's Standard Operating Procedures, as memorialized in this Mitigation Measure and as further laid out in the Harbor District Protocol.

1. Ground-disturbing activities shall be immediately stopped if potentially significant historic or archaeological materials are discovered. Examples include, but are not limited to, concentrations of historic artifacts (e.g., bottles, ceramics) or prehistoric artifacts (chipped chert or obsidian, arrow points, groundstone mortars and pestles), culturally altered ash-stained midden soils associated with pre-contact Native American habitation sites, concentrations of fire-altered rock and/or burned or charred organic materials, and historic structure remains such as stone-lined building foundations, wells or privy pits. Ground-disturbing Project activities may continue in other areas that are outside the discovery locale.
2. An "exclusion zone" where unauthorized equipment and personnel are not permitted shall be established (e.g., taped off) around the discovery area, plus a reasonable buffer zone, by the District, or party who made the discovery.
3. The discovery locale shall be secured (e.g., 24-hour surveillance) as directed by the District if considered prudent to avoid further disturbances.

4. Coast's plant manager (located at 25 Waterfront Drive in Eureka) or party who made the discovery and initiated these Protocols shall be responsible for immediately contacting by telephone the parties listed below to report the find:
    a. The Harbor District's authorized POC, as listed in the Harbor District Protocol; and
    b. Coast's Cultural Resources POC.
5. Upon learning about a discovery, the District's POC shall be responsible for immediately contacting by telephone the POCs listed below to initiate the consultation process for its treatment and disposition:
    a. THPOs with Blue Lake Rancheria, Bear River Band and Wiyot Tribe; and
    b. Other applicable agencies involved in Project permitting (e.g., USACE, California Coastal Commission, etc.).
6. In cases where a known or suspected Native American burial or human remains are uncovered, the Humboldt County Coroner (707-445-7242) shall <u>also</u> be notified immediately, along with the property owner of the discovery site. In addition, Mitigation Measure CR-3 shall be followed.
7. Ground-disturbing Project work at the find locality shall be suspended temporarily while the District, the three THPOs, a consulting archaeologist and other applicable parties consult about appropriate treatment and disposition of the find. Ideally, a Treatment Plan will be developed within three working days of discovery notification. Where the Project can be modified to avoid disturbing the find (e.g., through project redesign), this may be the preferred option. Should human remains be encountered, the provisions of State laws shall apply and Mitigation Measure CR-3 followed. The Treatment Plan shall reference appropriate laws and include provisions for analyses, reporting, and final disposition of data recovery documentation and any collected artifacts or other archaeological constituents. Ideally, the field phase of the Treatment Plan may be accomplished within five (5) days after its approval, however, circumstances may require longer periods for data recovery.
8. Any and all inadvertent discoveries shall be considered strictly confidential, with information about their location and nature being disclosed only to those with a need to know. The District's authorized representative shall be responsible for coordinating any requests by or contacts to the media about a discovery.
9. These Mitigation Measures shall be communicated to Coast's field work force (including contractors, employees, officers and agents) and such communications may be made and documented at safety briefings.
10. Ground-disturbing work at a discovery locale may not be resumed until authorized in writing by the District.
11. The plant manager or party who made the discovery and initiated these Protocols, shall make written notes available to the Harbor District describing: the circumstances, date, time, location and nature of the discovery; date and time each POC was informed about the discovery; and when and how security measures were implemented.
12. The plant manager, Cultural Resources POC, or party who made the discovery shall record how the discovery downtime affected the Project work schedule.
13. Treatment Plans and corresponding Data Recovery Reports shall be authored by professionals who meet the Federal criteria for Principal Investigator Archaeologist and reference the *Secretary of the Interior's Standards and Guidelines for Archaeological Documentation* (48 Fed. Reg. 44734-44737).
14. Final disposition of all collected archaeological materials shall be documented in a final Data Recovery report and its disposition decided in consultation with Tribal representatives.

15. Final Data Recovery Reports, along with updated confidential, standard California site record forms (DPR 523 series) shall be filed at the Northwest Information Center of the California Historical Resources Information System and the Harbor District, with report copies provided to the three identified THPOs.

Mitigation Measure CR-3: Protocols for inadvertent discovery of human remains and grave goods.

In the event of inadvertent discovery of human remains or Native American grave goods during ground-disturbing activities, work at the discovery locale shall be halted immediately, the Harbor District and County Coroner contacted, and, consistent with State law, the following protocol followed (in addition to the protocol described under Mitigation Measure CR-2).

1. If human remains are encountered, they shall be treated with dignity and respect. Discovery of Native American remains is a very sensitive issue and serious concern of affiliated Native Americans. Information about such a discovery shall be held in confidence by all Project personnel on a need-to-know basis. The rights of Native Americans to practice ceremonial observances on sites, in labs and around artifacts shall be upheld.
2. Violators of Section 7050.5 of the California Health and Safety Code may be subject to prosecution to the full extent of applicable law (felony offense).

In addition, the provisions of California law (Section 7050.5 of the California Health and Safety Code and Section 5097.98 of the California Public Resources Code) will be followed:

1. The Coroner has two working days to examine the remains after being notified of the discovery. If the remains are Native American, the Coroner has 24 hours to notify the NAHC in Sacramento at (916) 653-4082.
2. The NAHC is responsible for identifying and immediately notifying the most likely descendant (MLD) of the deceased Native American. (Note: NAHC policy holds that the Native American Monitor will not be designated the MLD.)
3. Within 48 hours of their notification by the NAHC, the MLD will be granted permission by the property owner of the discovery locale to inspect the discovery site if they so choose.
4. Within 48 hours of their notification by the NAHC, the MLD may recommend to the owner of the property (discovery site) the means for treating or disposing, with appropriate dignity, the human remains and any associated grave goods. The recommendation may include the scientific removal and non-destructive or destructive analysis of human remains and items associated with Native American burials. Only those osteological analyses (if any) recommended by the MLD may be considered and carried out.
5. Whenever the NAHC is unable to identify a MLD, or the MLD identified fails to make a recommendation, or the property owner rejects the recommendation of the MLD and mediation between the parties by NAHC fails to provide measures acceptable to the property owner, he/she shall cause the re-burial of the human remains and associated grave offerings with appropriate dignity on the property in a location not subject to further subsurface disturbance.

6.4.8 Level of Significance After Mitigation

Implementation of Mitigation Measures CR-1, CR-2, and CR-3 would reduce IMPACT CR-1 to less than significant levels. Therefore, no significant and unavoidable adverse impacts relating to historic, archaeological or tribal cultural resources remain.

6.4.9 Effects Analysis of Alternatives

IMPACT CR-1 would be less than significant with mitigation under all proposed Project alternatives.

Alternative 1: 10-Foot Spacing Alternative
As with the Preferred Alternative, the placement of stakes and posts associated with intertidal aquaculture under Alternative 1 has the potential to impact archaeological resources. While Alternative 1 would involve placement of aquaculture equipment on 955 intertidal acres, 333 more acres than are proposed for culture under the Preferred Alternative, the total number of longlines placed on the beds under Alternative 1 would decrease from 48,456 (cultch and basket) to 38,960 (cultch and basket). Thus, while more intertidal acreage will be occupied by culture equipment under Alternative 1, the overall level of potential disturbance of the substrate will be slightly less than in the Preferred Alternative.

As with the Preferred Alternative, Mitigation Measures CR-1, CR-2, and CR-3 would be implemented under Alterative 1. While the likelihood of encountering cultural, archaeological or tribal resources may be increased under Alternative 1 given the increased spatial area of the culture plots, IMPACT CR-1 will be less than significant with mitigation.

Alternative 2: Reduced Acreage Alternative
As with the Preferred Alternative, the placement of stakes and posts associated with intertidal aquaculture under Alternative 2 has the potential to impact historic, archaeological and tribal cultural resources. Impacts to these resources would be less likely under Alternative 2 due to the reduced footprint of intertidal culture. Rather than a 622 acre expansion area, Alternative 2 proposes 300 acres of additional intertidal culture. The total number of longlines under Alternative 2 would also be reduced from 48,456 to 21,600. As with the Preferred Alternative, if historic, archaeological or tribal cultural resources are encountered, Mitigation CR-1, CR-2, and CR-3 would be implemented. With mitigation, IMPACT CR-1 is considered less than significant under Alternative 2.

Alternative 3: Existing Footprint Alternative
Under Alternative 3, there would be no change from baseline conditions and no additional potential impact to historic, archaeological or tribal cultural resources. With Mitigation Measures CR-1, CR-2, and CR-3, IMPACT CR-1 is considered less than significant under Alternative 4.

Alternative 4: No Project Alternative
The removal of stakes, posts and other equipment associated with Coast's current shellfish culture activities has the potential to impact historic, archaeological and tribal culture resources. These resources may be encountered during removal operations, which, similar to installation, would involve some disturbance of the substrate in intertidal culture areas. As with the Preferred Alternative, if historic, archaeological or tribal cultural resources are encountered, Mitigation Measures CR-1, CR-2, and CR-3 would be implemented. With Mitigation Measures CR-1, CR-2, and CR-3, IMPACT CR-1 is considered less than significant under Alternative 4.

6.5 Biological Resources

This section describes the present and possible future conditions regarding biological resources in the Project area. The significance of effects regarding biological resources is defined by CEQA Appendix G criteria.

6.5.1 Existing Conditions

The following information discusses the environmental setting of Humboldt Bay, focusing on conditions related to eelgrass habitat and other biological resources in North Bay that could be affected by the Project.

6.5.1.1 General Habitat Conditions

Humboldt Bay is composed of three distinct sub-basins: (1) North Bay, (2) Entrance Bay, and (3) South Bay. Habitat within each of these sub-basins is a mixture of unconsolidated sediment (or mudflats), eelgrass beds (both continuous and patchy[2]), coastal salt marsh habitat, macroalgae, and subtidal habitat. Humboldt Bay habitats were recently mapped by NOAA (2012) using the emerging Coastal and Marine Ecological Classification Standard (CMECS). This effort provides a valuable baseline for evaluating future changes in habitat. Figure 6.5.1 includes the CMECS classifications for North Bay, as mapped by NOAA (2012).

Native eelgrass (*Zostera marina*) is the dominant habitat of North Bay. There are also large amounts of coastal marsh, macroalgae, and subtidal habitats in the bay. A smaller, but significant, amount of habitat is currently used for shellfish culture. In considering the role of each of these habitats, species utilization and changes to the system should be considered. As an example, the diking and filling of salt marsh habitat from the 1880s to the 1980s resulted in significant impacts, including channel confinement, gradient increase, and ongoing erosion of residual salt marsh habitat (Schlosser and Eicher 2012). It is important to also take into account the ecological value of a habitat mosaic on species diversity, connectivity between habitats (e.g., freshwater to estuarine), and resilience to natural and anthropogenic changes.

6.5.1.2 Limitations to Eelgrass Growth

Eelgrass in Humboldt Bay appears to be at, or near, carrying capacity (Gilkerson 2008). The major controlling factors for eelgrass include: (1) light, (2) temperature, (3) energy, and (4) nutrients. Eelgrass areal extent and shoot density in North Bay show a significant amount of natural variability. A more detailed analysis of limitations to eelgrass growth in North Bay is provided in the Eelgrass Technical Report (Appendix D of the DEIR). The following is a summary of the information presented in Appendix D.

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[2] The DEIR uses the definitions of eelgrass beds provided by Schlosser and Eicher (2012):

- Patchy eelgrass beds: >10% and <85% cover by eelgrass and larger than 0.01 hectare (0.025 acres).
- Continuous eelgrass beds: >85% to 100% cover by eelgrass; variable density. An unvegetated area or patch of macroalgae (<0.01 hectare within an eelgrass bed) was considered part of the continuous bed.

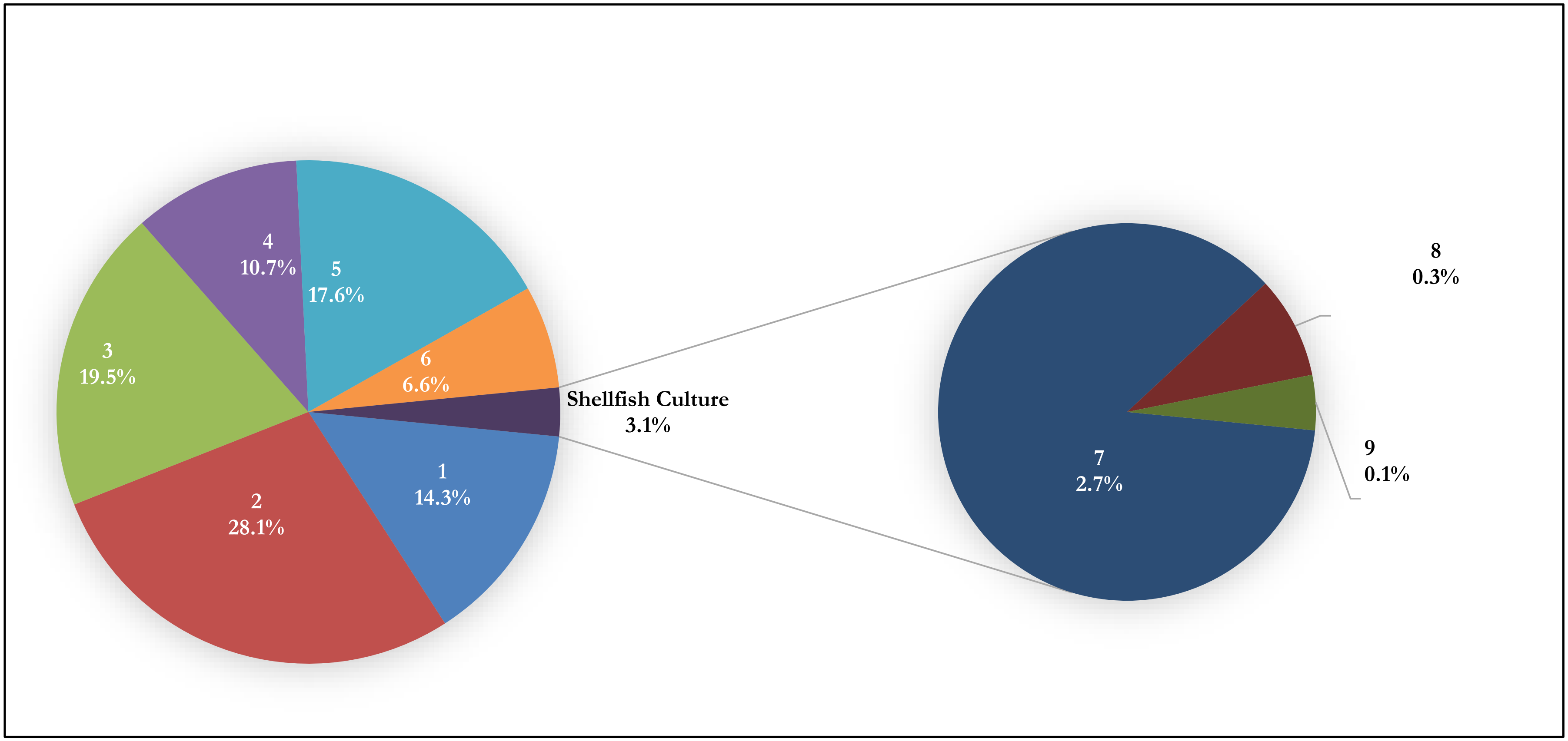

Figure 6.5.1 Habitats in North Bay Classified under the Coastal and Marine Ecological Classification Standard.
Source: Wagschal, pers. comm., 2015; Notes: Habitat areas based on data from NOAA (2012).

Light

Eelgrass requires light for photosynthesis, and the lower limit of growth is typically limited by light availability at depth (Dennison 1987). The amount of light available for photosynthesis depends on the depth of the water column, the amount of dissolved material, and the amount of suspended material (e.g., phytoplankton, sediment, etc.). Suspended sediments can limit light penetration and nutrients can stimulate growth of phytoplankton in the water column, which then absorb light and further limit photosynthesis. Light availability at depth appears to be greater for South Bay compared to North Bay (Gilkerson 2008). For example, daily suspended sediment increases occur from natural bottom disturbance during low tides and strong wind events, especially in the shallow North Bay mudflat habitat. Few restrictions on light likely result in eelgrass growing at greater depths in South Bay.

Temperature

Tidal exposure resulting in desiccation stress is one of the most important factors limiting the upper extent of eelgrass. Desiccation is caused by exposure to elevated air temperatures, which results in heat stress and leaf necrosis (Boese et al. 2005). Coastal air temperatures are heavily influenced by sea surface temperatures, and a recent study by Lebassi et al. (2009) indicated that air temperatures in coastal low lying areas have cooled since the late 1940s. These findings are only partially supported by data from CeNCOOS (2014), which indicates that temperatures increased from 1950 to 1997 before decreasing through 2010. Despite this trend of decreasing average temperatures, eelgrass stress due to air exposure is primarily associated with short-term heat stress-related desiccation events.

Energy

Wave exposure is a major factor in controlling seagrass cover, and wave exposure indices have proven instructive for predicting cover (Fonseca and Bell 1998). The seabed is also dynamic, and sediment movement over time may bury plants, expose roots, or uproot plants (Kirkman and Kuo 1990, Preen et al. 1995). Gilkerson (2008) indicated that wave-related stress is highest within the western half of North Bay, Entrance Bay, and the North Bay Channel; the latter two correspond to the deepest portions of the dredged shipping channel. Similar to observations made by Kirkman and Kuo (1990) and Preen et al. (1995), water depth in Humboldt Bay is in a constant state of change, especially within dredged locations, resulting in shifting locations where wave-related stress is the greatest. Gilkerson (2008) developed a relative exposure index (REI) for Humboldt Bay to identify areas where eelgrass habitat may be prone to disturbance from wind and waves.

Nutrients

Nutrients enter Humboldt Bay via three pathways: municipal wastewater, runoff, and nearshore waters. Municipal wastewater, although historically a major nutrient source, has become much less significant as a result of various treatment improvements instituted in the 1980s and 1990s. Runoff, although potentially a significant source, occurs primarily during the wet winter months when there is little potential for nutrient uptake by flora and fauna in the bay. Water quality monitoring for nitrates and silicic acid indicated that nutrients follow a similar pattern in North Bay (Indian Island) as compared to ocean conditions (Bay Entrance), with a few differences in the summer for nitrates that appear to correlate with peaks in phytoplankton abundance (Shaughnessy and Hurst 2014).

6.5.1.3 Natural Variability of Eelgrass Habitat

There are a number of data sources in Humboldt Bay to provide an understanding of natural variability in eelgrass habitat, although there are limitations to each data set. For example, the SeagrassNet (2015) data spans the longest continuous time period (2007-2011 and 2013-2014) but the data were collected only along two transects (one in North Bay and the other in South Bay). Similarly, data by Rumrill and Poulton (2004) represents a wider range of sample locations, but only spans a three-year period (2001-2003). The following information discusses available data sets that provide an indication of natural variability in areal extent and shoot density of eelgrass habitat in Humboldt Bay.

Areal Extent

Bay-wide mapping has occurred to some degree between 1959 and 2009 (Schlosser and Eicher 2012). In North Bay, the areal extent of eelgrass ranged from a minimum of 840 acres in 1959 to a maximum of 3,577 acres in 2009 (Figure 6.5.2). However, comparing mapped eelgrass between years may not be meaningful due to: (1) differences in mapping methods, and (2) the fact that eelgrass distribution varies seasonally and mapping was not necessarily done during the same season each year. While trends and inter-annual variability are difficult to determine from the bay-wide mapping efforts, a review of the data suggests that eelgrass is extensive and relatively stable in Humboldt Bay (Judd 2006, Gilkerson 2008, Schlosser and Eicher 2012).

Shoot Density

Eelgrass in Humboldt Bay tends to begin growing in April, and shoot density peaks in July before declining again. Eelgrass shoot density can vary dramatically between years and even within the same season, suggesting that differences in light penetration and/or nutrient conditions can cause dramatic changes in overall productivity (Harding 1973). Eelgrass shoot length typically reaches a peak in August or September, although in some years shoot length continues extending through December before die-back and storm damage reduce the plants to an annual low in January (Schlosser and Eicher 2012).

Compiled data for the summer growing season in North Bay indicates that the standard deviation in shoot density can range between 34% and 77% of the mean within the same sampling year (Figure 6.5.3). Individual measurements that make up mean shoot density within the same area can range from a low of 48 turions/m^2 to a high of 272 turions/m^2 with no discernable factor controlling this variability. Finally, there can be high temporal variability, with percent change in density ranging between -41% and +45% between years. Overall, shoot density has high natural variability within North Bay.

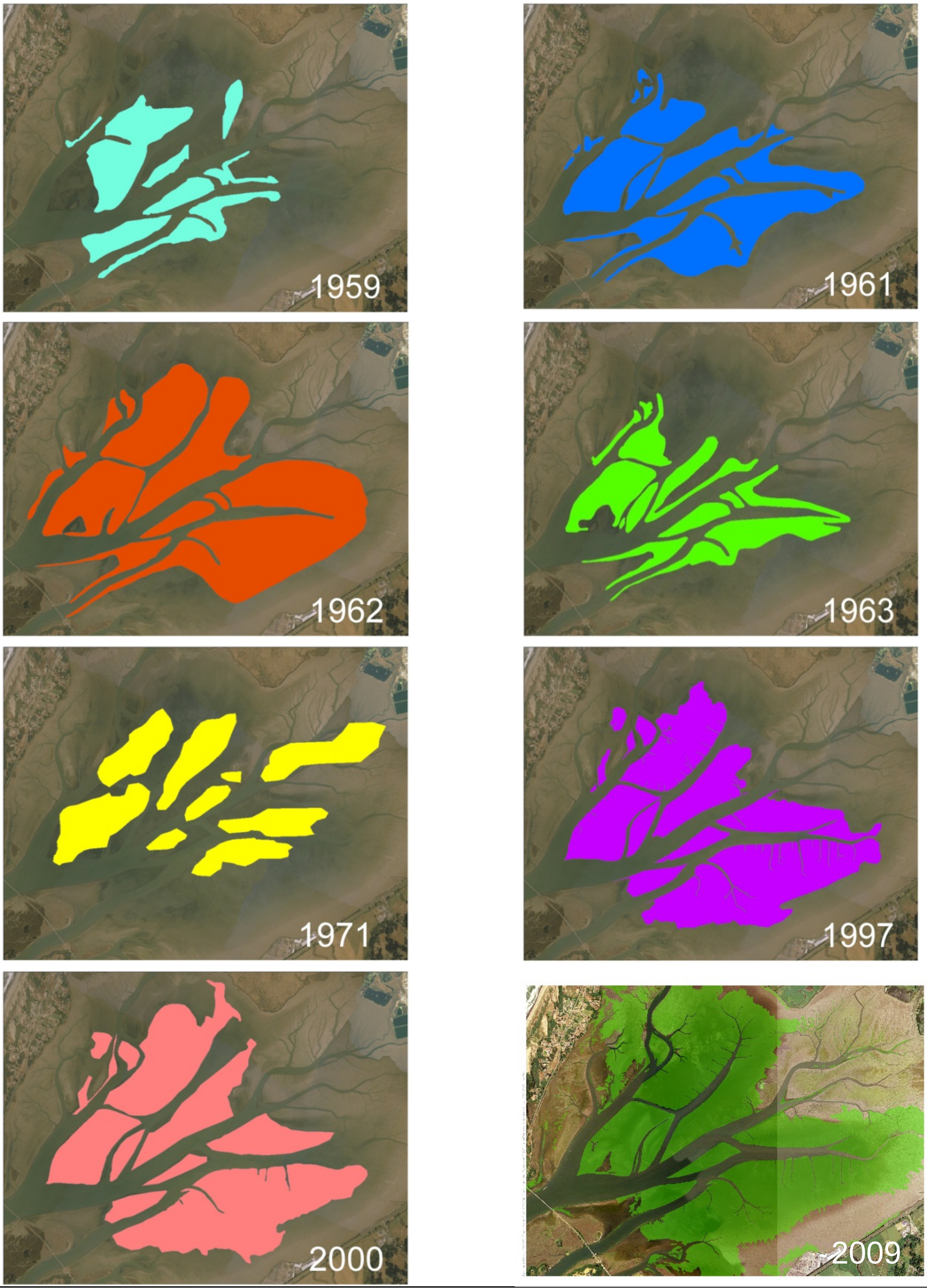

Figure 6.5.2 North Bay Eelgrass Cover from 1959 to 2009.
Source: modified from Schlosser and Eicher (2012).

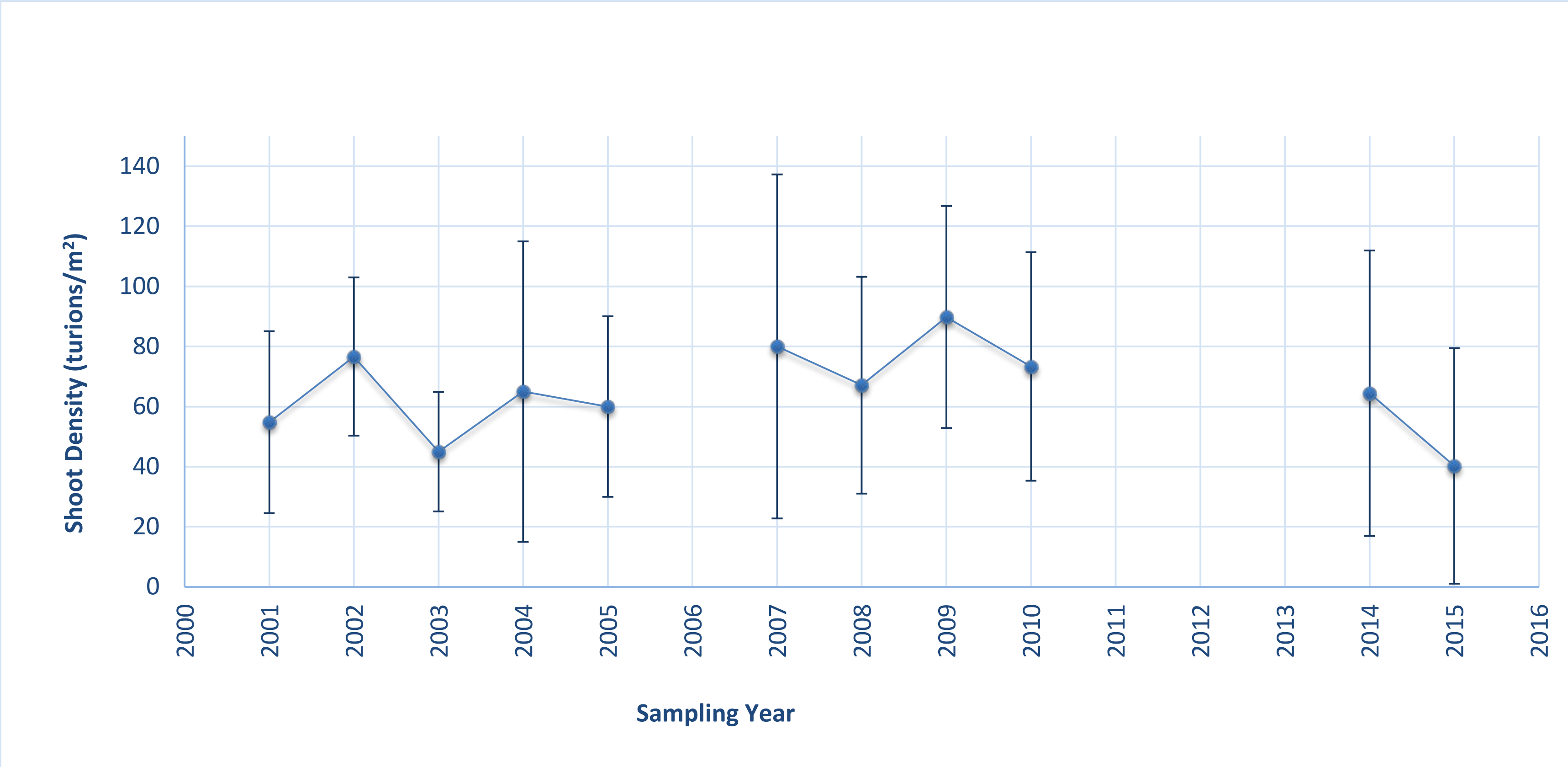

Figure 6.5.3 North Bay Summer (June-August) Eelgrass Shoot Density.
Sources: Rumrill and Poulton 2004, Schlosser and Eicher 2012, SeagrassNet 2015, Rumrill 2015, SHN 2015.
Note: No data were identified for the summer of 2006 and 2011-2013.

6.5.1.4 Ecological Communities

The ecological communities in North Bay include two main types of habitats: subtidal and intertidal. A general description of these communities is provided below.

Subtidal Communities

The subtidal community in Humboldt Bay is comprised of plant and animal species that inhabit areas that are always inundated by water. Approximately 14.3% of North Bay is subtidal (see Figure 6.5.1). Due to the numerous aquatic species that occur in the bay and estuaries, "functionally related" species groups have been defined (HBMP 2007). Special status fish in this community include Pacific lamprey (*Entosphenus tridentatus*), green sturgeon (*Acipenser medirostris*), white sturgeon (*A. transmontanus*), coho salmon (*Oncorhynchus kisutch*), Chinook salmon (*O. tshawytscha*), steelhead (*O. mykiss*), coastal cutthroat trout (*O. clarki*), eulachon (*Thaleichthys pacificus*), and longfin smelt (*Spirinchus thaleichthys*). Commercially and recreationally important species that use subtidal areas include Dungeness crab (*Cancer magister*), Pacific herring (*Clupea pallasii*), rockfish (*Sebastes* spp.), and California halibut (*Paralichthys californicus*). Numerous bird and marine mammal species also use subtidal areas.

Intertidal Communities

Intertidal areas include substrates exposed during lower tides and submerged during higher tides. The tidal range in North Bay is approximately -2.0 ft to +8.5 ft relative to mean lower low water (MLLW). Intertidal areas in North Bay have substrates that are comprised mainly of silty mud with some sand.

There are six major channels in North Bay that cut across the mudflats (Figure 6.5.4). In some areas, eelgrass forms dense beds, and, in other areas, eelgrass is sparsely distributed or absent. Species of marine algae also occur on the mudflats, including red algae (e.g., *Polysiphonia* sp., *Porphyra* sp., and *Ceramium* sp.), rockweed (*Fucus* sp.), and sea lettuce (*Ulva* sp.).

During high tides, fish can use the mudflats as foraging and nursery habitat. According to Schlosser and Eicher (2012), "In summer, large numbers of flatfish, rockfish, sculpins and other juvenile fishes move over flats at high tide to feed on mobile epifauna, sedentary infauna and protruding siphons and tentacles. These demersal fish are opportunistic predators and their prey choice will reflect the infaunal species distribution of the area." Various invertebrate species, including the commercially and recreationally important Dungeness crab, can occur on mudflats during high tides and low tides. Bird and marine mammal species also use intertidal areas. These species are discussed throughout this document.

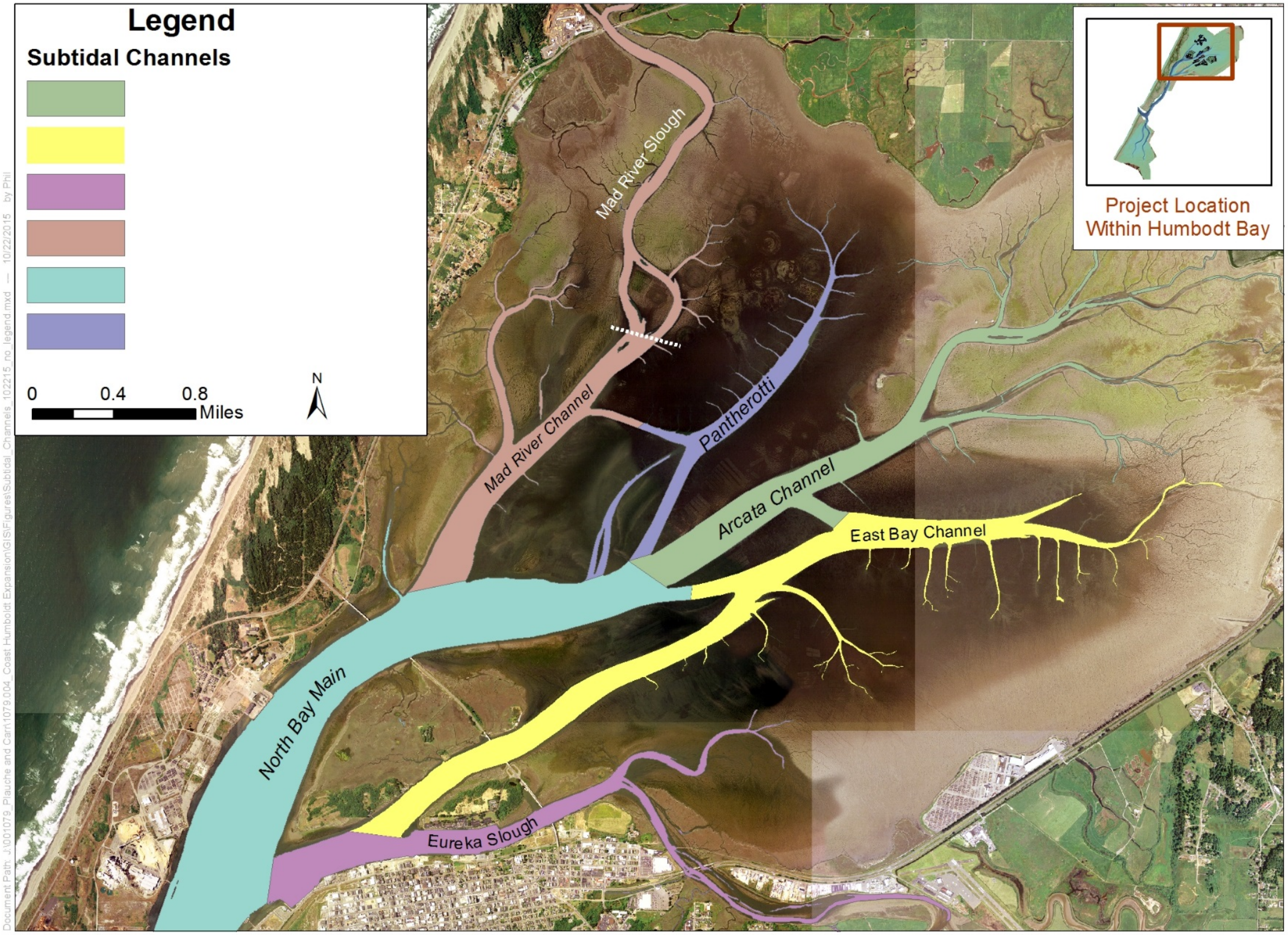

Figure 6.5.4 Major Channels in North Humboldt Bay.
Source: modified from Pinnix et al. (2005), Dale, pers. comm., (2015).

6.5.1.5 Special Status Marine Aquatic Species Potentially Affected

This section focuses on marine aquatic species that are:

- Likely to occur within or adjacent to the Project sites and potentially be affected by the Project.
- Listed under the Endangered Species Act (ESA) or California Endangered Species Act (CESA).
- Listed as a Species of Special Concern or Fully Protected Species by CDFW.
- Marine mammals protected under the Marine Mammal Protection Act (MMPA).

These species are referred to as "special status marine aquatic species." Table 6.5.1 provides a list of species for which the discussion of potential impacts to special status marine aquatic species will focus. Note that black brant (*Branta bernicla*) and other birds will be discussed in a subsequent section. Table 6.5.2 provides an indication of use by month for the special status marine aquatic species discussed below.

Table 6.5.1 Special Status Marine Aquatic Species Potentially Affected by the Project.

Common Name	Scientific Name	Status
Pacific lamprey	*Entosphenus tridentatus*	SSC
Green sturgeon – Southern DPS	*Acipenser medirostris*	FT, SSC
White sturgeon	*Acipenser transmontanus*	SSC
Coho salmon – Southern OR-Northern CA ESU	*Oncorhynchus kisutch*	FT, ST, SSC
Chinook salmon – California coastal ESU	*O. tshawytscha*	FT
Steelhead – Northern California DPS	*O. mykiss*	FT
Coastal cutthroat trout	*O. clarki*	SSC
Eulachon – Southern DPS	*Thaleichthys pacificus*	FT, SSC
Longfin smelt	*Spirinchus thaleichthys*	ST, SSC
California sea lions	*Zalophus californianus*	MMPA
Harbor seal	*Phoca vitulina*	MMPA
Harbor porpoise	*Phocaena phocaena*	MMPA

Sources: CDFW 2015a, CDFW 2015b, NMFS 2015

DPS = Distinct Population Segment; ESU = Evolutionary Significant Unit; FT = Federally Threatened; SE = State Endangered; ST = State Threatened; SSC = CDFW Species of Special Concern; MMPA = Marine Mammal Protection Act

Notes:

1. Special status bird species are addressed in Section 6.5.1.7 below.
2. Tidewater goby (*Eucyclogobius newberryi*) was not included in this analysis, although they are federally endangered species, because they occur in "brackish (somewhat salty) water in shallow lagoons and lower stream reaches where water is fairly still but not stagnant" (USFWS 2015). This type of habitat will not be affected by the Project.

Northern California brook lamprey (*Entosphenus folletti*) were not included in this analysis, even though they are CDFW Species of Special Concern, because they are likely to use Humboldt Bay primarily as a migratory route to freshwater spawning grounds. There are no known studies that have documented their presence in North Bay or intertidal areas of Humboldt Bay.

Table 6.5.2 Timing of special status marine aquatic species use in Humboldt Bay.

Species	Life Stage	Timing											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pacific lamprey	Adult (up)	○	●	●	●	●	●				○	○	○
	Adult (down)	○	○	●	●	●	●	●					○
Green sturgeon	Adult/sub-adult				●	●	●	●	●	●	●		
White sturgeon	Adult/sub-adult	●						●	●	●	●	●	●
Coho salmon	Adult	●	●	●								●	●
	Juvenile		●	●	●	●	●	●	○	○	○	○	○
Chinook salmon	Adult	●										●	●
	Juvenile					●	●	●	●				
Steelhead	Adult	●	●	●	●								●
	Juvenile	○	○	●	●	●	●	●	●	●	○	○	○
Coastal cutthroat	Adult	●	●	●	●								●
	Juvenile					○	○	●	●	●	○	○	
Eulachon	Adult	○	○	●	●	○							○
Longfin smelt	Adult	●	●	●	●	○	○	○	○	○	○	●	●
	Juvenile	○	○	○	○	○	○	○	○	○	○	○	○
California sea lion	Adult	○	○	○	○	○	○	○	○	○	○	○	○
Harbor seal	Adult	●	●	●	●	●	●	●	●	●	●	●	●
	Pups			●	●	●	●						
Harbor porpoise	Adult	○	○	○	○	●	●	●	●	●	●	○	○

○ Based on limited description
● Based on clear timing description

Sources: Goetz 1983, Kucas and Hassler. 1986, Cole 2004, HBWAC and RCAA 2005, Pinnix et al. 2005, Wallace and Allen 2007, Burns 2008, Lowry et al. 2008, Israel et al. 2009, Gustafson et al. 2010, Schlosser and Eicher 2012, Ricker et al. 2014, CDFW 2015b, Pinnix, pers. comm, 2015, Wallace and Allen 2015

Pacific Lamprey

The Pacific lamprey is a CDFW Species of Special Concern (CDFW 2015b). It is the largest lamprey in California, and adults can be up to 40 centimeters (cm) long. Pacific lamprey are widely distributed throughout the coast of California (e.g., Klamath and Eel rivers) and inland to watersheds in the Central Valley (e.g., San Joaquin River and Putah Creek). Similar to salmon, lamprey populations may be anadromous or resident and have a number of distinct runs. For example, Anglin (1994 *as cited in* CDFW 2015b) indicated that the Klamath River may have a spring-run of adults that spawn immediately after upstream migration and a fall-run that wait to spawn until the following spring. According to CDFW (2015b), "the general run trend is low numbers of migrants in October and November and higher numbers in the spring."

Sturgeon – Green Sturgeon and White Sturgeon

Green sturgeon is a long-lived, slow-growing fish species, which is listed as threatened under the Federal ESA (NMFS 2015a) and as a CDFW species of special concern (CDFW 2015b). Mature males range from 4.5 ft to 6.5 ft and they do not reach sexual maturity until about 15 years, while mature females range from 5 ft to 7 ft and do not mature until they are 20 to 25 years (Kelly et al. 2007).

Green sturgeon are considered the most marine-oriented of all the sturgeon species in North America (Moser and Lindley 2007). Juveniles enter bays and estuaries after only a year in freshwater and remain in marine waters until they return as adults to spawn. While green sturgeon are not expected to spawn in any of the Humboldt Bay tributaries, adults and sub-adults use the bay for foraging habitat. Green sturgeon typically access non-spawning estuaries in the summer and early fall months, and sturgeon have been documented in Humboldt Bay between April and October (Pinnix, pers. comm., 2015). Adults and sub-adults are regularly observed in deeper channels of Humboldt Bay, channel margins and mudflats when the tideflats are inundated during high tide, and around Sand Island in North Bay. While they have been observed in mudflats and along eelgrass margins (Pinnix, pers. comm., 2015), green sturgeon do not typically frequent shallow habitat where shellfish aquaculture is located.

Like the green sturgeon, white sturgeon is a long-lived, slow-growing anadromous fish species. It is a CDFW species of special concern (CDFW 2015b). Mature males range from 2.5 ft to 3.5 ft and they do not reach sexual maturity until about 10 to 12 years, while mature females range from 3 ft to 4.5 ft and do not sexually mature until they are 12 to 16 years (CDFW 2015b).

White sturgeon spend most of their lives in nearshore oceanic waters, bays (including Humboldt Bay), and estuaries, although they prefer estuaries of large rivers (PSFMC 1996). The only known self-sustaining spawning population in California is in the Sacramento River, and spawning is believed to occur in the San Joaquin, Klamath, and Eel rivers (Israel et al. 2009). While white sturgeon are not expected to spawn in any of the Humboldt Bay tributaries, adults and sub-adults likely use the bay for foraging habitat. Juvenile white sturgeon have been shown to prefer water greater than 12.5 meters (m) in the Columbia River (McCabe and Tracy 1994). Juvenile and adult white sturgeon prefer deeper water, although they are occasionally found foraging in shallower habitats (Israel et al. 2009, CDFW 2015b).

Salmonids – Coho Salmon, Chinook Salmon, Steelhead Trout, and Coastal Cutthroat Trout

Humboldt Bay supports three salmonid species that are listed as threatened under the Federal ESA (NMFS 2015a): coho salmon Southern Oregon-Northern Coastal California (SONCC) evolutionary significant unit (ESU), the Northern California steelhead trout distinct population segment (DPS), and the California coastal Chinook salmon ESU. The coho salmon SONCC ESU is also listed as threatened under CESA. Additionally, Humboldt Bay supports coastal cutthroat trout, a CDFW species of special concern (CDFW 2015b).

Salmonid life history is characterized by periods of adult upstream migration, spawning and egg development, fry and juvenile development, juvenile downstream migration, and stream-estuary ecotone rearing. Channels within marsh habitats may be of particular importance to juvenile salmonids because of the high insect and invertebrate prey resources and potential refuge from predators

(Bottom et al. 2005). There is significant use of the tidal portions of Humboldt Bay tributaries, including Freshwater Creek, Elk River, and Salmon Creek by juvenile salmonids (Wallace 2006, Wallace and Allen 2007, Wallace and Allen 2015). While this stream-estuary ecotone is very important for salmonid survival, most of the Humboldt Bay sloughs are contained between levees and the adjacent marshes were converted to pasture lands over the last 150 years.

Sampling efforts in eelgrass beds of Humboldt Bay have not resulted in the capture of juvenile salmonids. For example, Pinnix et al. (2005) sampled over a two-year period (August 2003 to August 2005) using fyke nets, shrimp trawls, beach seines, purse seines, cast nets, and minnow traps. The authors identified a diverse and abundant fish community using the mud flats, oyster culture, and eelgrass meadows in Humboldt Bay, including a total of 49 species from 22 families of fishes. However, over the two years of sampling, no salmonid species were captured in any of the six different types of sampling gear employed in these studies. Another long-term study was conducted from June 1994 through August 1995 and then again from May 2003 through May 2006 in a small eelgrass bed adjacent to the main channel near the mouth of Entrance Bay (Garwood et al. 2013). The study collected 43 species representing 20 families of fishes, but only one juvenile steelhead and no other salmonids were collected throughout the six-year study.

There are two basic life history strategies for juvenile coho salmon in Humboldt Bay tributaries (Wallace and Allen 2007). The first were coho that rear in the upper estuary (near salt marsh habitat) for the summer and migrate back upstream to over-winter, and the second were coho that rear in the lower estuary (e.g., intertidal habitat of Humboldt Bay) and then migrate to the ocean. A recent study in Humboldt Bay, California by Pinnix et al. (2013) used acoustic transmitters that were surgically implanted into out-migrating coho salmon smolts that exhibited this second life history strategy. Coho smolts spent more time in the stream-estuary ecotone compared to the lower estuary. During their residency in Humboldt Bay, coho smolts primarily used deep channels and channel margins and lasted an average of 15 to 22 days before migrating out to the open ocean. Coho smolts were also detected near floating eelgrass mats adjacent to the channels, but not over eelgrass beds. The results from this study emphasize the importance of edge habitat and the need for structural heterogeneity during salmonid residency and migration through Humboldt Bay.

Forage Fish – Southern Eulachon and Longfin Smelt

The eulachon is a small, anadromous fish that ranges from the Bering Sea, Alaska to Humboldt Bay, California. Due to a 20-yr decline in eulachon spawning runs, the National Marine Fisheries Service (NMFS) listed the Southern DPS as threatened under ESA in March 2010 (CDFW 2015b). The DPS includes populations in Washington, Oregon, and California. Critical habitat was designated in October 2011 and includes the Klamath River, Redwood Creek, and Mad River in California, which is the known southern extent of the southern DPS population (76 FR 65323). While the critical habitat for southern eulachon extends to just north of Humboldt Bay (i.e., Mad River), there were past occurrences of eulachon in Humboldt Bay tributaries (Jennings 1996) and they are thought to be infrequent visitors in the bay (Gustafson et al. 2010).

Longfin smelt are small, pelagic fish listed as threatened under the CESA and as a CDFW species of special concern (CDFW 2015b). Longfin smelt are known to occur in Humboldt Bay, but little is known regarding their distribution, abundance, or life history. The longfin smelt is a short-lived (generally 2 years) species. Adults spawn in low salinity or freshwater areas within the lower reaches of coastal rivers and the buoyant larvae are swept into more brackish waters where they rear and then move to marine waters. Spawning is believed to occur in tributary watersheds to Humboldt Bay between November and April when water temperatures are below 16°C.

Marine Mammals – California Sea Lions, Harbor Seals, and Harbor Porpoises

California sea lions are restricted to middle latitudes of the eastern North Pacific. There are three recognized management stocks: (1) U.S. stock from Canada to Mexico, (2) western Baja California stock, and (3) Gulf of California stock (Lowry et al. 2008, Carretta et al. 2009). Breeding colonies only occur on islands off southern California, along the western side of Baja California, and in the Gulf of California (Heath and Perrin 2008). California sea lions feed on fish and cephalopods, some of which are commercially important species such as salmonids, Pacific sardines (*Sardinops sagax*), northern anchovy (*Engraulis mordax*), Pacific mackerel (*Scomber japonicus*), Pacific whiting (*Merluccius productus*), rockfish, and market squid (*Loligo opalescens*) (Lowry et al. 1991, Lowry and Carretta 1999, Weise 2000, Lowry and Forney 2005). California sea lions do not breed along the Humboldt County coast. However, non-breeding or migrating adults may occur in Humboldt Bay year-round.

Harbor seals are widely distributed throughout the northern Atlantic and Pacific oceans. They occur along coastal waters, river mouths, and estuaries (Burns 2008, Lowry et al. 2008). Harbor seals consume a variety of prey, but small fishes predominate in their diet (Tallman and Sullivan 2004). In Northern California, pupping peaks in June and lasts about two weeks; pups are weaned in four weeks (Burns 2008). Foraging occurs in a variety of habitats, from streams to bays/estuaries to the open ocean, and harbor seals can dive to depths of almost 500 m (Eguchi and Harvey 2005). Harbor seals breed along the Humboldt County coast and inhabit the area throughout the year (Sullivan 1980). Harbor seals use Humboldt Bay as a pupping and haul-out area; other nearby haul-out sites are located in Trinidad Bay and the mouths of the Mad and Eel rivers. The main pupping locations for harbor seals in Humboldt Bay are in South Bay (Laughlin 1974).

Harbor porpoises are distributed throughout the coastal waters of the North Atlantic, North Pacific Oceans, and the Black Sea. In the North Pacific, they range from Point Conception, California, to as far north as Barrow, Alaska, and west to Russia and Japan (Gaskin 1984, Angliss and Allen 2009, Carretta et al. 2009). Harbor porpoises from California to the inland waters of Washington have been divided into six stocks (Carretta et al. 2009), with three additional stocks occurring in Alaskan waters (Angliss and Allen 2009). Porpoises from Humboldt County are included in the SONCC stock that extends from Point Arena, California, to Lincoln City, Oregon (Carretta et al. 2009). Harbor porpoises have been observed throughout the year at the entrance to and within Humboldt Bay, usually as single individuals but sometimes in groups, with a maximum size of 12 animals (Goetz 1983). Abundance peaks between May and October, and porpoises are most abundant in Humboldt Bay during the flooding tide.

6.5.1.6 Commercially Important Marine Aquatic Species Potentially Affected

This section focuses on marine aquatic species that are:

- Likely to occur within or adjacent to the Project sites and potentially be affected by the Project.
- Commercially or recreationally important marine aquatic species.

These species are referred to as "commercially important marine aquatic species," including Dungeness crab, Pacific herring, rockfish, and California halibut. Table 6.5.3 provides an indication of use by month for the commercially important marine aquatic species discussed below.

Table 6.5.3 Timing of commercially important marine aquatic species use in Humboldt Bay

Species	Life Stage	Timing											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dungeness crab	Adult												
	Juvenile												
Pacific herring	Adult												
	Juvenile												
Rockfish	Adult												
	Juvenile												
California halibut	Adult												
	Juvenile												

Based on limited description

Based on clear timing description

Sources: Cole 2004, Fodrie and Mendoza 2006, Williamson 2006, Mello 2007, Studebaker and Mulligan 2009, Schlosser and Eicher 2012

Dungeness Crab

Dungeness crabs are highly mobile, living in sandy to sand-mud substrates of bays and estuaries and the open ocean at depths less than 750 ft as adults (CDFW 2013). Juvenile Dungeness crabs are found in bays and estuaries from March to July (Wild and Tasto 1983). There is also abundant crab larvae in the planktonic community of the bay in November through February. Adults are rare in Humboldt Bay (Emmett et al. 1991), and the majority of landings occur in the open ocean off the coast in the vicinity of Humboldt Bay.

Habitat use for crabs depends primarily on life stage and size. For example, Williamson (2006) reported that juvenile crabs (mean sizes from 12.2 mm to 35.0 mm) in South Bay were positively correlated with dense eelgrass, areas with less variability in shoot length, and closer proximity to the channel. This study collected juvenile crabs in eelgrass ranging from 212 to 1,016 shoots per square meter (m^2) and distances ranging from 4 m to 75 m from a channel. Small crabs were more prevalent in habitat characterized by higher shoot density than larger crabs. Small juvenile crabs may be associated with high density eelgrass as a predator avoidance mechanism (Fernandez et al. 1993). Similarly, in Willapa Bay, adult Dungeness crabs primarily used unstructured muddy areas to feed, adult rock crabs (*Cancer productus*) used oyster aquaculture areas, and juvenile crabs of both species preferred shell deposits and oyster aquaculture areas over eelgrass and unstructured habitat (Dumbauld et al. 2000, Holsman et al. 2006).

Pacific Herring

Pacific herring are small, pelagic fish (also considered forage fish, but not a special-status species as defined above). Herring use Humboldt Bay primarily for spawning and nursery habitat. According to Ray (pers. comm., 2015), herring are present along the coast and make some exploratory excursions into Entrance Bay until they are ready to spawn. This is similar to the pattern of the San Francisco Bay herring stock (Moser and Hsieh 1992, Bollens and Sanders 2004). Herring enter California bays and estuaries from October to April (peak from December to February), remain for one to three weeks without feeding, spawn, and then leave within days (Moser and Hsieh 1992, Bollens and Sanders 2004, CDFW 2006). Adults will hold in deep channels of estuaries to ripen for up to two weeks and then move to shallow areas to spawn (Ray, pers. comm., 2015). As observed by Bollens and Sanders (2004), juvenile herring abundance in San Francisco Bay peaks in February or March, and juvenile fish use the bay for rearing until about August when they migrate out to nearshore coastal waters. Pacific herring were collected as part of the mid-water assemblage in North Bay between 2003 and 2005. The general trend of herring abundance included low numbers in March, peak abundance from April through June, and then low numbers again from August to October (Pinnix, pers. comm., 2015). Overall, there are not many deep areas in Humboldt Bay for adult herring to remain long-term, but the bay is used extensively for nursery habitat of larval and juvenile fish.

Rabin and Barnhart (1986) reported that Pacific herring spawn in both North and South bays, but most spawning occurs in the northern end of the bay. The authors indicated that this is possibly due to an interaction between herring and freshwater inflows where low-salinity conditions may stimulate herring spawning. Although eelgrass is the principal substrate used for spawning in Humboldt Bay, the densest beds did not have spawn deposition during the most recent surveys (Mello 2007, Ray, pers. comm., 2015). A typical spawning event involves the deposition of herring eggs on approximately 300 acres of eelgrass in North Bay (Mello and Ramsay 2004). This represents less than 10% of available eelgrass used in each spawning event.

Groundfish – Rockfish and California Halibut

Both rockfish and California halibut in Humboldt Bay are a commercially- and recreationally-important species (Warner 1982). Some rockfish species (e.g., yelloweye rockfish and bocaccio) are considered to be part of the deepwater assemblage and primarily use rocky substrates at depths greater than 151 ft, whereas other species (e.g., copper, brown, and black rockfish) are part of the nearshore sedentary assemblage that live in close association with rocky habitats at depths less than 120 ft (Schlosser and Bloeser 2006, Bargmann et al. 2011). The juvenile life stage of certain species (e.g., black and copper rockfish) are more common within shallower depths and non-rocky substrates such as sand, mud, and areas with kelp or eelgrass (Schlosser and Bloeser 2006, Studebaker and Mulligan 2009, Garwood et al. 2013). The larvae are pelagic and found in the upper mixed zone of the ocean before metamorphosing into juveniles and moving closer to shore (Larson et al. 1994 *as cited in* Parker et al. 2000). Humboldt Bay is primarily habitat for juvenile rockfish (i.e., it does not support much suitable adult habitat), and juvenile rockfish are present in eelgrass and nearshore habitats primarily from May to October (Studebaker and Mulligan 2009).

A study by Schlosser and Bloeser (2006) was conducted in estuaries and nearshore sites in California and Oregon, including Humboldt Bay, in June 2003 through December 2005. One of the main goals of the study was to "identify habitat associations of juvenile rockfish, cabezon and kelp greenling."

The study results indicated that the most common species (in order of abundance) included black, copper, grass, and blue rockfish, which accounted for 91% of the 1,814 rockfish collected. The most highly used habitat types by juvenile rockfish in Humboldt Bay included mud associated with drift algae and pilings. Mud (or sediment with clay or silt) is a prominent habitat in North Bay (Figure 6.5.5).

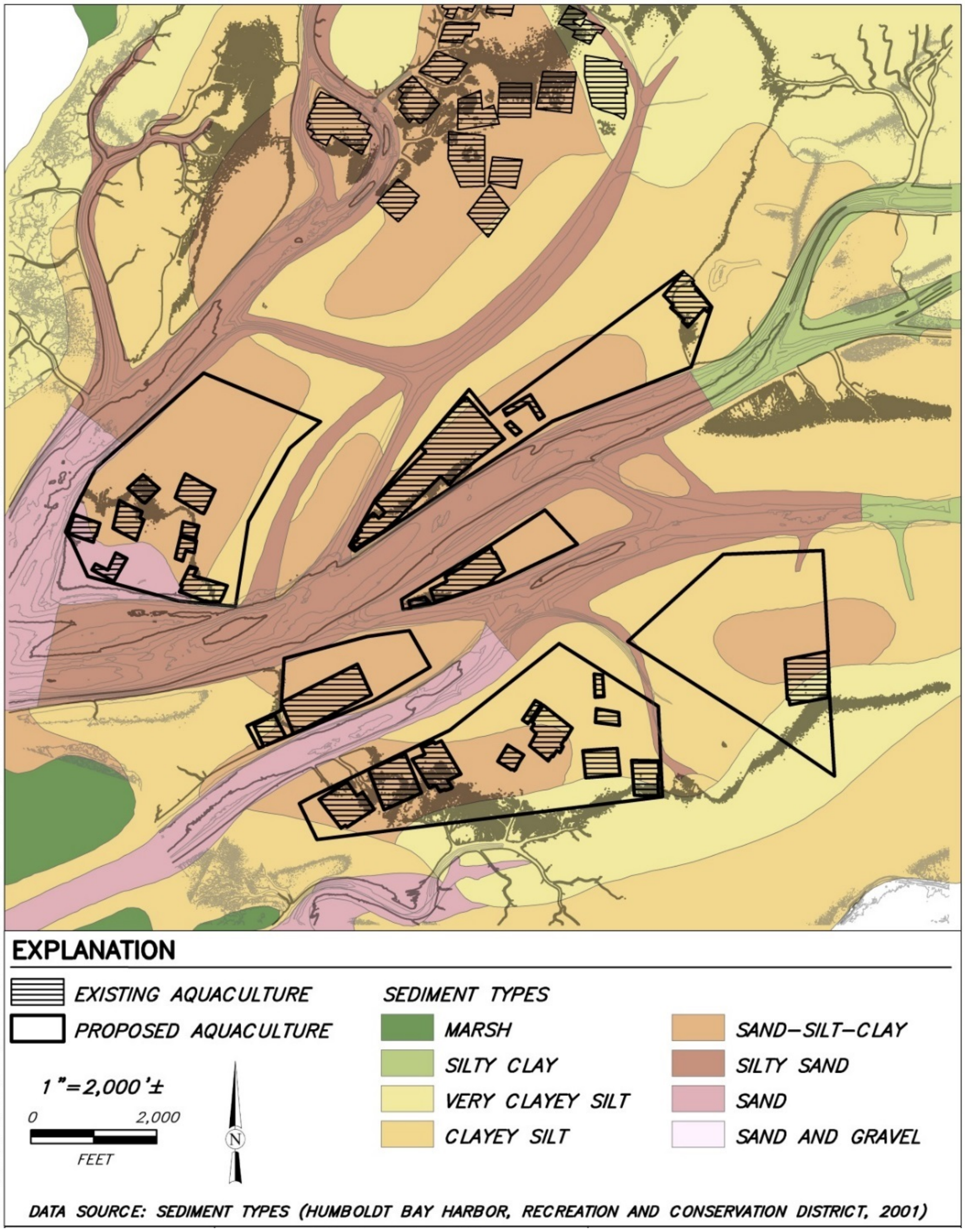

Figure 6.5.5 Sediment Types within the Existing Culture and Proposed Expansion Areas.
Source: SHN (2015).
Notes: Black outlines represent proposed expansion areas; hatched areas represent current culture areas.

A study on the feeding habits of juvenile black and copper rockfish in eelgrass habitats of Humboldt Bay (Studebaker and Mulligan 2009) reported that gammarid amphipods and copepods were the dominant prey items. This is in general agreement with other studies that indicate rockfish feed predominantly on planktonic and epifaunal crustaceans (see references *as cited in* Studebaker and Mulligan 2009). In addition, there was a diet shift in copper rockfish over the course of the study from small planktonic crustaceans to larger epifaunal caprellid amphipods as the fish grew larger, whereas black rockfish showed no preference in diet over time.

Adult California halibut live in nearshore waters ranging from 1 to 100 m deep (Kramer and Sunada 1992 *as cited in* Fodrie and Mendoza 2006). Spawning occurs in pulses throughout the year, but peaks typically occur in February, July, and October. Larvae are planktonic for 3 to 4 weeks and settlement occurs in shallow coastal habitats. Fodrie and Mendoza (2006) conducted an analysis of the availability, usage, and contribution of potential nursery habitats for the California halibut in San Diego County. The authors indicated that there is approximately a 50/50 relationship of halibut that use protected embayments for nursery habitat compared to exposed coasts. Densities of fish in protected embayments (similar to Humboldt Bay) were highest at depths less than 2 m. In addition, fish densities were significantly different between vegetated and unvegetated bottoms, where juveniles (smaller than 250 mm) avoided areas covered by kelp forest, understory algae, or surfgrass. This is in agreement with other work that indicates that California halibut is one of the few fishes whose abundance was much higher in unvegetated areas compared to eelgrass beds (Valle et al. 1999, Bloeser 2000). Drawbridge (1990 *as cited in* Valle et al. 1999) reported that juvenile California halibut (smaller than 63 mm) prefer bare sand over eelgrass in the laboratory because they use the sand to partially bury themselves to avoid predation.

6.5.1.7 Special Status Birds Potentially Impacted

This section focuses on special status bird species that are:

- Likely to occur within or adjacent to the Project sites and potentially be affected by the Project.
- Listed under the Endangered Species Act (ESA) or California Endangered Species Act (CESA).
- Listed as a Species of Special Concern or Fully Protected Species by the California Department of Fish and Wildlife (CDFW).

These species are referred to as "special status bird species." Table 6.5.4 provides a list of species on which the discussion of potential impacts to special status bird species will focus.

Table 6.5.4 Special Status Bird Species Potentially Affected by the Project

Common Name	Scientific Name	Status
Marbled Murrelet	*Brachyramphus marmoratus*	FT, SE, SS
Western Snowy Plover	*Charadrius nivosus*	FT, SSC
California Brown Pelican	*Pelecanus occidentalis californicus*	FD, SD, FP
Black Brant	*Branta bernicla nigr*	SSC

Sources: CDFW 2015a, CDFW 2015b, USFWS 2015
FT = Federally Threatened; FD = Federally Delisted; SE = State Endangered; SD = State Delisted; FP = CDFW Fully Protected; SS = CDFW Sensitive; SSC = CDFW Species of Special Concern

Marbled Murrelet

The marbled murrelet (*Brachyramphus marmoratus*) occurs along the Pacific coast from Alaska to California, foraging nearshore in marine subtidal and pelagic habitats for small fish and invertebrates (USFWS 1992). Nesting occurs in mature, coastal coniferous forest with nest cups built on large branches in tall trees. In California, nesting occurs primarily in Del Norte and Humboldt counties, but occurs south to Santa Cruz County. The loss of old-growth forest is a primary reason for this species' decline (USFWS 1992). In California, marbled murrelets nest in redwoods greater than 200 years old (Nelson 1997). They are also vulnerable to oil spills along the coast.

Marbled murrelets are known to occur in small numbers in Humboldt Bay as foragers, particularly in the late summer and fall; they are observed primarily in the subtidal entrance portion of the bay between King Salmon and the Elk River mouth (Strong, pers. comm., 2015).

Western Snowy Plover

The western snowy plover (*Charadrius nivosus nivosus*) nests along the Pacific Coast from Damon Point, Washington to Bahia Magdalena, Baja California, Mexico (USFWS 2007). Degradation and use of habitat for human activities has been largely responsible for the decline in snowy plover breeding population; other important threats to the snowy plover are mammalian and avian predators, and human disturbance (Page et al. 1995). In the Humboldt Bay region, western snowy plovers primarily breed and winter on ocean-fronting beaches (Brindock and Colwell 2011) although small numbers of plovers have been documented nesting on gravel bars of the Eel River (Colwell et al. 2011).

California Brown Pelican

The California brown pelican (*Pelecanus occidentalis californicus*), a subspecies of the brown pelican (*P. occidentalis*), ranges widely along the U.S. West Coast. The brown pelican (entire species) was federally listed as endangered, and the California subspecies was listed as endangered by the State of California, due to widespread reproductive failures linked to environmental contaminants such as DDT. It was state and federally delisted in 2009. However, the subspecies remains protected by the State of California. The California brown pelican nests in the Channel Islands, in southern California, as well as in Mexico, but occurs widely along the U.S. West Coast as far north as British Columbia, Canada (Jaques et al. 2008). They feed in estuaries and nearshore ocean waters, plunge-diving to capture small schooling fishes near the water's surface. Communal roosting occurs year-round as pelicans move up and down the coast, and this roosting appears to have several important functions such as predator detection and avoidance, assistance with finding prey, and socialization (Jaques et al. 2008). Pelicans roost on sandbars, pilings, jetties, breakwaters, and offshore rocks, sometimes in large communal roosts that can number in the thousands. In Humboldt Bay, roosting has been reported on Sand Island (high count of 350 pelicans in summer), oyster racks (high counts of just over a hundred pelicans in summer and fall), jetties, mudflats, and manmade structures (Jaques et al. 2008). They are most abundant in Humboldt Bay from summer through mid-fall (Nelson 1989).

Black Brant

The black brant (*Branta bernicla nigricans*) is a sea goose that relies on Pacific coastal habitats. Brant nest in the arctic, including areas in Alaska, Canada, and Russia (Pacific Flyway Council 2002). Due to their broad range, the Pacific Flyway brant population is a shared resource amongst Mexico, the United States, Canada, Russia and Japan (Pacific Flyway Council 2002). The population of black brant is monitored by the Pacific Flyway Council pursuant to the 2002 Pacific Flyway Management Plan for the Pacific Population of Brant (Brant Management Plan) (Pacific Flyway Council 2002). Brant are managed for sustained yield, with a population objective of 150,000 birds. The Brant Management Plan recommends protecting critical brant habitat in the species' range, including pursuing mitigation for loss or degradation of eelgrass beds, grit and loafing sites (Pacific Flyway Council 2002). Black brant are considered a species of special concern while wintering/staging in California.

Humboldt Bay is an important wintering area and spring staging site for brant in the Pacific flyway. Based on peak use, Humboldt Bay is the most important spring staging site in California and the fourth most important site in the Pacific flyway (Moore et al. 2004). Annual estimates of total use-days ranged between 1 to 6 million before 1954, but since have usually been less than 1 million, reaching a low of 285,000 in 1985 (Moore and Black 2006a). The total Pacific Flyway black brant population estimates based on midwinter surveys in January averaged 133,300 from 1991 to 2000 (Pacific Flyway Council 2002). During a two-year study, Humboldt Bay was estimated to support 28% of the flyway population (37,600 birds) in 2000 and 58% (77,800 birds) in 2001 (Lee et al. 2007), indicating that a substantial proportion of the population relies on Humboldt Bay. Although "wintering" brant are generally considered winter residents of the bay, the resident brant population in January and early February is not completely stable, with 3 to 8% turnover per week until February 15 (Lee et al. 2007). The mean stopover duration for all birds in winter and spring (January – April) was estimated to be 26 days (Lee et al. 2007). Therefore, in a given year, Humboldt Bay supports a substantial proportion of the black brant population during migration.

Black brant feed almost exclusively on eelgrass (Ward et al. 1997, 2005; Moore et al. 2004), making them vulnerable to degradation of existing eelgrass habitat (Pacific Flyway 2002; Ward et al. 2005).[3] A large proportion of Pacific Flyway brant uses Humboldt Bay, likely due to its high eelgrass abundance and relative isolation from other suitable spring staging sites (Moore et al. 2004). Eelgrass varies in quantity and quality, and is unavailable to brant during two high tides per day, making the achievement of energy demands challenging for brant (Clausen 2000, Moore and Black 2006b). Brant have been documented repeatedly returning to eelgrass beds that are relatively high in quality (density, biomass, and nutrient content), and have been seen waiting over eelgrass beds until tides recede (Moore and Black 2006b), suggesting brant are making foraging decisions based on prior experience and performance. This observation also suggests that eelgrass quality in Humboldt Bay is important to the ability of brant to meet energetic demands for migration, and thus a reduction in quality and quantity could result in impacts to the flyway population.

There is anecdotal evidence that brant have experienced eelgrass shortages on occasion in Humboldt Bay, and although their non-breeding diet is restricted almost exclusively to eelgrass, brant have been observed in salt marshes and pastures in those years (Moore et al. 2004). Eelgrass shortages have occurred in the winter/spring of the years 1937/38, 1940/41, 1951/52, 1952/53, 1957/58, and 1997/98 (various sources as cited in Moore et al. 2004). The most recent circumstance (1997/98)

[3] A 1995 study of black brant correlated oyster aquaculture in Willapa Bay, Washington with a reduction in eelgrass abundance and corresponding decrease in brant use-days (Wilson & Atkinson 1995); however, the study is not as germane to the Project as other studies, such as those mentioned below, as the study area occurred in oyster ground culture as opposed to off-bottom longline culture.

where eelgrass was unavailable was hypothesized to be due to a long storm duration coupled with a tide cycle that did not allow for eelgrass exposure at low tide, as opposed to any reduction in eelgrass quantity or quality (Dale pers. comm. 2014). There were no notable declines in brant use of Humboldt Bay in those years (despite a decline in their main food source), possibly because of energetic constraints to brant migration and the relative isolation of the bay from others along the Pacific Flyway (Moore et al. 2004). Moore et al. (2004) suggest Humboldt Bay may be a bottleneck for migrating brant, and that some individuals may be unable to move to another site along the flyway without first obtaining adequate energy reserves (i.e., from surrounding habitats, if necessary). Based on the above, there is no evidence that overall eelgrass abundance has been insufficient within the last 50 years to support wintering and staging brant in Humboldt Bay, and brant appear to meet their energetic requirement foraging on a relatively stable and abundant source of eelgrass, except in rare circumstances where heavy rains and tide conditions can constrain foraging efforts.

Surveys conducted in Humboldt Bay each February between 1976 and 2000 found a mean number of 5,049 brant in South Bay and 1,322 brant in North Bay. Otherwise stated, approximately 80% of the birds were observed in South Bay during that period (Moore et al. 2004). Based on comparisons with historical data (1931-1941), the relative proportions of brant using South Bay and North Bay have been similarly distributed (Moore et al. 2004). However, the most recent 2015 winter/spring annual surveys conducted by the Humboldt Bay National Wildlife Refuge detected a recent shift in brant population from South Bay to North Bay, estimating a total of 192,400 bird days for North Bay and 147,930 bird days for South Bay (Refuge, unpublished data). For example, an April survey estimated 3,650 birds occupying North Bay and 2,860 birds in South Bay.

To better inform the impact assessment process, H. T. Harvey & Associates conducted surveys for black brant in North Bay in April 2015, representing the approximate period of peak abundance for the species during the 2015 spring migration period (HTH 2015). Surveys were conducted throughout the entire North Bay (as weather allowed) during high and low tides to record the abundance of brant using North Bay. Surveys were also conducted in North Bay to document the number of brant occurring within Coast's existing aquaculture beds and areas that are proposed for aquaculture expansion. Time-lapse camera monitoring was conducted to augment survey efforts with behavioral observations in aquaculture structure. The mean count during low tide in North Bay was 4,164 birds (range 3,120—5,559) and the mean count during high tide was 3,170 birds (range 2,234—4,340). The observed differences in low and high tide counts reflect observations that brant would congregate in areas away from inundated mudflats during high tides, concentrating in areas including Eureka Slough, areas south of Samoa Bridge (i.e., along Indian Island), or on the lee side of marsh habitats. This occurred presumably because foraging opportunities were more limited during high tides in North Bay when eelgrass was inundated and brant were likely avoiding the windy conditions in the open bay that were more prevalent during afternoon spring high tide surveys.

6.5.1.8 Other Bird Species Potentially Affected

This section focuses on other bird species that are likely to occur within or adjacent to the Project sites and potentially be affected by the Project.

Roosting Birds

Bird species such as double-crested cormorants (*Phalacrocorax auritus*), California brown pelicans, Caspian terns (*Hydroprogne caspia*), Forster's terns (*Sterna forsteri*), elegant terns (*Thalasseus elegans*), and gulls (*Larus* spp.) can be found roosting on structures within Humboldt Bay. Abundance of some species within the bay varies seasonally: Forster's terns are most abundant in winter and spring, elegant terns occur in fall, and pelicans peak in late summer/fall. While double-crested cormorants and gulls are generally abundant year-round, they show a significant increase in species diversity and numerical abundance in winter (eBird 2015). These birds may roost on rafts or other structures associated with aquaculture, and pelicans have been reported roosting on Sand Island located in close proximity to existing shellfish culture areas, as well as on oyster racks in North Bay (Jaques et al. 2008).

Nesting Birds

Caspian terns and double-crested cormorants nesting colonies are present on Sand Island, approximately 320 ft from the northeastern edge of the current oyster culture area (see Figure 6.5.12, *infra*). In 2001-03, 809 double-crested cormorant nests (representing 13% of the statewide total and the largest colony in northern California), and 262 individual Caspian terns, were counted on Sand Island (Capitolo et al. 2004). In 2008, only 103 cormorant nests were counted (Caspian terns were not counted), reflecting a reduction in nests from previous counts; it is possible some birds may have moved to Teal Island in the South Bay where their numbers increased (365 nests in 2003 to 485 nests in 2008) (Adkins and Roby 2010). In 2014, more than 400 cormorant nests were counted and over 300 Caspian tern nests were estimated on Sand Island; the colony was also active in 2015, although numbers are not yet available (P. Capitolo, University of California Santa Cruz, Unpubl. Data). The colony is presumed to still be active.

American Wigeon and Other Waterfowl

Humboldt Bay is the main waterbird migration stopover and wintering area between San Francisco Bay and the mouth of the Columbia River in Oregon. Common waterfowl species in Humboldt Bay during winter include dabbling ducks: American wigeon (*Anas americana*), green-winged teal (*A. crecca*), northern pintail (*A. acuta*), and mallard (*A. platyrhynchos*); diving ducks: greater and lesser scaup (*Aythya marila* and *A. affinis*), bufflehead (*Bucephala albeola*), and surf scoter (*Melanitta perspicillata*); and other waterbirds such as the American coot (*Fulica americana*) (Denson and Bentley 1962, Nelson 1989). Wigeon are one of the first species to arrive in fall, and by far the most abundant waterfowl species in North Bay, followed by pintail and diving ducks (Denson and Bentley 1962, Nelson 1989). Diving ducks generally occur in the deeper channel areas of Humboldt Bay (Nelson 1989), although some diving species, such as scaup, are known to feed on eelgrass (Nienhuis and Groenendijk 1986, Austin et al. 1998, Savard et al. 1998, Kessel et al. 2002) and thus may forage in shallower areas of the bay where shellfish culture sites are located. Surf scoters could also occur at the shellfish culture sites, because they are strongly attracted to and feed on biofouling mussels that accumulate on the shellfish aquaculture structures (Kirk et al. 2007, Žydelis et al. 2008).

Based on winter surveys conducted in 1987-88, waterfowl numbers were higher in the South Bay than North Bay (approximately 8,400 versus 8,000 birds), although American wigeon were more abundant in North Bay than in South Bay (approximately 3,900 versus 2,900 birds) (Nelson 1989). American wigeon is the waterfowl species, other than black brant, most likely to be affected by shellfish culture, based on their habitat use, food preferences, and relative abundance in winter in North Bay. Wigeon utilize a variety of habitat types in and around the bay, occurring in permanent freshwater ponds in fall, shifting to tidal habitats in mid-winter, then moving to flooded pastures in spring, presumably to maximize foraging performance (Brendan 2015). When in tidal habitats of the bay, they are often found in the vicinity of the large eelgrass beds (Denson and Bentley 1962), where they are known to feed on both emergent and free-floating eelgrass (invasive Zostera japonica and endemic Z. marina), and generally occur in low densities (maximum of 1.4 birds/acre from winter 2014 surveys) (Brendan 2015). Other dabbling ducks that occur in the bay, including pintails, mallard, scaup, and teal, are also known to feed on eelgrass, although it makes up a smaller proportion of their diets than it does for wigeon (Baldwin and Lovvorn 1994, Nienhuis and Groenendijk 1986). Feeding on emergent eelgrass generally occurs during low tides when the birds have direct access to eelgrass beds (Baldwin and Lovvorn 1994, Brendan 2015).

Migratory Shorebirds

Humboldt Bay has been designated as a Site of International Importance in the Western Hemisphere Shorebird Reserve Network because it is considered an important estuary for migrating and wintering shorebirds in the Pacific flyway. Numerous species, sometimes numbering in the thousands, use Humboldt Bay during migration. As many as 32 shorebird species and over 80,000 individuals have been recorded during a spring migration (as observed during surveys conducted in April 1991); however, shorebird counts conducted during the 1990's reflect a decline relative to historic estimates (Colwell 1994). Various non-breeding shorebird species use intertidal mudflat areas of Humboldt Bay for foraging, although specific habitat use may be differential based on species morphology, as well as habitat conditions such as water depth (related to tidal cycles) and substrate type.

Shorebirds are very flexible in their diets and consume prey opportunistically, with considerable dietary overlap among species and foraging guilds (Skagen and Oman 1996). They often take prey in accordance with availability, concentrating where prey is most dense (Goss-Custard 1970; Goss-Custard 1977; Goss-Custard 1979), therefore observed distribution of foraging shorebirds likely reflects an abundance of available prey in those locations. Shorebirds typically concentrate at the edge of a receding tideline, where worms, crustaceans, and bivalves occur close to the surface and are available for consumption. Thus, hydrologic regimes and ecosystem processes that maintain abundant invertebrate populations are more important than the presence of specific invertebrate taxa for shorebirds. Near the waterline, shorebird microhabitat use usually depends on each species' leg length, as well as the size and shape of their bills. For example, short-billed semipalmated plovers (*Charadrius semipalmatus*) and black-bellied plovers (*Pluvialis squatarola*) often feed on recently exposed mud, using visual foraging methods. Small sandpipers, such as western sandpiper (*Calidris mauri*) and least sandpipers (*Calidris minutilla*), forage on recently uncovered mud and shallow water. Mid-sized birds such as dunlin (*Calidris alpina*), long-billed dowitchers (*Limnodromus scolopaceus*), and short-billed dowitchers (*Limnodromus griseus*) can forage in slightly deeper water (by probing with their bills), and larger shorebirds such as willets (*Tringa semipalmatus*), long-billed curlews (*Numenius americanus*), and marbled godwits (*Limosa fedoa*) are able to probe in deeper water (although these species will forge in exposed areas as well). In addition to bill shape and leg length, sediment type can dictate where shorebird species forage and sediment particle size influences shorebird distribution in Humboldt Bay. For instance, sanderlings (*Calidris alba*) tend to select areas with coarser sediments and American avocets (*Recurvirostra americana*) tend to occur in areas with finer sediments (Danufsky and Colwell 2003).

In addition to intertidal habitats, shorebirds in Humboldt Bay also exploit non-tidal habitats, particularly agricultural fields when intertidal mudflats are inundated (Colwell and Dodd 1997; Long and Ralph 2001). Shorebird use of pastures is correlated with (and dependent on) rainfall, as shorebirds likely exploit increased prey availability when pastures are wet, or possibly their use of pastures is related to a decrease in prey availability on mudflats during rainfall (Colwell and Dodd 1997). Shorebird use of non-tidal habitats has been observed in other estuaries, including in San Francisco Bay where shorebirds regularly use salt ponds, salt pans, marsh ponds, and other habitats (HTH 2005).

6.5.2 Pertinent Laws and Regulations

In the vicinity of the Project, numerous riparian habitats and other sensitive natural communities have been identified by city governments, CDFW, and the U.S. Fish and Wildlife Service (USFWS). These natural communities provide habitat for year-round and migrant species. Specific areas managed by local, state, or federal entities protecting riparian habitats and other sensitive natural communities include:

- The Humboldt Bay National Wildlife Refuge Complex, owned and managed by the USFWS.
- The Arcata Marsh and Wildlife Sanctuary, owned and managed by the City of Arcata.
- CDFW Wildlife Areas (WA), at the following locations: South Spit WA, Eel River WA.
- Fay Slough WA, Mad River Slough WA, Elk River WA.

Plans protecting biological resources in the vicinity of the Project include Local Coastal Plans, the Open Space Element of the County General Plan, Habitat Conservation Plans (HCPs), and recovery plans for listed species that are likely to occur within the Management Area.
Local Coastal Plans and other relevant documents include:

- City of Arcata Certified Local Coastal Program.
- Humboldt Bay Area Plan of the Humboldt County Local Coastal Program. 2014. County of Humboldt.
- Eel River Area Plan of the Humboldt County Local Coastal Program. April 2007. County of Humboldt.
- Humboldt County Local Coastal Plan, Issue Identification Report. September 2003. Humboldt County Planning and Building Department.
- Humboldt Bay National Wildlife Refuge Comprehensive Conservation Plan. 2009. U.S. Fish and Wildlife Service.
- Humboldt Bay Management Plan. 2007. Humboldt Bay Harbor, Recreation and Conservation District.

Humboldt County's coastal plan policies call for providing maximum public access and recreational use of the coast; protecting wetlands, rare and endangered habitats, environmentally sensitive areas, tidepools, and stream channels; maintaining productive coastal agricultural lands; directing new development to already urbanized areas; protecting scenic beauty, and locating coastal energy facilities such that they have the least impact (County of Humboldt 2003).

The County General Plan is currently being updated (County of Humboldt 2012). The Biological Resources section of the Conservation and Open Space Elements describes the policies for preservation of natural resources, production of resources, outdoor recreation, and public health and safety.

In the general vicinity of the Project, HCPs and candidate conservation agreement and assurances plans have been written, but none geographically overlap the expansion area.

The Humboldt Bay Management Plan (2007) provides guidance to the District regarding management of the bay. Preferred uses in North Bay identified by the plan include (1) continued or heightened protection of North Bay's environmental resources, (2) continued use for aquaculture or mariculture, and (3) the continuance and enhancement of recreational opportunities. Overall, the plan expresses a need to balance mariculture activities with other legitimate uses of the bay.

6.5.2.1 Endangered Species Act

Fish and wildlife species are managed by the NMFS and USFWS. Jointly referred to as "the Services", each has regulatory jurisdiction over fish and wildlife resources in the vicinity of Humboldt Bay. The Services regulate fish and wildlife species, and their defined critical habitats, listed for protection under the federal ESA (16 USC 1531–1544, as amended).

6.5.2.2 Magnuson-Stevens Fisheries Conservation and Management Act

Federally managed commercial fisheries are managed under the authority of the Magnuson-Stevens Fishery Conservation and Management Act of 1990, as amended, also referred to as the Magnuson-Stevens Act (MSA). Federal management plans for commercial fisheries have been developed by the Pacific Fishery Management Council (PFMC) and are implemented and enforced under the jurisdiction of NMFS.

Fishery management plans cover fish species that are known to occur or are likely to occur in Humboldt Bay. Habitats used by these federally managed species are protected by NMFS under the Essential Fish Habitat (EFH) provisions of Section 305 of the MSA. The MSA authorizes the federal government to regulate fishing from 3 to 200 miles offshore. In 1996, the MSA was amended to include the Sustainable Fisheries Act, which makes substantive changes regarding bycatch and the conservation of fish habitat. Per U.S. Public Law 109-479, federal agencies or projects with a federal nexus must consult with NMFS when conducting actions that might adversely affect EFH. While the fishery management jurisdiction of the MSA applies to federal waters, the EFH provisions of the act apply throughout the range of the managed species and commonly extend into state-managed estuarine and riverine habitats. The MSA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" for species protected under the act.

6.5.2.3 Marine Mammals Protection Act

All marine mammals are protected under the Marine Mammal Protection Act of 1972 (50 CFR 216). The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. Take under the MMPA is defined as "to hunt, harass, capture, or kill" any marine mammal or attempt to do so.

6.5.2.4 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918 protects numerous species of migratory birds. The list of species protected under the MBTA is maintained by USFWS. The MBTA states that it is "unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product, manufactured or not."

Subject to limitations in the Act, the Secretary of the Interior may adopt regulations determining the extent to which, if at all, hunting, taking, capturing, killing, possessing, selling, purchasing, shipping, transporting or exporting of any migratory bird, part, nest or egg will be allowed, having regard for temperature zones, distribution, abundance, economic value, breeding habits and migratory flight patterns. Regulations are effective upon Presidential approval. §§ 703 and 704.

6.5.3 Definition of Significance and Baseline Conditions

The CEQA Guidelines provide direction in evaluating the Project impacts and determining which impacts will be significant (Remy et al. 1999). CEQA defines significant effects as "a substantial adverse change in the physical conditions which exist in the area affected by the proposed project." Under CEQA Guidelines Section 15065 (Mandatory Findings of Significance), effects on aquatic biological resources are deemed significant where a project would:

- Substantially reduce the habitat of a fish or wildlife species;
- Cause a fish or wildlife population to drop below self-sustaining levels;
- Threaten to eliminate a plant or animal community; or
- Reduce the number or restrict the range of an endangered, threatened, or rare species.

In addition to the Section 15065 criteria that trigger mandatory findings of significance, Appendix G of the CEQA Guidelines provides a checklist of other potential impacts to consider when analyzing the significance of project effects. The impacts for consideration when determining significance include whether the Project would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by CDFW or USFWS.
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA through direct removal, filling, hydrological interruption, or other means.
- Have a substantial adverse effect on coastal wetlands as defined by the CalCA.
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Conflict with any local policies or ordinances protecting biological resources.
- Conflict with the provisions of an adopted HCP, Natural Community Conservation Planning (NCCP), or other approved local, regional, or state HCP.

Specifics on the definition of significance related to specific habitats or species are provided in the individual technical reports for eelgrass habitat (Appendix D), biological resources (Appendix E), and avian resources (Appendix F).

6.5.4 Effects Analysis of the Project

Direct and indirect impacts for biological resources are discussed in this section. This information represents a summary of impacts discussed in four technical reports: (1) Eelgrass Technical Report (Appendix D), (2) Biological Resources Technical Report (Appendix E), (3) Avian Resources Technical Report (Appendix F), and (4) Aquacultural Carrying Capacity Analysis (Appendix G).

Two main metrics are used in order to understand how potential impacts will affect biological resources. The first metric is spatial overlap between different habitat types present in North Bay and the Project (Table 6.5.5). It is important to understand that spatial overlap between habitats is not a quantification of impact because impacts typically occur in discrete portions of a culture area and during limited times and for limited durations. In addition, species do not use different types of habitat to the same degree. For example, near channel habitat, or habitat within 100 meters (m) of a channel, is one of the primary habitat types used in Humboldt Bay by fish and wildlife (e.g., Williamson 2006, Garwood et al. 2013, Pinnix et al. 2013).

Table 6.5.5 Spatial Overlap of the Project with Habitats in North Bay.

Area	Subtidal Channel Habitat	Near Channel Habitat			Intertidal Habitat		
		Non Eelgrass	Patchy Eelgrass	Continuous Eelgrass	Non Eelgrass	Patchy Eelgrass	Continuous Eelgrass
North Bay (acre)	2,110	1,736	657	1,134	3,035	1,301	827
Culture Area (acre)	[6.5]*	6	31	204	9.5	77	288
Area of Influence (%)	0.0%	0.4%	4.7%	18.0%	0.3%	5.9%	34.8%

Source: NOAA 2012

*Subtidal habitat calculations are limited to spatial overlap with floating culture. Although subtidal channel habitat overlaps with 6.5 acres of the proposed expansion areas as represented by planting polygons in Figure 4.4 of the Project Description, intertidal planting is not proposed for these habitats. Since no culture would be planted in subtidal channels, including a 10-ft buffer, the area of influence is shown as 0.0%.

The second metric is frequency of human presence. This metric is relevant for both potential impacts to eelgrass habitat and the potential to disturb fish and wildlife. Frequency of human presence depends on the type of culture method present and the timing of operations (Table 6.5.6).

Table 6.5.6 Frequency of Activity by Culture Method.

Culture Method	Type of Visit	Frequency and Rate
Cultch-on-Longline	Harvesting/Planting	2 days per acre (each acre every 1.5-3 years)
	Maintenance and Inspection	0.4 hours per acre (each acre once every month)

Table 6.5.6 Frequency of Activity by Culture Method.		
Culture Method	**Type of Visit**	**Frequency and Rate**
Basket-on-Longline	Harvesting/Planting	12 days per acre (each acre every 4 months)
	Maintenance and Inspection	While harvesting/planting; sometimes more frequently
Rack-and-Bag	Harvesting/Planting	12 days per acre (each acre every 4 months)
	Maintenance and Inspection	1 day per acre (each acre daily)
FLUPSY	Maintenance and Inspection	Daily
Sources: Dale, pers. comm., 2015; *see also* DEIR Section 4, Project Description		

IMPACT BIO-1: Impacts associated with overwater structures.

The only overwater structure proposed to be added to Humboldt Bay associated with the Project are those associated with the FLUPSY expansion. Although not shown in Table 6.5.5, there will be an increase of 8 bins in the FLUPSY located within Central Bay, which is equivalent to an increase of approximately 72 square feet of additional surface area. While structure can provide increased prey resources (discussed below) and refugia from predation, it can also increase the number of predatory fish associated with the added structure and result in direct impacts from the consumption of fish eggs and larvae (literature *as cited in* Forrest et al. 2009).

Most of the scientific literature on the potential to increase predation pressure in marine systems is in relation to docks and pilings. There are obvious differences between these larger structures and shellfish aquaculture gear, but there are some relevant observations that can be used to determine potential impacts. Typically, when structure is discussed in the literature, the benefit is reported as higher for smaller fish that can use the structure as refugia rather than as predator ambush sites.

Cardwell and Fresh (1979) analyzed the stomach contents of maturing Chinook salmon, copper rockfish, and staghorn sculpin and reported that only staghorn sculpin stomachs contained juvenile salmonids and the presence of juvenile salmonids in the stomach contents did not change in relation to added structure. Ratté and Salo (1985) found no indication that predatory fish aggregated under piers. Instead, predators were actually less abundant in shaded habitat. Salo et al. (1980) found that juvenile salmon comprised less than 4% of piscivorous fish diet in association with pier habitat.

In a study designed to determine if floating clam rafts resulted in increased predator density, or increased salmonid/longfin smelt predation rates, Kalson and Kramer (2015) surveyed fish species under and around floating clam rafts in Humboldt Bay. Seven species of fish were collected. All species are native to Northern California. None of the collected specimens were deemed likely predators on salmonids or longfin smelt.

Further, the proposed expansion is a modest expansion of an existing FLUPSY and is not likely to result in any additional impacts associated with the increase in area. Therefore, impacts associated with overwater structures are considered less than significant under CEQA.

IMPACT BIO-2: Changes to unstructured habitat from the addition of shellfish aquaculture gear.

Unstructured habitat is a very important resource within a mosaic of habitats because it provides edges or transitional zones between two habitat types (Holt et al. 1983, Orth et al. 1984, Boström et al. 2006). Habitat transitions often represent areas with increased biological diversity because it provides habitat for larger species that likely use edge habitat (or near channel habitat, as described above) for foraging. There is a total overlap of 15.5 acres of non-eelgrass habitat within the expansion area (see Table 6.5.5), which includes unstructured habitat with or without macroalgae species present. Approximately 39% (or 6 acres) of this area is within 100 m of a main channel. The addition of structure (e.g., PVC pipes, rack-and-bag structures, and basket-on-longlines) will displace habitat and change the community structure associated with these areas. Conservation Measure BIO-1 requires that no intentional deposition of shells or any other material would occur that would change the sediment type associated with culture operations.

There are certain species (e.g., California halibut, black brant) that tend to avoid structure and other species (e.g., families Cottidae and Embiotocidae) that tend to be structure-oriented. The existing literature on off-bottom culture that would be similar to the proposed activity does not support the conclusion that shellfish aquaculture adversely impacts fish and wildlife. For example, Forrest et al. (2009), which is a review of over 200 papers associated with off-bottom shellfish aquaculture, indicated that effects to fish are often neutral or positive. Adding structure to mudflat habitat in North Bay can provide an increase in prey resources along the near channel habitat where many species appear to forage (discussed below). Researchers have shown that oyster reefs provide more interstitial spaces for predator refugia and increased native species of recreationally and commercially important fish and invertebrates in their early life history stages (Dealteris et al. 2004, Coen et al. 2007). Food-web modeling of intertidal oyster culture at much higher densities than is proposed for the Project (e.g., Leguerrier et al. 2004) also support the conclusion that off-bottom culture could benefit fish and birds due to an enhanced food supply (discussed in more detail below).

While there will likely be changes, the amount of unstructured habitat affected within important transition zones from channels is a small portion of the unstructured nearshore habitat available in North Bay. The species that may be restricted from these areas are not limited by food availability (discussed within individual species sections below), and the potential to increase food resources along the margins of nearshore channel habitat may be a benefit to the majority of higher trophic organisms using North Bay. Therefore, changes to unstructured habitat from the addition of shellfish aquaculture gear are considered less than significant under CEQA.

IMPACT BIO-3 Eelgrass density reduction.

The For this specific Project, the CEQA threshold of significance, as discussed in Appendix D, for impacts to eelgrass habitat was defined as Project effects that result in a change in areal extent of eelgrass and/or a greater than 25% change in eelgrass density. This threshold is based on metrics discussed in the California Eelgrass Mitigation Policy (CEMP), Fonseca et al.'s (1998) discussion of functional equivalency, and management documents (e.g., HBWAC and RCAA 2005, Schlosser et al. 2009).

Aquaculture gear (e.g., baskets, PVC tubes, floats), shellfish products (e.g., cultch), and aquaculture activities can lead to shading, desiccation, and mechanical abrasion, which may affect the spatial extent and density of eelgrass beds in the immediate vicinity of culture. The type and concentration of gear can influence the level of this effect. For example, Rumrill and Poulton (2004) determined that the spatial extent of an eelgrass bed and shoot density were negatively influenced when oyster longline culture was closely spaced (1.5 ft to 2.5 ft) but showed no effect compared to control sites when spacing occurred at 5 ft and 10 ft spaces between longlines. Coast is proposing to use oyster longlines spaced at 5 ft apart (Conservation Measure BIO-2) in order to reduce potential effects to eelgrass.

Based on the best available scientific research (i.e., Western Regional Aquaculture Center (WRAC) study by Rumrill and Poulton (2004), it is apparent that oyster longlines can reduce eelgrass turion density directly under the lines themselves while the space between longlines does not show a reduction in density. According to Rumrill (2015), "eelgrass beds and commercial oyster cultivation can coexist in Humboldt Bay, and that implementation of best management practices that include reduced density of oysters (i.e., oyster culture at 5 ft and 10 ft spacing between the longlines) may aid in the conservation of eelgrass communities." Further, the Rumrill and Poulton (2004) analysis concludes that oyster longline culture spaced at 5 ft apart is not likely to result in a significant impact to eelgrass as compared to control sites without shellfish culture. These observations are consistent with additional recently collected data (SHN 2015) that indicates there is no change to areal extent with longlines spaced 5 ft apart, but there is a density reduction under the longlines.

One of the key calculations provided in Appendix D is the width of effect, which is the extent to which a reduction in eelgrass density would occur under oyster longlines (see Figure 6.5.6 as an example of shading potential from macroalgae growth). This metric was calculated differently for cultch-on-longline compared to basket-on-longline. For cultch-on-longline, the width was based on the amount or length of cultch per line, average width of cultch (weighted by species cultured), growth of oysters, number of floats and posts, and width of fouling organisms attached to the cutch. For basket-on-longline, the width was based on the length of baskets per line, width of baskets, width of floats and posts, and width of fouling organisms attached to the baskets.

Using the values estimated from the empirical data cited above, a density reduction of 47% was estimated within the area described as "width of effect" under cultch-on-longline areas and 70% under basket-on-longline areas. This reduction was applied along the entire length of a longline (100 ft) and within an average width of effect of 0.5 ft for cultch-on-longline culture and 0.9 ft for basket-on-longline culture. Based on this width of effect and the reduction in density directly under the longlines, there would be an approximately 5.0% reduction in eelgrass density within the shellfish aquaculture expansion area and 1.7% when considering the larger eelgrass bed area (i.e., the shellfish culture and the contiguous eelgrass beds surrounding the expansion areas). While this analysis identified a reduction in eelgrass directly under the longlines, the projected reduction is not anticipated to exceed the CEQA thresholds identified above when evaluated within the culture areas or within eelgrass beds. Finally, the analysis of potential impacts was based on empirical observations of loss directly under the longlines and between the lines, which inherently incorporates shading, desiccation, mechanical abrasion, and other working practices that potentially affect eelgrass.

Figure 6.5.6 Depiction of Width of Effect Directly under Oyster Longlines.
Source: modified from Dale, pers. comm., 2015.

The existing culture operations are part of the environmental baseline under CEQA, and so density reduction under the existing culture was not calculated. According to Coast's southwest operations manager (Dale, pers. comm., 2015), many longlines that were originally planted in areas adjacent to eelgrass were later colonized by eelgrass. While no monitoring was associated with the earlier aquaculture activities, the data from NOAA (2012) shows eelgrass and existing shellfish culture in the same areas, potentially supporting the observations that eelgrass has expanded into aquaculture areas.

The Project, with oyster longlines spaced at 5-ft intervals, results in a relatively passive use (especially compared to historical shellfish operations and other anthropogenic activities) of eelgrass habitat. As described in Section 6.5.1.3, eelgrass distribution and density in Humboldt Bay has exhibited a high degree of variability in aerial extent and shoot density during the last 50+ years. This variability is from both natural and anthropegenic factors. For example, changes in water clarity due to runoff associated with upland watershed activities (e.g., silviculture and agriculture) have historically degraded conditions for eelgrass. Increased nutrients from agricultural use of fertilizers or animal waste runoff and municipal sewage discharges have, also affected eelgrass distribution. Throughout these disturbances, eelgrass abundance has remained relatively high and no species populations were identified as limited based on a lack of eelgrass abundance and distribution in Humboldt Bay (see Schlosser et al. 2009).

Unlike other locations around the world where population declines are correlated with habitat loss (e.g., Dulvy et al. 2003), populations of species in Humboldt Bay that are highly associated with eelgrass habitat have not exhibited declines that are directly correlated with changes in eelgrass abundance and distribution (see discussions IMPACT BIO-21 for Pacific herring spawning and IMPACT BIO-25 for black brant foraging). The species utilizing eelgrass in Humboldt Bay are adapted to the variability in abundance and distribution of eelgrass, and the changes to eelgrass density associated with the Project are well below the variability in eelgrass density typically seen in any given year or decade. Given that many of the anthropogenic stressors within the watershed have been reduced or modified (e.g., better agricultural practices, high treatment standards for municipal outfalls, reduced timber harvest and improved management), and that species present in Humboldt Bay are adapted to high variability in eelgrass distribution and abundance, the limited Project effects to eelgrass density will not result in measurable or appreciable changes to species populations in the bay. Stated another way, based on available data, current shellfish aquaculture operations are within the resilience of Humboldt Bay eelgrass, and potential impacts from the Project also are within the natural variation of the system. Despite this conclusion, Coast is proposing habitat improvements (Conservation Measure BIO-3) to compensate for the loss in eelgrass turion density, discussed in Section 6.5.5, Conservation Measures, below.

Coast will also be implementing an eelgrass monitoring plan, attached to the DEIR as Appendix H, to evaluate the Project's impacts to eelgrass. The monitoring plan includes an extensive survey of background eelgrass conditions prior to Project implementation and two years of monitoring following Project construction. The Project may be modified, as needed pursuant to adaptive management, or additional mitigation may be required if observed impacts to eelgrass are greater than anticipated. Assumptions from the impact analysis and monitoring results will be tracked through a Mitigation Accounting system, as described in Appendix B of the Eelgrass Technical Report (Appendix D of the DEIR).

In summary, the Project will meet the goals established by the CEMP to adhere to the goal of no net loss of ecological function. The potential impacts from placing longline aquaculture in eelgrass habitat do not exceed the CEQA thresholds of significance. Coast has proposed to provide compensatory mitigation for potential loss of eelgrass regardless of whether there is a change to ecological functions, which means that the impacts associated with shellfish aquaculture can be outweighed by the net benefits provided by shellfish and the proposed mitigation associated with the Project. Therefore, potential impacts to eelgrass are less than significant under CEQA.

IMPACT BIO-4: Potential trampling of eelgrass related to access and activities during shellfish aquaculture operations.

Although trampling is included in the empirical data discussed above, it is a primary concern in terms of potential effects to eelgrass habitat. Eckrich and Holmquist (2000) studied trampling effects at three intensities on turtle grass in Puerto Rico. The study found that trampling (20 events/month) resulted in reduced seagrass cover and rhizome biomass. The effects were the greatest in areas with softer substrates. The sediment types within the proposed expansion area are primarily clayey silt, sand-silt-clay, or sand (see Figure 6.5.5 above), which fall into the category of "softer substrates." However, turtle grass is known to have slower recovery times compared to eelgrass because it recovers primarily by rhizome extension rather than seed dispersal (Zieman 1976). A more accurate comparison of potential effects from trampling would be for shoal grass (*Halodule beaudettei*). According to Zieman (1976), impacts to shoal grass from recreational activity are not likely to be a problem because the "plant does not have a well-developed deep rhizome system, grows well from seed, and is capable of colonizing a damaged area in a short time." These characteristics are similar to eelgrass (Ruesink et al. 2012).

More importantly, the potential trampling activity within Coast aquaculture plots is much lower than trampling activity studied by Eckrich and Holmquist (2000). Crew access to plots depends on the culture type (see Table 6.5.6), although all culture has TObe visited at least once per month to ensure that aquaculture gear is properly maintained (Conservation Measure BIO-4). Although cultch-on-longline requires the least amount of human activity, harvest activities would occasionally include the placement of bushel tubs, which are connected to floats and would be collected during the next high tide up to 12 hours later. Basket-on-longlines and rack-and-bag are visited more frequently than cultch-on-longline. Basket-on-longline plots are visited on an almost daily basis, but crews are not in the same parts of the bed each day; instead, they work through a bed such that an individual line is visited on average every 4 months (average rate of 12 days per acre). Rack-and-bag culture requires daily visits, to inspect, monitor, and repair bags, but rack-and-bag culture would not be placed in eelgrass (Conservation Measure BIO-5). Apart from planting and harvest, most activity is simply a visual inspection of culture equipment where staff can survey large amounts of equipment without physically accessing all parts of the plot.

In general, disturbance events associated with aquaculture operations in eelgrass are considered infrequent and of short duration within any one location relative to the time that the beds remain submerged. Therefore, trampling effects to eelgrass are considered less than significant under CEQA.

IMPACT BIO-5: Potential to contribute to habitat fragmentation by placing oyster longline aquaculture within patchy and continuous eelgrass beds and boat use.

The development of longline aquaculture (i.e., basket-on-longline and cultch-on-longline) within patchy and continuous eelgrass beds is not expected to contribute to habitat fragmentation. Although shading and other processes associated with lines may reduce eelgrass density within existing eelgrass beds, this reduction is not expected to be large enough to change how fish use the habitat or to affect the ability of the bed to persist from year to year. Prey organisms in the sediment tend to be more closely linked to sediment characteristics than to other habitat features (Frost et al. 1999, Bowden et al. 2001). Furthermore, if habitat fragmentation were to occur, the relationship between species survival and patch characteristics are neither unidirectional nor universal. For example, hard clam survival may improve in continuous eelgrass (Irlandi 1997), while juvenile crab survival may improve in smaller patches (Hovel and Lipcius 2001). The majority of literature related to aquatic habitat indicates that edge habitat is extremely productive (Holt et al. 1983, Orth et al. 1984, Boström et al. 2006), and as long as a habitat mosaic is provided, species use of an estuary would not be significantly altered (Hosack et al. 2006).

Anchoring and operating boats in eelgrass also has the potential to result in habitat fragmentation. The smaller skiffs and longline harvester used to access plots during high tide use small anchors (e.g., 10 lbs. Danforth anchors with 2 m of chain). Based on a study by Milazzo et al. (2004), small boats had a temporary effect to Neptune grass in the Mediterranean Sea, which is a slower growing seagrass that does not have the same recovery potential as eelgrass. In addition, Coast will not anchor the longline harvester so as to shade the same area of eelgrass for a period extending 12 hours (Conservation Measure BIO-6). The main study on boat anchoring that did result in fragmentation of seagrass beds was correlated with moderate anchoring pressure (0.9 boats/day/2500 m^2) from large boats that used 12 kg Brittany-type anchors (Francour et al. 1999). In comparison, the anchoring pressure from Coast operations is currently as shown in Table 6.5.6 (approximately 8 boats/day for 300 acres (or 0.02 boats/day/2500 m^2), and the larger work boats are not anchored in eelgrass

(Conservation Measure BIO-7). Finally, Coast will operate in such a way as to minimize the degree of sediment mobilization and avoid propeller scarring in areas of eelgrass (Conservation Measure BIO-8). Aerial photography in Humboldt Bay does not indicate that the eelgrass beds are being damaged by anchors or propellers, so it appears that no significant loss in biomass is occurring or likely would occur from boat use.

There is no identified impact associated with the Project that is likely to result in habitat fragmentation of eelgrass. Therefore, fragmentation effects to eelgrass from the Project are considered less than significant under CEQA.

IMPACT BIO-6: The potential to affect the development of floating eelgrass rafts and wrack within intertidal habitat of North Bay.

Eelgrass provides habitat structure both within rooted eelgrass beds and in areas where fragments and blades of eelgrass form floating rafts or wrack along the shoreline. Floating eelgrass may provide habitat that facilitates the movements and provides predator refugia for larval and post-larval fish (e.g., Worcester 1994, Pinnix et al. 2013), and can promote the long distance dispersal of eelgrass seeds (e.g., Källström et al. 2008). The break-down of floating rafts can also contribute to nutrient cycling and, through detritivores, the addition of nutrients can contribute to the food web (e.g., Heck et al. 2008). Eelgrass wrack along shorelines provides a food resource for amphipods and isopods, which in turn are preyed upon by birds and fish. The production of floating rafts and wrack is likely proportional to overall eelgrass abundance, with some estimating that approximately 50% of eelgrass biomass produced each year contributes to detrital food webs (Mateo et al. 2003).

A reduction in eelgrass biomass from the addition of longline culture could contribute to reductions of floating rafts and wrack. The presence of longlines could affect the movement of floating materials and cause some material to become entangled in lines or transition from floating to submerged detached eelgrass. However, it is anticipated that most eelgrass material will be detained temporarily and will continue to travel to the areas where material is either concentrated into rafts by surface currents or becomes a component of beach wrack. Oyster longlines spaced 5 ft apart (Conservation Measure BIO-2) should provide similar circulation in the system to allow for movement of material as is already experienced within an eelgrass bed (see discussion of tidal circulation in IMPACT BIO-7 below). More importantly, the reduction in eelgrass density appears to be well within the natural variability of North Bay and the species that use these habitats are adapted to this level of variability in the system, which indicates that a minor reduction in eelgrass density will not significantly affect the processes associated with, or habitats provided by, floating rafts and wrack. Because eelgrass habitat is at or near carrying capacity, a minor reduction in density from the Project will not significantly affect these processes. Therefore, effects to floating eelgrass rafts and the creation of wrack are considered less than significant under CEQA.

IMPACT BIO-7: The potential to change sediment distribution and tidal circulation by placing oyster aquaculture structures within intertidal habitat of North Bay.

The largest alteration of sediment distribution and dynamics in Humboldt Bay continues to be the dredging of channels for navigational purposes. Volumes dredged in the main shipping channels average 143,000 cubic yards per year, with 113,000 cy on average occurring in Eureka Channel (Corps 2012). Historically, oyster harvesting practices (oyster dredging) may have also caused changes in sediment distribution (Barnhart et al. 1992). Oyster dredging is no longer utilized as a method for harvesting oysters in Humboldt Bay (Conservation Measure BIO-9).

Forrest et al. (2009) commented that effects on seabed topography can occur at sites where cultivation structures are in high density or aligned perpendicular to tidal currents. The goal of gear placement for existing culture has been to align gear to minimize sediment accumulation or scouring. This may include gear being placed parallel to tidal currents, to the extent practicable, although currents change seasonally (Dale, pers. Comm., 2015). Overall, it appears that gear placement measures have resulted in very few changes to the seabed of Humboldt Bay where shellfish culture occurs. For example, Rumrill and Poulton (2004) reported a deposition of fine sediments in 5-ft spaced longlines in May (up to 95 mm) that was eroded by July (down to 51 mm). The authors gave no indication whether this was a significant change or if this change persisted. The change observed by Rumrill and Poulton (2004) is minor and within the typical detection limit for this type of study (80 mm) (Hannam and Mouskal 2015). It is anticipated that basket-on-longline areas will have similar effects, although they would potentially be an intermediate effect between cultch-on-longline and rack-and-bag (discussed above). Regardless, studies in locations with active transport do not indicate that changes to sediment distribution and tidal circulation from the proposed types of shellfish aquaculture result in significant changes to the seabed topography (see discussion in Forrest et al. 2009).

The proposed Project, with 5 ft spacing between cultch-on-longlines, 5 ft spacing between groups of three basket-on-longlines and then a 20 ft space, and low density of rack-and-bag structures, is not expected to significantly affect sediment deposition or tidal circulation patterns in North Bay. For the majority of proposed culture, which would be placed in eelgrass, oyster longlines will be similar to conditions exhibited in eelgrass beds. Overall the effect of the Project on these habitat variables is considered less than significant under CEQA.

IMPACT BIO-8: The potential to change nutrients and turbidity conditions within intertidal habitat of North Bay.

Oysters remove nutrients from the water column and can reduce turbidity through filter feeding on phytoplankton and other particulate matter. The amount of benefit that filtration provides depends on the physical mixing of nutrient sources (e.g., oceanic vs. riverine), residence time in the estuary, and grazing pressure of farmed shellfish (Dumbauld et al. 2009). While not currently recognized as a significant benefit in West Coast estuaries, bivalve filtration may become more valuable as nutrient input increases within coastal communities and solutions are needed to reduce nutrient levels (Shumway et al. 2003, Burkholder and Shumway 2011, Kellogg et al. 2013). An ancillary benefit of the shellfish reef structure, which is also true for shellfish aquaculture gear and shellfish, is that the structure and faunal composition provide ample microhabitats for communities of nitrifying microbes. One of the conclusions by Kellogg et al. (2013) was that oyster reef restoration could be considered a "safety net" to reduce additional downstream impacts to water quality. Because shellfish aquaculture provides many of the same benefits, with the added benefit of the total removal of nutrients at harvest, the shellfish industry may be considered to provide a net benefit to water quality ecosystem functions (albeit small).

The studies described above confirm the importance of cultured and natural shellfish assemblages in maintenance of ecosystem stability in many marine estuaries, including the maintenance of eelgrass ecosystems. Relating these observations to Humboldt Bay, it is clear that filter feeding shellfish may locally reduce turbidity and represent a net removal of nitrogen from the bay, as well as a net translocation of nitrogen from the water column to the sediments. The turbidity changes are too small to represent a measurable change from natural variation. The net removal of nitrogen is beneficial, as it compensates for anthropogenic additions of nitrogen, but data are not adequate to quantitatively compare anthropogenic nitrogen influx vis-à-vis nitrogen removal via oyster harvest. The effects of nitrogen translocation are unclear, and it is not possible to predict with confidence how those effects are altering North Bay, or whether the effects are adverse or beneficial.

IMPACT BIO-9: The potential to exceed carrying capacity in Humboldt Bay.

As noted above, shellfish filter water and by doing so can affect food resources for other filter feeding organisms. The Humboldt Bay Mariculture Carrying Capacity Analysis (Carrying Capacity Analysis) attached as Appendix G assessed the potential cumulative impacts associated with the Project, the Humboldt Bay Mariculture Pre-Permitting Project (District Project or Pre-Permitting Project), and existing culture in the bay. The results of this analysis are summarized here, but additional details of this analysis are provided in Appendix G. Note that the information below provides the results from both projects combined instead of separating out the effects from the Project specifically.

The Carrying Capacity Analysis used a set of three indicators developed for shellfish farms by Gibbs (2007) for assessing environmental performance and determining culture carrying capacity within a system, including: (1) clearance efficiency, (2) filtration pressure, and (3) regulation ratio. For each indicator, Gibbs (2007) noted specific thresholds at which the level of culture is nearing the capacity of the system. Based on a review of local data and literature, the Carrying Capacity Analysis calculated clearance efficiency from three different flushing rates for Humboldt Bay: 3 days, 7 days, and 14 days.

The most important indicators used to determine carrying capacity of Humboldt Bay were filtration pressure and regulation ratio. While clearance efficiency was important, and may be approaching the flushing rate for Humboldt Bay under the worst-case scenario, it does not account for phytoplankton production in the bay and only considers the volume of water available for filtration. Comparatively, the other two indicators specifically address the question of food availability. Filtration pressure was shown to range between 5 and 9%, depending on a range of clearance rates, which indicates that the "vast majority of carbon fixed by phytoplankton remains available to non-cultured species." This was considered a conservative result because the calculations do not account for other sources of productivity (e.g., detritus, benthic microalgae, biodeposits), which could add another 30% of carbon to the system (Headstrom 1994 *as cited in* SHN et al. 2015). The final indicator, regulation ratio, was well below the 0.05 threshold established by Gibbs (2007), which indicates that phytoplankton turnover rate replaces itself several times per day. Overall, the Carrying Capacity Analysis concluded that the existing and proposed culture would have some cumulative effect on Humboldt Bay food resources, but there is an abundance of food available and cultured species will not significantly affect the food resources in the bay. Therefore, impacts to food resources for other filter feeding organisms are considered less than significant.

IMPACT BIO-10: The potential to change the presence and persistence of contaminants within North Bay.

Oyster culture has the potential to increase contaminants in the water column associated with the use of work skiffs for accessing the oyster beds and associated areas. As with any mechanized machinery, there is a limited risk of accidental discharge of fuel, lubricants, or hydraulic fluids. The risk to water quality depends on the type of contaminant spilled, time of year, spill amount, and success of containment efforts. Although spills of this nature are detrimental to aquatic organisms, it is expected the impacts would be negligible because of the limited occurrence of spills. Coast is also implementing a number of Conservation Measures (as discussed below and in Section 6.10, Hazards) to minimize the potential for spills and to reduce impacts from any spill that does occur. For example, Coast fuels its boats at the local commercial fuel dock and maintains oil spill absorption pads and seals wash decks or isolates fueling areas prior to fueling so as to prevent any contaminants from entering the water. Coast has also converted all of its skiff motors to highly efficient, less polluting 4-stroke outboards. Coast regularly cleans and maintains all of their equipment and is highly motivated to avoid any spillage of contaminants due to the sensitive nature of oysters both in terms of growth and taste with respect to petrochemicals. With the Conservation Measures discussed in Section 6.10, this impact is considered less than significant under CEQA.

IMPACT BIO-11: The potential to change sediment quality underneath shellfish aquaculture gear due to biodeposits from filter-feeding organisms.

The process of filter-feeding creates nitrogen and phosphorous (biodeposits) that are not digested by bivalves and that are added to the sediment below the aquaculture structure. The release of nutrients can have both negative and positive benefits to a system, depending on scale of the aquaculture operation, and physical conditions of the system (e.g., flushing rate and circulation). The deposition of biodeposits within a shellfish farm can increase the organics in the sediment and potentially change sediment quality. According to Forrest et al. (2009), "the capacity of the environment to assimilate and disperse farm wastes will mainly depend on water current velocity and wave action (Souchu et al. 2001), as these factors control the size and concentration of the depositional 'footprint'." For example, Mallet et al. (2006) reported that oysters from South St-Simon Bay (New Brunswick) raised at a biomass ranging between 4 and 8 kg/m^2 in an 86.5-acre oyster lease using rack-and-bag and floating bag culture showed no significant differences in sediment chemistry between the culture and control sites. St-Simon Bay is characterized as a shallow open bay with excellent water exchange, an extensive eelgrass bed, and bottom sediments that are frequently re-suspended by wind events, particularly during the spring and fall. Comparatively, in Humboldt Bay, oysters in the expansion area are proposed to occur at a biomass of 0.12 kg/m^2 and the bay has many similarities to St-Simon Bay, as described by Mallet et al. (2006). Based on the literature related to sediment quality changes at different shellfish aquaculture densities and the lack of evidence of organic enrichment in a well-flushed system, the density of culture and circulation or wave energy in Humboldt Bay would reduce this potential effect to be less than significant under CEQA.

IMPACT BIO-12: The potential to change species composition through the addition of nutrients to the sediment or adding structure to unstructured habitat.

The majority of studies related to benthic community changes from increased biodeposition are from rack-and-bag culture in areas where culture well exceeds what is proposed by Coast; in some cases, by more than 10 orders of magnitude (e.g., Bouchet and Sauriau 2008). However, even at these extreme densities of culture operations, the literature suggests that oyster culture has a small impact on the stability of the ecosystem or that the ecosystem has adapted to oyster culture in the systems studied. Based on food web modeling, changes from increased organics to the system were shown to result in a positive impact on the food supply for birds and fishes (Leguerrier et al. 2004).

Studies related to the addition of structure came to similar conclusions, with studies reporting an increase in prey resources associated with shellfish aquaculture gear (e.g., Hosack 2003, Ferraro and Cole 2011, 2012). In order to understand whether fish are attracted to or avoid oyster gear compared to eelgrass habitat and unstructured environments, a study performed by Pinnix et al. (2005) directly addressed the question of difference in use by fish between cultch-on-longline culture, eelgrass habitat, and mudflat habitat in Humboldt Bay. Pinnix et al. (2005) noted higher fish abundance associated with oyster culture in North Bay, although species composition was slightly different. Although not studied, basket-on-longline would likely have similar changes with the exception that there are not as many interstitial spaces available for colonization by prey organisms. Simenstad and Fresh (1995) suggested that fish use specific prey resources associated with unique habitats and their use of an area may be linked to species-specific productivity of these prey. Oyster culture can increase epibenthic species present such that fish species targeting specific prey resources in the Pinnix et al. (2005) study may have accounted for the higher abundance found in oyster culture areas (compared to eelgrass or mudflat habitats).

Overall, the literature supports the conclusion that oyster aquaculture gear provides similar foraging habitat and species composition as found in other structured environments (e.g., eelgrass), and may provide more benthic invertebrates and epibenthic invertebrates than mudflat habitat because of the addition of attachment points for organisms. While this is a change to the system, the literature indicates that these changes provide an advantage to smaller organisms or life history stages that are using these areas as rearing habitat. Therefore, changes to species composition are considered less than significant impact under CEQA.

IMPACT BIO-13: The potential to change benthic species composition through trampling during site access for shellfish aquaculture activities (e.g., planting, harvesting, and maintenance).

Studies related to benthic community changes from trampling are generally from locations that have a plant species that responds slowly to disturbance (e.g., turtle grass) and involve recreational areas that have a much higher incidence of potential disturbance than would result from the Project (e.g., Eckrich and Holmquist 2000). The Eckrich and Holmquist (2000) study, for example, (associated with turtle grass in Puerto Rico) looked at impacts to invertebrates and fish at different trampling intensities. They found that, at a trampling rate of 20 events per month and greater, abundances of shrimp decreased while fish did not change. Native eelgrass responds very quickly to disturbance through either rhizome extension or seed dispersal (Ruesink et al. 2012). In terms of potential disturbance events, cultch-on-longline activity occurs about 2 days per acre every 1.5- to 3-years for planting and harvesting and 4 hours per 10-acre area once each month for maintenance. Frequency and intensity for basket-on-longline is about 12 days per acre for planting and harvesting with the same line in rotation about every 4 months.

Aside from the low frequency of access for longlines, a portion of the access is conducted when the beds are inundated (approximately 44% for cultch-on-longline and 80% for basket-on-longline/rack-and-bag). The most intensive culture method proposed, in terms of trampling potential, is rack-and-bag. This culture method is proposed in 4 acres of unstructured habitat outside of eelgrass, and would require daily activity for maintenance. Within Coast's current culture footprint, they have converted all rack-and-bag culture to basket-on-longline culture. The main reason that Coast has transitioned to longline methods is to reduce its ecological footprint in the bay. Longlines (both cultch-on-longline and basket-on-longline) require less maintenance than rack-and-bag culture and allow the site to be accessed when the plots are inundated. However, even with the higher level of activity associated with rack-and-bag culture, Project sites can only be accessed an average of 11% of the year when the plots are exposed during a low tide, which naturally reduces trampling potential associated with shellfish aquaculture operations. Therefore, potential trampling does not occur at the rates discussed above even though human presence occurs more frequently. Disturbance associated with the Project is infrequent and of short duration within any one location. Therefore, trampling effects to the benthic community are considered to be less than significant under CEQA.

IMPACT BIO-14: The potential to introduce non-indigenous species (NIS) to Humboldt Bay from commercial shellfish aquaculture operations.

The list of NIS sampled from Humboldt Bay were compared to surveys of NIS in San Francisco Bay (Cohen and Carlton 1995). The majority of introductions were from the long history of maritime commerce, including both commercial shipping and mariculture, in Humboldt Bay (e.g., introductions from ballast water or in marine algae historically used as packing material for oysters). Boyd et al. (2002) indicated that most organisms were likely present in Humboldt Bay for over 100 years, with the exception of more recent introductions of some tunicates. New introductions that were identified are primarily associated with commercial shipping activity, especially from vessels that transit between San Francisco Bay and Humboldt Bay. The probability that an expansion of oyster culture would expand NIS and fouling organisms outside of the culture areas is considered unlikely. Most NIS that colonize aquaculture gear and shellfish products are sessile (e.g., sponges, anemones, bryozoans, and tunicates) and require structured habitat. Fouling organisms are cleaned on-site from the harvested oysters to conserve water during processing, which means that they can be redistributed into the surrounding habitat. However, the only "hard structure" in the intertidal habitats where Coast is operating is the aquaculture gear and oyster shell itself, which means that there is no suitable substrate to attach to even if the NIS is present after cleaning. Of the 95 NIS identified in Humboldt Bay by Boyd et al. (2002), 14 species were found in oyster growing areas and none of these were identified as invasive[4]. On the contrary, the majority of literature related to organisms that colonize shellfish aquaculture gear are considered to provide additional food resources for fish and larger invertebrates (see discussion above).

[4] Species that are identified as invasive have to fit the criteria of "non-native organisms which cause economic or environmental harm" (ISCC 2015).

Current operations involve a number of stringent management measures to avoid introduction of new NIS and disease. Coast is a participant in a disease prevention program called the "Shellfish High Health Program" sponsored by the Pacific Coast Shellfish Growers Association (PCSGA). This program involves examination of oysters imported into California by a US Department of Agriculture (USDA)-certified Shellfish Pathologist and maintenance of a CDFW permit to import oyster seed from out-of-state or out-of-country hatcheries. Given these management measures to control for disease and NIS, it is unlikely that current oyster operations would result in NIS introductions. Therefore, this impact is considered less than significant under CEQA.

IMPACT BIO-15: The potential to naturalize cultured oysters (that are NIS) into Humboldt Bay.

The cultured species of oysters (Pacific oyster and Kumamoto oyster) are both non-native to Humboldt Bay. Their ability to spread and persist beyond the culture area is low, primarily because water temperature limits the functioning of oysters (Barrett 1963). The oyster species imported into California tolerate water temperatures below 70°F well enough to permit them to grow, but not necessarily to reproduce or for larvae to develop (Barrett 1963, Elliott-Fisk et al. 2005). This is why these species have to be incubated in hatcheries for several weeks before they are placed on the tideflats for grow-out. Further, Pacific oysters and Kumamoto oysters have a larval stage that lasts for two to three weeks (Barrett 1963). As discussed in the Carrying Capacity Analysis (Appendix G), estimated flushing times in Humboldt Bay range from 2.5 days to 14 days. Structured habitat is also limiting in terms of locations where oysters can settle and grow. If oysters were to spread beyond the culture area, they would not be considered to be an "invasive" species, as defined above. Based on the 80+ year history of culturing non-native oysters in Humboldt Bay, there do not appear to be adverse impacts from non-native bivalves, displacement of native species, or establishment of Pacific oysters and Kumamoto oysters. Finally, anecdotal evidence indicates that native Olympia oysters (*Ostrea lurida*) are setting on shellfish aquaculture gear (Dale, pers. comm., 2015), which may provide a benefit to the native species in a location where structured habitat is limited. Therefore, this potential impact is considered less than significant under CEQA.

IMPACT BIO-16: Potential impacts to Dungeness crab from the expansion of oyster aquaculture in Humboldt Bay.

There is no known information in the literature on the potential for human activity associated with oyster longline or rack-and-bag culture to result in impacts to Dungeness crabs. Spatial overlap of the expansion area represents 6.8% (or 241 acres) of near channel habitat (within 100 m of a main channel) available in North Bay overall. In terms of eelgrass habitat, significant changes are not predicted directly under the longlines (e.g., approximately 5% potential reduction in eelgrass density), there is no predicted change to areal extent of eelgrass beds, and the addition of structure can increase forage potential associated with benthic organisms that occur on or under shellfish aquaculture gear (although see discussion below). Additionally, aquaculture gear in the Project area would be exposed for approximately 11% of the year (Wagschal, pers. comm., 2015), which represents a small fraction of potential human presence in any one area where Dungeness crab may be present.

In a comparison of intertidal mudflat, seagrass (*Zostera marina*), and oyster (*Crassostrea gigas*) habitat use, Hosack et al. (2006) indicated that, "Fish and decapod species richness and the size of ecologically and commercially important species, such as Dungeness crab (*Cancer magister*), English sole (*Parophrys* *vetulus*), or lingcod (*Ophiodon elongatus*), were not significantly related to habitat type." The authors noted that these mobile species are using a diversity of habitat and the most important factor in their fitness was the presence of a habitat mosaic that included structured habitat, open spaces, and subtidal channels. The Project is not significantly affecting the mosaic of habitat present in North Bay. Oyster longlines can provide similar prey resources as eelgrass, and there would be no impacts to subtidal channels adjacent to eelgrass and intertidal habitats (see Conservation Measure BIO-10).

Studies of derelict fishing gear and crab pots suggest that marine debris can create a risk of capturing and killing a range of marine invertebrates, fish, birds, and marine mammals (e.g., Matsuoka et al. 2005, Gilardi et al. 2010). However, entanglement of Dungeness crabs is considered unlikely due to: (1) oyster longlines and rack-and-bag structures are not designed with the intention of trapping organisms (i.e., much different than fishing gear and crab pots), and (2) longlines and rack-and-bag structures are placed from 1 to 3 ft off the bottom, and crabs would be able to access the area under the lines when the habitat is inundated. Proactive maintenance and correction of line failures, such as required by Mitigation Measures HAZ-2 and HAZ-5, would essentially eliminate the potential for entanglement.

Overall, impacts to Dungeness crab from the expansion of oyster aquaculture in North Bay are considered less than significant under CEQA.

IMPACT BIO-17: Potential impacts to Pacific lamprey from the expansion of oyster aquaculture in Humboldt Bay.

Pacific lamprey tend to stay relatively close to their natal stream for several years before returning to spawn (CDFW 2015b), and adult migrants have been observed using Freshwater Creek (a main tributary to Humboldt Bay). Coast employees would not interact with early life stages of Pacific lamprey as their habitat is in freshwater. Migrating and holding adult Pacific lamprey may come into contact with Coast employees, but individual culture areas are visited infrequently and disturbance would not be expected.

Pacific lamprey spend most of their life in fresh or marine water, rather than estuaries. There are numerous tributaries to Humboldt Bay which Pacific lamprey may use to spawn. Estuaries are important to Pacific lamprey for foraging, holding, and transitioning from freshwater to marine waters (CDFW 2015b). Although the body of research on Pacific lamprey habitat needs is small, the Project is not expected to limit use of Humboldt Bay by Pacific lamprey. Therefore, the effects of the Project are expected to be less than significant with respect to habitat loss or degradation for Pacific lamprey in the bay. The primary built element that is associated with lamprey decline is dams (CDFW 2015b).

Adult Pacific lamprey are predators of larger fish and marine mammals. The Project would not be expected to exclude larger fish or marine mammals from areas of the North Bay. The shallow intertidal habitats associated with oyster aquaculture in North Bay are primarily used for nursery habitat. For example, Pinnix et al. (2005) estimated 44% of species were using oyster longlines as nursery habitat.

Overall, impacts to Pacific lamprey from the expansion of oyster aquaculture in North Bay are considered less than significant under CEQA.

IMPACT BIO-18: Potential impacts to sturgeon from the expansion of oyster aquaculture in Humboldt Bay.

Green sturgeon appear to be particularly persistent in the North Bay Main Channel and Arcata Channel (see Figure 6.5.4 for the channel labels), and frequently migrate between the Samoa Bridge and Sand Island (Pinnix, pers. comm., 2015). Moser and Lindley (2007) speculate that green sturgeon may use coastal bays as foraging habitat due to their high productivity. The acoustic tag detections shown in Figure 6.5.7 suggest that green sturgeon are moving in channels. However, 97% of observations occurred at two detection locations: Arcata Channel and North Bay Main Channel near the Samoa Bridge. Tracking studies in San Francisco Bay suggest that sturgeon detections are associated with either movement or feeding activity and that directional movement of sturgeon is rapid (Kelly et al. 2006). Taken together, these observations suggest that the large number of detections (148,997) near the extreme north end of Arcata Channel likely represents an area where feeding is occurring. These detections are adjacent to proposed Growing Area 4, including an area occupied by existing culture. However, the detections are also adjacent to extensive mudflat habitats unrelated to shellfish aquaculture operations, which are believed to represent preferred intertidal feeding habitat. Acoustic receivers on the other side of Growing Area 4, and in channels adjacent to all other proposed growing areas have low numbers of detections, suggesting these areas were used primarily for movement activities. White sturgeon also prefer deeper habitats (CDFW 2015b), and use of Humboldt Bay is likely similar to green sturgeon. Human interaction with sturgeon on the oyster plots would be restricted to periods of time when the area is inundated and activity is occurring (approximately 44% for cultch-on-longline and 80% for basket-on-longline/rack-and-bag). Sturgeon present in shallow waters are easy to observe (rolling and splashing), and would be easy for Coast employees to avoid.

Sturgeon are known to utilize intertidal mudflats and deeper channels for feeding. Their preferred prey species include various crustaceans, mollusks, and, for adults, various fish species (Moyle et al. 1992, Moser and Lindley 2007, Dumbauld et al. 2008). Foraging sturgeon tend to frequent areas less than 33 ft deep, moving on and off mudflats with tidal fluctuations (Kelly et al. 2007). The potential overlap of near channel areas (up to 100 m from the channel) in unstructured habitat is approximately 0.4% of North Bay habitat and the potential overlap of near channel areas in eelgrass habitat is approximately 13.1%. This does not represent habitat from which sturgeon are excluded. For example, Pinnix (pers. comm., 2015), suggested that a 5-ft spacing of oyster longlines would allow sufficient area for these fish to maneuver in the event that they do occur in the shellfish growing areas.

Adding shellfish aquaculture gear does represent a change to the habitat. While sturgeon have been known to frequent the Sand Island area (see Figure 6.5.7), a portion of which would include additional structured habitat, sturgeon would be able to access foraging areas in the 5-ft spaces between the longlines and 20-ft spaces between a group of three baskets. Rack-and-bag culture, while spaced closer together for groups of three racks (3 ft apart), also has a 5-ft space between groups. Because the oyster culture expansion areas will mostly be in eelgrass beds, where sturgeon infrequently feed, it is unlikely that sturgeon feeding will be significantly disrupted by the Project.

Overall, impacts to green and white sturgeon from the expansion of oyster aquaculture in North Bay are considered less than significant under CEQA.

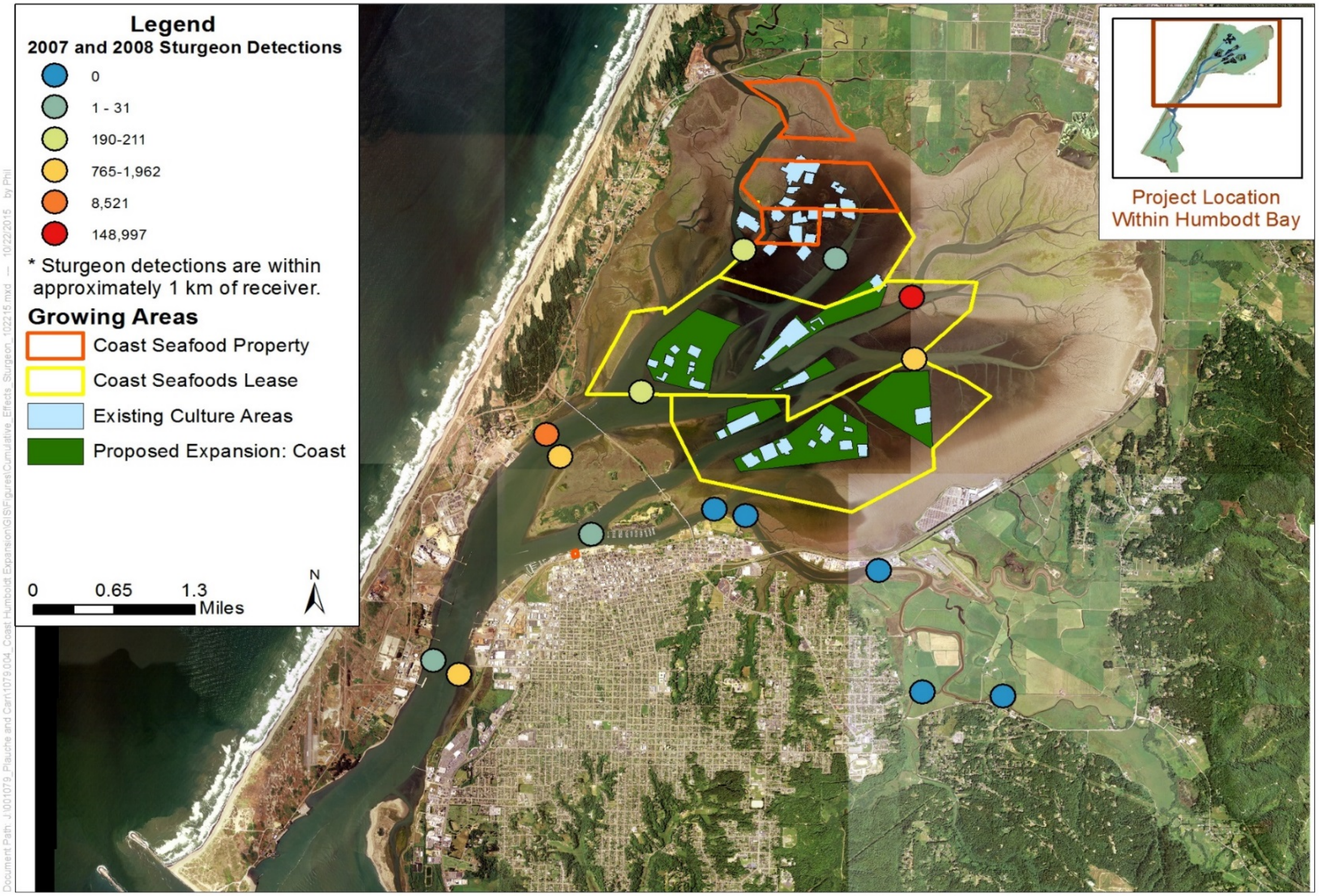

Figure 6.5.7 Green Sturgeon Tracking Data from 2007 and 2008.

Source: modified from CDFW data provided to G. Dale (pers. comm., 2015).

Note 1: The 1 km detection limits for the acoustic receivers and a detection in Freshwater Creek were presented in maps prepared by CDFW, but Pinnix (pers. comm., 2015) indicated that these elements were not necessarily an accurate depiction of where sturgeon are found. Please see discussion in the text.

Note 2: Lease boundaries are approximate based on a review of the legal description and do not represent surveyed locations.

IMPACT BIO-19: Potential impacts to salmonids from the expansion of oyster aquaculture in Humboldt Bay.

Site-specific studies in Humboldt Bay indicate that there may be limited use of eelgrass beds and intertidal mudflats in Humboldt Bay by juvenile salmonids (Pinnix et al. 2005, Garwood et al. 2013). Pinnix et al. (2013) reported that tagged juvenile coho salmon were primarily using deeper channel areas and the margins of these channels during their rapid migration out of the bay and that they were not utilizing shallow estuarine habitat for rearing. Figure 6.5.8 summarizes the tagging data, although see Pinnix et al. (2013) for a complete interpretation of these data. In comparison, work by CDFW has reported extensive use by juvenile salmonids of the upper intertidal areas (which include eelgrass) close to the stream-estuary ecotone that is not associated with oyster growing areas (Wallace 2006, Wallace and Allen 2007, Wallace and Allen 2015). Studies in other areas along the West Coast indicate that most anadromous salmonids that rear for an extended time in freshwater (e.g., coho, spring Chinook, steelhead, sockeye, sea run cutthroat) will be oriented toward deeper water when they are present in estuaries (Simenstad et al. 1982). However, the early migrant fry of chum, pink, and fall Chinook salmon use the shallower margins of estuaries for a few weeks in the spring before moving into deeper water as they grow larger (Simenstad and Eggars 1981, Simenstad et al. 1982). (Note that chum and pink salmon do not occur in Humboldt Bay.) Together, these data suggest that coho and other salmonids are not substantially using the locations where oyster longline culture is being proposed. The primary interaction with Coast operations would be during transit between sites in work vessels and fish would be able to easily avoid boats when present. Finally, even if fish were present in oyster longline areas, individual lines are visited infrequently by Coast employees and disturbance would not be expected.

Magnusson and Hilborn (2003) assessed the survival of coho and fall Chinook salmon released from West Coast hatcheries with respect to three characteristics: (1) size of the estuary, (2) percentage of the estuary that is in natural condition, and (3) presence of oyster culture in the estuary. While Humboldt Bay was not one of the estuaries assessed, the results suggested that oyster culture was not having an adverse impact on salmon survival in estuaries where there were substantial runs. Willapa Bay, which has a 150+ year history of extensive oyster culture in dense eelgrass beds, had the highest coho salmon survival. Grays Harbor, also an important oyster farming estuary, had the third highest coho survival of the 20 estuaries included in the study. Despite the large number of oyster cultivation operations in Willapa Bay and Grays Harbor (over 25% of the oysters consumed in the U.S. are grown in these estuaries), these Washington estuaries have some of the best released coho salmon survival among the areas examined.

Pinnix et al. (2005) found that fish species richness in oyster culture areas of North Bay was greater than or equal to eelgrass areas without oyster culture and in all cases significantly greater than mudflats. This suggests that oyster culture does not lead to habitat loss or degradation with respect to fish habitat, even though no salmonids were sampled during the Pinnix et al. (2005) study. It should be noted that species composition was slightly different in eelgrass compared to oyster culture, which means that oyster culture may support a different community of fishes (Pinnix, pers. comm., 2015). However, there is no indication that the change in community would alter the stability of Humboldt Bay's food web, as discussed above. Therefore, the effects of the Project are expected to be less than significant with respect to habitat loss or degradation for salmonids in the bay.

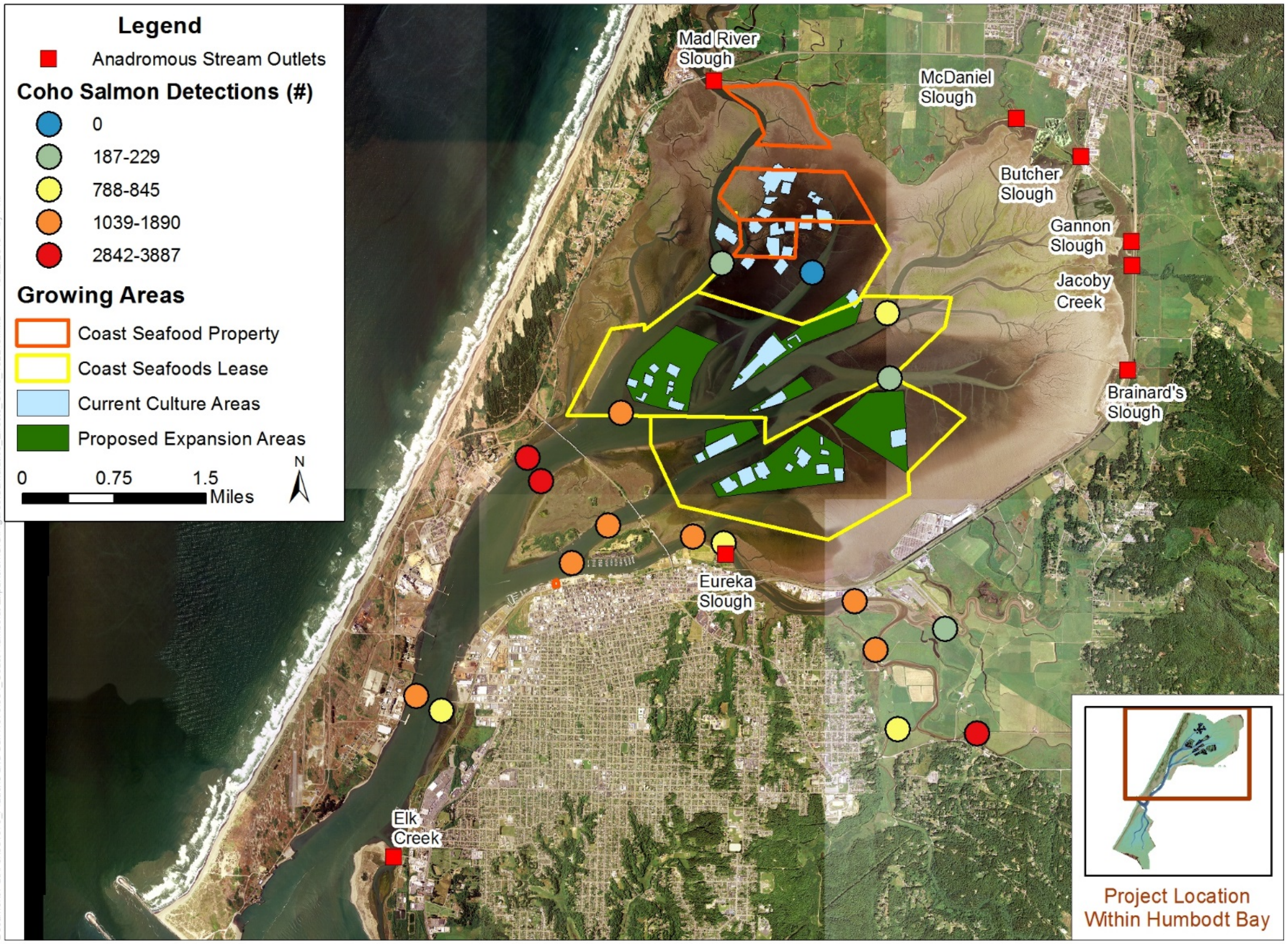

Figure 6.5.8 Coho Salmon Tracking Data from 2007 and 2008.

Note: Lease boundaries are approximate based on a review of the legal description and do not represent surveyed locations.

Multiple studies have looked at the ability of shellfish aquaculture gear to provide salmonid prey items. For example, Simenstad et al. (1991) reported that densities of a harpacticoid copepod (*Tisbe* sp.), which is an important prey item for some juvenile salmonids (e.g., chum salmon), were enhanced in areas of oyster culture compared to bare mudflat. Brooks (1995) found that *Corophium acherusicum*, another critical prey resource for salmonids, was enhanced in actively cultured oyster beds. Dumbauld et al. (*in review*[5]) conducted a study to identify whether intertidal oyster aquaculture in Willapa Bay, Washington effects the distribution and feeding ecology of juvenile salmonids. The study identified that the majority of salmon found over low intertidal habitats were not dependent on structured habitat (e.g., eelgrass or oyster aquaculture) for prey items. Chum salmon was the possible exception, which is typically a smaller fish during estuarine residency. Many authors suggest that prey resources targeted by juvenile salmonids in oyster culture areas are likely equivalent to other productive habitats, such as eelgrass meadows (e.g., Hosack 2003, Hosack et al. 2006, Ferraro and Cole 2011, 2012).

Overall, impacts to salmonids from the expansion of oyster aquaculture in North Bay are considered less than significant under CEQA.

IMPACT BIO-20: Potential impacts to special status forage fish (eulachon and longfin smelt) from the expansion of oyster aquaculture in Humboldt Bay.

Eulachon are not likely to use Humboldt Bay. There are no major spawning streams that drain into the bay and Humboldt Bay is south of their known geographical extent (NMFS 2011). Longfin smelt spawn primarily in freshwater habitat so juvenile and adult smelt may both utilize the expansion area. Aquaculture activity will increase human disturbance in the vicinity of the aquaculture beds where eulachon (if present) and longfin smelt are likely found. Disturbance of fish would be limited to the arrival and departure of crews, which would occur approximately 0.4 hours per acre every month for cultch-on-longline (84% of proposed culture methods), 12 days per acre every 4 months for basket-on-longline (15% of proposed culture methods), and 1 day per acre on a daily basis for rack-and-bag (1% of proposed culture methods). These disturbances are unlikely to substantially increase the predator avoidance behaviors of these fish because aquaculture activities are limited in duration and area.

When oyster plots are accessed when there is no surface water (i.e., during a low tide that drains the tideflats), fish would not be present in the area. Project longlines would be exposed for approximately 11% of the year (Wagschal, pers. comm., 2015), but Coast presence during low tides within a particular one-acre area is a smaller portion of the year. For example, for cultch-on-longline, the average number of hours per acre is about 0.2% of the year (100 hours out of 61,320), but activity occurs in phases which varies by intensity of culture activities. Even for high intensity activity (e.g., harvest), visits are considered infrequent relative to the amount of time the area is left alone.

Juvenile eulachon and longfin smelt forage on small organisms in the water column (e.g., phytoplankton, barnacle larvae, euphausids) and other small crustaceans (Gustafson et al. 2010, DFO 2014). The types of prey resources identified for forage fish are associated with both oyster aquaculture and eelgrass habitat (e.g., Castel et al. 1989, Simenstad and Fresh 1995, Hosack 2003, Hosack et al

[5] Although the information presented was taken from the manuscript, it is also discussed in the WRAC project termination report that supported the manuscript (Dumbauld 2006).

2006, Ferraro and Cole 2011, 2012). Based on the most recent carrying capacity analysis (see Appendix G and IMPACT BIO-9 above), filtration pressure of cultured shellfish would be equivalent to approximately 5 to 9%[6] of the carbon fixed by phytoplankton in North Bay. Additionally, modeling results indicate that the phytoplankton turnover rate is too fast to be significantly affected by current and proposed shellfish culture. Changes to prey resources due to Project actions are unlikely to significantly change prey availability for eulachon and longfin smelt.

Overall, impacts to eulachon and longfin smelt from the expansion of oyster aquaculture in North Bay are considered less than significant under CEQA.

IMPACT BIO-21: Potential impacts to Pacific herring from the expansion of oyster aquaculture in Humboldt Bay.

There is likely overlap with Pacific herring and the proposed expansion area because herring spawn on eelgrass habitat and herring have been recently observed spawning in areas where the Project will occur (for example, see Figure 6.5.9). Additionally, adults use subtidal channels adjacent to spawning areas. The extent to which particular channels are used by Pacific herring is dependent on tidal stage, size of the tidal exchange, time (day or night), maturity level, herring abundance, predator activity, and freshwater influx (Ray, pers. comm., 2015). As they mature, the herring begin to spend more time in closer proximity to spawning grounds and there is considerable movement of fish up into the channels of North Bay on flood tides and then out again on ebb tides. Based on data from CDFW about past and current spawning locations, the East Bay channel and Arcata channel (adjacent to the East Bay Management Area) are likely locations for pre-spawning holding activities (Mello et al. 2007, Ray, pers. comm., 2015). These channels are used to transit to oyster plots, but other than temporary passage of work vessels, there would be no human activities in the pre-spawning holding areas. Potential disturbance in channels is anticipated to be minor, given that the Project would result in an increase of approximately 18 boat trips per week throughout the bay, of which a smaller portion would be in the East Bay and Arcata channels.

While there is more potential overlap with Pacific herring because they spawn on eelgrass habitat, trends in eelgrass abundance and shellfish aquaculture operations appear to be unrelated to herring spawning biomass or locations of spawn deposition in Humboldt Bay. Eelgrass has been stable or expanding since the 1960’s (Schlosser and Eicher 2012). Despite the high abundance of eelgrass in the bay, herring populations have suffered a precipitous decline from 950 tons to 7 tons before monitoring was suspended in 2007 (Figure 6.5.10).

Significant population reductions have occurred during a period when Coast reduced its aquaculture footprint in the bay, including areas within the East Bay Management Area (EBMA) where spawn was historically dominant (Rabin and Barnhart 1986, Mello 2007) and where the majority of spawn deposition was recently identified during the 2014/2015 spawn survey (see Figure 6.5.9). Herring spawn surveys are not conducted within existing culture areas. However, several areas that were active in 2004 were sampled during the 2014/2015 season. There were successful detects of spawn deposition in historic culture areas and areas directly adjacent to actively farmed oyster plots

[6] This result is for all cultured shellfish, including culture proposed under the Pre-Permitting project, as discussed in Section 7.0, Cumulative Impacts.

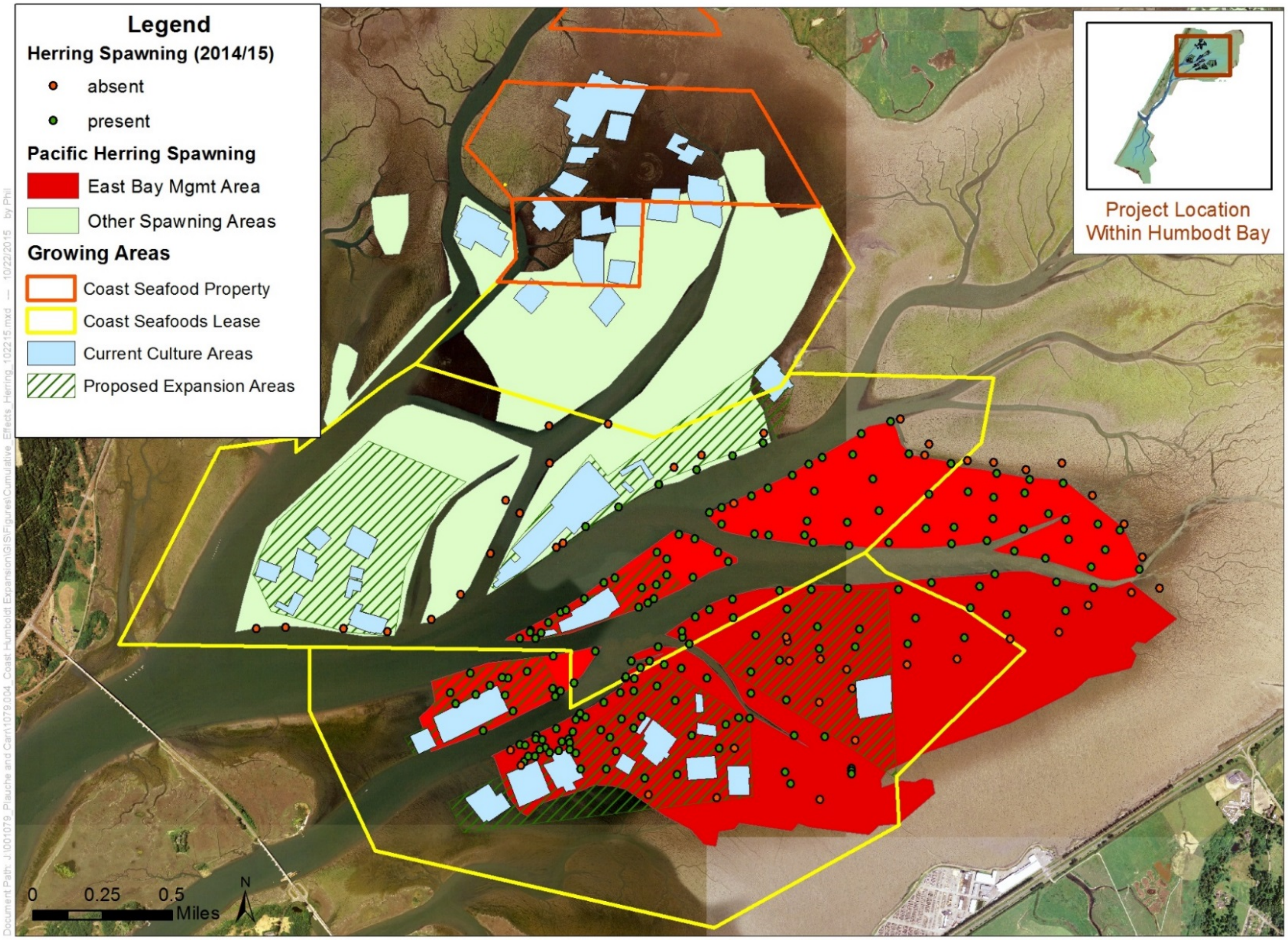

Figure 6.5.9 Pacific Herring Spawning Locations in East Bay, Humboldt Bay, California.
Source: modified from CDFW data provided to G. Dale (pers. comm., 2015).
Note: Lease boundaries are approximate based on a review of the legal description and do not represent surveyed locations.

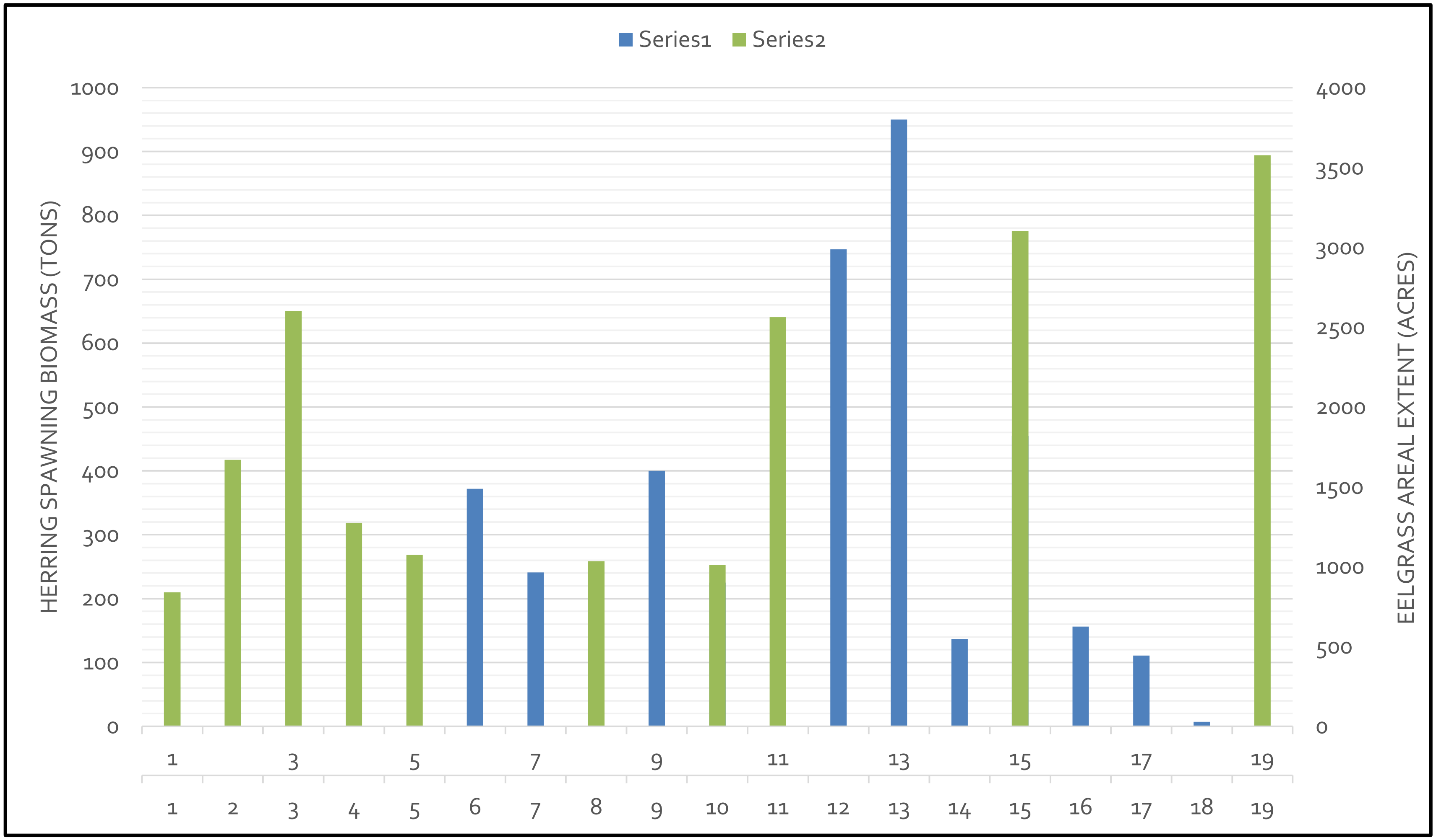

Figure 6.5.10 Herring Spawning Biomass and Eelgrass Areal Extent in North Bay (Humboldt Bay).

Sources: Schlosser and Eicher 2012, Mello 2007

Note: While this represents the best available information, there are limitations to mapping methods that make direct comparisons complicated. In general, eelgrass appears to be stable in Humboldt Bay but overall areal extent may be inaccurate between years.

Herring spawning occurs primarily in the EBMA, but has also been observed in other locations of North Bay. Project-specific impacts to herring spawning locations would include a potential eelgrass density reduction of up to 5% directly under the longlines. However, Pacific herring are not limited by spawning substrates in Humboldt Bay, using a maximum of approximately 10% of the available spawning substrate during a typical spawning event (Mello and Ramsay 2004).

Shelton et al. (2014) indicated that spawn survival varies with spawning populations, not by substrate type. The authors reported that egg loss rates were not significantly different on the three substrates studied, including native eelgrass (*Z. marina*), non-native eelgrass (*Z. japonica*), and non-native macroalgae (*Sargassum muticum*). Aquaculture gear can also be used as a spawning substrate, but is elevated approximately 1 foot above the bay bottom, and herring eggs on gear would have slightly greater periods of exposure during low tides. Based on an exposure elevation analysis of aquaculture gear (Wagschal, pers. comm., 2015), spawn on gear potentially represents an increase of exposure to air by approximately 11%. Jones (1972) estimated that herring eggs deposited at higher elevations have up to 3% higher mortality based solely on desiccation potential. However, increased mortality due to desiccation is likely to be offset by reduced predation pressure from invertebrates and fish during high tides (Palsson 1984, Rooper and Haldorson 2000). These latter authors noted that desiccation potential and predation pressure are the main trade-offs for Pacific herring spawning locations.

Another potential impact to herring spawn is potential survival on shellfish aquaculture gear (e.g., PVC, baskets-on-longline). The effects of artificial substrate on spawn survival were evaluated by Palsson (1984) and Hourston et al. (1984). Hourston et al. (1984) found no difference in egg viability between eggs spawned on plastic versus 11 natural substrates, including eelgrass. Palsson (1984) evaluated a total of 6 artificial substrates placed in natural spawning substrates and found that egg survival rates were somewhat lower on artificial substrates than on adjacent natural substrata. However, Palsson (1984) also speculated that reduced survival may have been due to characteristics of his sampling array rather than characteristics of the artificial substrate.

Based on the amount of overlap with potential herring spawning habitat (channel and near channel habitat, 10.1%), and the potential for herring to spawn on aquaculture gear, impacts to egg deposition is potentially significant if gear or shellfish products are removed when eggs are present. Therefore, Coast will avoid potential impacts to spawning locations (Mitigation Measure BIO-1). Culture beds to be worked are visually surveyed to determine whether herring have spawned on eelgrass, culture materials, or substrate during December through March (e.g., herring spawning season in Humboldt Bay). If spawn is observed, CDFW will be notified and aquaculture activities will be postponed until all of the eggs have hatched.

Based on Mitigation Measure BIO-1, and the above analysis, impacts to Pacific herring from the expansion of oyster culture in North Bay are considered less than significant under CEQA.

IMPACT BIO-22: Potential impacts to groundfish from the expansion of oyster aquaculture in Humboldt Bay.

Juvenile rockfish and flatfish (at least more common species such as English sole) use intertidal mudflat and eelgrass habitats in North Bay (Pinnix et al. 2005). A total of two California halibut were collected in a combined total of six years of sampling effort (Garwood et al. 2013), and surveys in Humboldt Bay have identified this species as an "occasional visitor." There would be overlap with habitats used by groundfish and the proposed shellfish aquaculture activities. Similar to other fish species discussed above, there is a potential to disturb groundfish during oyster aquaculture activities. However, the level of disturbance is considered less than significant based on the frequency and duration of activities. When oyster plots are accessed when there is no surface water, fish would not be present in the area. Similarly, when the area is accessed when the plots are inundated, fish would be able to easily avoid locations where Coast employees are present. While there would be some energetic costs associated with avoiding culture activities, it is minimal.

Groundfish use eelgrass habitat and unstructured habitat for cover and ambush predation. Data collected by Pinnix et al. (2005) in North Bay indicated that fish abundance and diversity (including juvenile rockfish and flatfish species) was higher in oyster culture areas and eelgrass habitat compared to open mudflats. While California halibut may avoid structure, their presence is periodic in Humboldt Bay, especially in the shallow intertidal areas associated with oyster aquaculture (Pinnix et al. 2005). While the Project has the potential to reduce eelgrass density by 5% within the overall culture area, the Project is not anticipated to result in any aerial loss of eelgrass and fish would be able to use the habitat in a manner similar to their current use of eelgrass beds. Based on work by Pinnix et al. (2005), there is no indication that groundfish species are restricted or substantially affected by the presence of oyster longlines.

Structurally complex habitats (e.g., eelgrass) have been shown to enhance the abundance of invertebrates important as groundfish food sources (Bell et al. 1984, Attrill et al. 2000, Jenkins et al. 2002). Several studies have shown that epifaunal invertebrate densities are similar between eelgrass beds and areas with oyster culture and both of these types of habitat have greater densities of epibenthic invertebrates and fish compared to open mudflats (Castel et al. 1989, Simenstad and Fresh 1995, Hosack 2003, Hosack et al. 2006, Ferraro and Cole 2011, 2012). In addition, Simenstad and Fresh (1995) found that many potential disturbances from aquaculture activities were within the scale of natural variation experienced by smaller epibenthic crustaceans.

Groundfish would primarily use channels for migration or shallow mudflats when inundated. There is no evidence that oyster longlines would affect access or migration of groundfish species. As discussed above, changes to unstructured habitat are not necessarily negative for groundfish species, except potentially California halibut which are occasional visitors to Humboldt Bay. California halibut are primarily using near channel habitat, which is a minor component of the Project (e.g., 0.4% overlap with North Bay near channel habitat in unstructured environments). Other flatfish (English sole) and juvenile rockfish can be a dominant species within oyster growing areas (Pinnix et al. 2005), and would not be excluded from aquaculture areas with gear present.

Overall, impacts to groundfish from the expansion of oyster aquaculture in North Bay are considered less than significant under CEQA.

IMPACT BIO-23: Potential impacts to marine mammals from the expansion of oyster aquaculture in Humboldt Bay.

Underwater noise produced by Coast work vessels could impact marine mammals if they are present in the vicinity. Skiffs, like those typically used by Coast, can produce underwater noise levels ranging from 157 to 169 dB_{PEAK} 3 feet from the motor (Kipple and Gabriele 2003). The threshold used by NMFS for behavior impacts to marine mammals is 120 dB_{RMS} (root mean squared). It is not possible to convert peak levels to RMS levels directly, but a conservative rule of thumb can be applied in noise assessments. Peak levels are generally 10 to 20 dB higher than RMS levels. Therefore, to convert from peak to RMS, subtract 10 dB. This likely overestimates the RMS value, but enables the assessment to remain as conservative as possible. Using the conservative conversion of peak to RMS and then using the spherical spreading loss formula to calculate the distance for the underwater noise created by the motor to attenuate to the behavior threshold of marine mammals, the maximum underwater noise generated by a skiff (169 dB_{PEAK}) will attenuate to the marine mammal behavior threshold (120 dB RMS for non-pulse noise) within 136 ft.

This does not take into account the background underwater noise levels of Humboldt Bay, to which marine mammals are habituated. NMFS (2015c) suggested that the 120 dB_{RMS} threshold may be slightly adjusted if background noise levels are at or above this level. There are numerous contributing sources to background marine sound conditions. Sound levels produced by other sources not associated with the Project include recreational boating in the area. Background noise in North Bay was estimated to be between 164 and 182 dB_{PEAK} at 1-yard distance, based on recreational boat use (Kipple and Gabriele 2003). Coast's boat trips would increase (approximately 18 additional/week), although the type of boat would not change. Additionally, Coast recently upgraded from 2-stroke to quieter 4-stroke engines in their boats. Thus, the use of Coast's boats at 157 to 169 dB_{PEAK} would be similar to the background noise conditions currently experienced when boats are operating.

While there are haul-out locations near the Project (Figure 6.5.11), the closest pupping haul-out site is in South Bay, more than six miles away. Therefore, Coast's activities should have no impact on breeding or pupping activities at these haul-out sites. While there are closer non-pupping haul-out locations to the Project, only one haul-out location is near a culture area (Sand Island) and that area has been actively cultured for over 60 years with no indication that there are significant effects to harbor seal populations. Regardless, Coast will not undertake any activities that would be defined as take or harassment (as defined by the MMPA) of any marine mammals (Conservation Measure BIO-11). In addition, Coast will also employ Mitigation Measure BIO-2, which includes avoiding activities that would disturb marine mammals and staying more than 100 m from animals hauled out on Sand Island.

Marine mammals typically use the channels and haul-out locations adjacent to the channels. No activities that result in habitat degradation or alteration were identified that would impact these locations. Forrest et al. (2009) reported on studies that found small dolphin species are reluctant to swim through wooden structure or structure with rope. Harbor porpoises are small dolphins which may exhibit similar behavior as those studied in Forrest et al. (2009). However, no structure is proposed in the channels where porpoises would likely be swimming.

Harbor seals, California sea lions, and harbor porpoises primarily feed on crustaceans, mollusks, squid, and fish (WDFW 2005, NMFS 2015a) in open water. These marine mammals will also alter their foraging behavior in response to seasonal prey pulses. Aquaculture activities that occur when there is no surface water would not impact foraging behavior of marine mammals because marine mammals forage in open water. Activities that occur when the site is inundated, such as when the longline harvester is being used, would avoid areas with marine mammals and so would also not affect foraging behaviors. As described above, there are no expected significant impacts to invertebrates or fish, and so a reduction in prey resources for marine mammals is not expected as a result of Project activities.

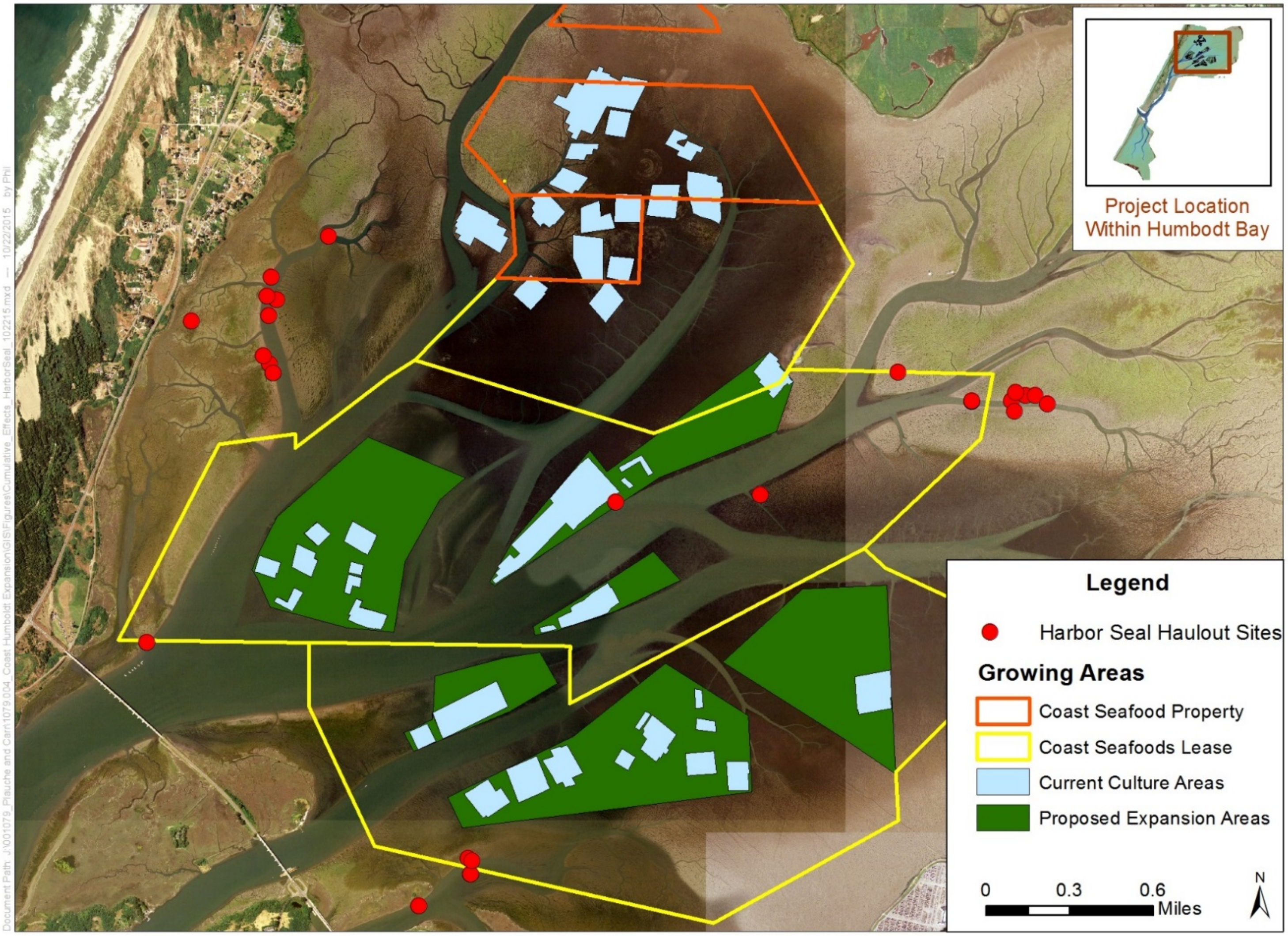

Figure 6.5.11 Harbor Seal Haul-Out Locations in North Bay, Humboldt Bay, California.
Source: modified from CDFW data provided to g. Dale (pers. comm., 2015).
Note: Lease boundaries are approximate based on a review of the legal description and do not represent surveyed locations.

Coast will implement Conservation Measures BIO-11 and Mitigation Measure BIO-2 to reduce potential impacts to marine mammals. Based on these measures, and the above analysis, impacts to marine mammals from the expansion of oyster culture in North Bay are considered less than significant under CEQA.

IMPACT BIO-24: Potential impacts to special status bird species from the expansion of oyster aquaculture in Humboldt Bay.

Marbled murrelets are known to occur in small numbers in Humboldt Bay as foragers, particularly in the late summer and fall; they are observed primarily in the subtidal entrance portion of the bay between King Salmon and the Elk River mouth (Strong, pers. comm., 2015). Marbled murrelets are unlikely to occur in the Project area, as their foraging habitat (i.e., subtidal channels and open bay habitats) does not overlap with the areas proposed for shellfish culture in North Bay, and thus the Project is not expected to impede their ability to forage. While boat traffic could result in disturbance, marbled murrelets are known to forage in subtidal portions of the Bay that have a significant amount of existing boat traffic and therefore may have become accustomed to occasional boat traffic nearby foraging areas. Further, the Project would not result in any additional boat trips to Central or South Bay, and would only result in 18 additional boat trips per week to North Bay. This small increase in boat traffic is not likely to result in a noticeable increase in potential disturbances as compared to existing conditions. Impacts on foraging marbled murrelets are therefore considered less than significant under CEQA.

Nonbreeding western snowy plovers infrequently occur on the interior of Humboldt Bay (Colwell 1994), but mostly in the South Bay on sandier substrates rather than on softer substrates associated with mudflats in North Bay. As noted above, the Project would not result in any additional boat trips to South Bay. Because they are not expected to occur within the subtidal or low intertidal areas proposed for shellfish culture, impacts on western snowy plovers are considered less than significant under CEQA.

Potential impacts on roosting California brown pelicans are described in Impacts to Roosting Birds, below.

IMPACT BIO-25: Potential impacts to black brant foraging from the expansion of oyster aquaculture in Humboldt Bay.

The results of the 2015 North Bay brant surveys conducted by H.T. Harvey & Associates, discussed above, indicate that tide height influences brant use of aquaculture plots and undeveloped expansion areas. During high tides, brant were observed in similar densities in expansion plots (mean density=1.0 birds/acre) and existing plots (mean density=1.3 birds/acre). However, during low tides, black brant were consistently observed in higher densities in undeveloped expansion plots (mean density=2.6 birds/acre) compared to existing aquaculture plots (mean density=0.1 birds/acre). Supplemental time-lapse recordings taken during the April survey period provide further anecdotal evidence that brant forage and traverse both existing and proposed aquaculture sites when water is sufficiently high to swim, but do not occur in sites with longlines at lower tides when the infrastructure is exposed, impeding their swimming ability, even in wider rows within longlines (i.e., 10-foot "boat rows"). The time-lapse video also indicated that brant did not avoid the edges of the existing aquaculture sites at any tidal level. Collectively, this evidence suggests that brant utilize their preferred method of foraging in shallow water when tide height provides sufficient access to rooted eelgrass. The presence of structure apparently precludes them from foraging in this manner when the structure impedes their ability to easily swim through aquaculture sites. Although brant are occasionally observed walking across dry beds and foraging at very low tides, they apparently employ that behavior infrequently, likely due to higher energetic costs associated with foraging in that manner. It should be noted that during these surveys and other observations, eelgrass did not appear to be a limiting resource for brant in North Bay; eelgrass appeared to be abundant bay-wide and brant did not appear to be restricted in their ability to forage.

The effects of brant avoidance of aquaculture structures and the Project's impact on brant food sources were further evaluated using a modeling approach based on a concept developed by Stillman et al. (2015). Stillman et al. (2015) presents an individual-based model that predicts changes in daily mass gain, stopover duration, and survival of black brant in Humboldt Bay in response to sea level rise, changes in eelgrass abundance, and increases in anthropogenic disturbance (e.g., boat traffic). The model takes advantage of the best available data on eelgrass density, distribution, and biomass in Humboldt Bay. Specifics of the model and population characteristics of brant in Humboldt Bay are presented in Appendix F. The model follows a population of brant over a 183-day spring season in which brant arrive, forage, and move throughout the bay.

The model predicts that the total biomass of eelgrass in Humboldt Bay could support up to five times the number of brant than have been observed to use the bay in recent years; however, the authors are careful to point out that this result is somewhat misleading because brant are limited in their ability to fully capitalize on the resource. Eelgrass is only available during a limited window of tidal height, which imposes a temporal limitation on the amount of total eelgrass that is available for foraging. When this temporal limitation is accounted for, the model predicts that as little as a 10% decrease in eelgrass biomass or increase in human disturbance could result in a significant decrease in daily mass gain, which in turn results in a significant increase in stopover duration (i.e., delayed migration toward the breeding grounds). A decrease in the number of birds emigrating from Humboldt Bay was not predicted until eelgrass biomass was reduced or human disturbance was increased by at least 30%.

To assess whether the Project could reduce eelgrass biomass availability to the extent that stopover duration for brant would be significantly increased, the biomass of eelgrass within the Project footprint was estimated using the same modeling approach as used in Stillman et al. (2015). An increase in stopover duration could reduce reproduction success; thus this more conservative metric is used as a threshold of significance under CEQA for impacts associated with loss of foraging resources and human disturbance. Eelgrass biometric parameters consisting of above ground biomass and average shoot length, derived from Sea Grant December/January biometric data collected in 2001/2002 and 2002/2003 (S. Schlosser, unpublished data *as cited in* Stillman et al. 2015), were modeled as a function of depth relative to MLLW (as described in Stillman et al. 2015). Details of this modeling is presented in Appendix F.

To estimate potential impacts to eelgrass biomass and the proportion of that biomass that is potentially available to brant considering existing and proposed oyster longline aquaculture operations, the following factors were incorporated into the analysis. First, information describing reduction in eelgrass density associated with longline oyster aquaculture, in particular a 4.8% reduction[7] in eelgrass density associated with placement of longlines in eelgrass, was used as a surrogate for biomass and applied to all areas associated with both existing aquaculture operations and proposed aquaculture expansion areas.

The bay-wide eelgrass biomass reduction (i.e., the impact to brant foraging) as a result of Project activities was estimated to be approximately 3%. This relies on the following assumptions: (1) aquaculture reduces overall eelgrass biomass by 4.8% within the Project footprint; (2) brant will forage on shoots taller than the longlines and other structures (when tide height allows); and (3) there is no buffer around Project footprints (i.e., where brant are excluded).

The 3% estimated loss of functionally available eelgrass is considered to be less than significant under CEQA. A bay-wide reduction of this magnitude is unlikely to result in additional energetic constraints such that daily mass gain is reduced or stopover duration is increased according to the Stillman et al. model, provided that aquaculture height is maintained at elevations at or below those evaluated in the model. Because higher elevation aquaculture infrastructure than evaluated would result in a further reduction in foraging opportunity for brant, the Project incorporates Mitigation Measure BIO-3, requiring Coast to maintain a maximum longline height of 1-ft above the surface or lower for cultch-on-longline and 40-inches above the surface or lower for basket-on-longline culture.

IMPACT BIO-26: Potential impacts to black brant associated with human disturbance from the expansion of oyster aquaculture in Humboldt Bay.

Disturbance near brant foraging, gritting, or roosting habitat, including loud noise or the presence and movement of people, may alter brant behavior. Such disturbance could result in temporary or permanent habitat loss attributable to avoidance of areas that have suitable habitat but intolerable levels of disturbance, a reduction in foraging efficiency if high-quality foraging areas are affected, and increased movement (e.g., flight response) or altered activity patterns. Reduced foraging time and increased flight time can deplete energy reserves of brant (Ward et al. 1994), thus reducing the potential for brant to migrate and breed. Disturbance that interrupts other behaviors such as resting or gritting can result in similar energetic constraints. Foraging typically occurred during low tides when eelgrass was available whereas resting and loafing (swimming) occurred more during high tides (Schmidt 1999).

Henry (1980) found that areas subject to human disturbance in Humboldt Bay were used at lower densities by brant than other areas. In addition to hunting activities (which are now only allowed in the Fall), clamming on mudflats and aircraft resulted in the highest levels of disturbance. The majority of brant disturbances in Humboldt Bay resulted from small boats (those under 23 feet; 27%), the presence of people (22%), and large boats (those over 23 feet; 21%); natural disturbances (caused mainly by birds) resulted in disturbance approximately 10% of the time. It is unknown if conditions related to human disturbance have changed significantly since the Schmidt (1999) study was conducted, but it is unlikely that boating or other disturbances have substantially increased since then. Because the tidal cycle constrains their ability to obtain eelgrass (Moore and Black 2006), brant have limited ability to compensate for foraging time lost to disturbance. Schmidt (1999) noted that larger,

[7] After the model was run, the estimate of eelgrass density loss was adjusted to be 5.0% rather than 4.8%; given the results of the model, a 0.2% increase in density loss does not affect the results of the analysis.

slower moving vessels were less likely to elicit a response from brant, compared to smaller and faster moving vessels.

To accommodate the additional expansion area, the Project will result in additional boat trips and the presence of personnel in North Bay. At most, two additional boats and an additional 18 boat trips will be needed throughout the bay on a weekly basis, with individual trip length remaining at 4 hours for scows and skiffs and at 4 to 6 hours for harvesters (see Table 4.4 in Project Description). The additional boat trips will result in an increase in approximately 74 boat hours per week. While some boats will carry up to two additional crew members, crew numbers on other boats will remain the same. Further, while the additional boat trips will service additional areas of Coast's proposed farm, it will not increase the frequency of disturbances on any particular plot or area. As with existing culture areas, oysters will be harvested and planted every 1.5 to 3 years, depending on culture method, conditions, species of oyster and other factors. Between harvests, culturists visit cultch-on-longline plots (proposed on 522 acres) approximately once a month to perform maintenance. Visits to basket-on-longline plots (proposed on 96 acres) are more frequent, with some work performed on different areas of each plot on an almost daily basis (the whole plot is not visited daily). Rack-and-bag culture, which represents a maximum of 4 acres of the expansion area, requires the most frequent maintenance, with crews working throughout the bed on an almost daily basis (see Table 6.5.6).

Although aquaculture expansion will result in an increase in human disturbance in North Bay, the increase is not expected to be significant beyond existing conditions. It is unlikely that the increased disturbance levels attributable to the Project will result in the total disturbance time of brant within the bay to be greater than 10%, considering that under pre-project conditions, disturbance levels for all human activities bay-wide have been estimated at 3.3%. The increase in disturbance associated with boat traffic will most likely affect brant foraging along channel edges (nearest boat traffic) as well as within eelgrass beds when culturists visit aquaculture sites. However, culturists will frequently be present in aquaculture sites during low tide, when culturists can walk on exposed beds but when brant are unable to forage due to low water levels and the presence of longlines and other structure (as discussed above). As such, brant are less likely to be disturbed during many of those activities, as they are unlikely to occur in those areas during the lowest tide cycles. In some cases, birds may habituate to human disturbance, but it is possible that increased disturbance, coupled with a loss of foraging opportunity at lower tides (due to the presence of aquaculture structure), may result in some areas being unused by brant. Nonetheless, although there will be additional energetic costs to brant associated with increased human disturbance because of the increased activity, this increase is not expected to approach CEQA significance thresholds and the impacts are considered less than significant.

IMPACT BIO-27: Potential impacts to black brant associated with loss of grit sites from the expansion of oyster aquaculture in Humboldt Bay.

Migrating brant feed almost exclusively on eelgrass and thus their ability to forage is restricted by the tidal cycle, but gritting sites are also very important areas that brant need to access to acquire sandy grit (Lee et al. 2004, Moore and Black 2006, Bjerre 2007, Spragens 2013). Gizzard grit is ingested by brant as an aid to mechanically breakdown eelgrass and provides an important source of calcium (Lee et al. 2004, Bjerre 2007). Brant tend to visit grit sites when they become available during retreating tides; grit sites occur relatively high in the intertidal zone and thus are available earlier than eelgrass beds (Lee et al. 2004, Moore and Black 2006). Brant then move from grit sites to eelgrass beds when tidal elevations are low enough for brant to access them (Moore and Black 2006). Although grit sites appear to be abundant in Humboldt Bay, brant have been observed preferentially selecting particular grit sites that provide supplemental calcium and include larger than average particle sizes (Lee et al. 2004, Bjerre 2007). In some cases, brant have been observed staging over the best gritting sites awaiting tides to recede, and brant continue to use gritting sites even when eelgrass (which occurs at lower elevations) was available for foraging (Bjerre 2007). Based on available literature, the primary grit sites in Humboldt Bay occur along the northern portion South Spit of South Bay (Figure 6.5.12). The South Spit is a large sandbar between the South Bay and Pacific Ocean where higher-elevation sandy substrate is available to brant on receding tides before eelgrass at lower elevations is available for foraging.

Although specific gritting sites within the Project footprint have not been identified, it is possible that there are some potential grit sites in the Project area and that brant may be precluded from using those sites after the installation of aquaculture infrastructure. The loss of gritting sites may result in brant using other sites, possibly resulting in higher energetic costs associated with additional movements to access other areas. However, the majority of the intertidal footprint of the Project occurs in lower intertidal areas (that are occupied by eelgrass) and are unlikely to contain suitable grit. Grit sites tend to be in higher, sandy areas that are exposed early on outgoing tides before lower-elevation eelgrass beds are exposed enough for foraging (Lee et al. 2004). Available grit within the Project footprint would be unavailable to brant except at very low tides, which means that they are likely less important than other gritting sites that are higher in elevation, such as Sand Island. Additionally, based on sediments mapping (see Figure 6.5.5), most of the Project substrate is associated with finer particles than used for grit. Because brant tend to use gritting sites on receding tides, it is unlikely that brant will be constrained in their movements to access them. Rather, their ability to forage is more likely to be restricted by the Project through placement of aquaculture infrastructure in eelgrass (see IMPACT BIO-25). Because the Project is not expected to impact any known gritting sites of importance to brant, and because the Project expansion will occur at lower tidal elevations than are associated with known important gritting sites for brant in Humboldt Bay, the impact is considered less than significant under CEQA.

IMPACT BIO-28: Potential impacts to roosting birds from the expansion of oyster aquaculture in Humboldt Bay.

Bird species such as double-crested cormorants (*Phalacrocorax auritus*), California brown pelicans, Caspian terns (*Hydroprogne caspia*), Forster's terns (*Sterna forsteri*), elegant terns (*Thalasseus elegans*), and gulls (*Larus* spp.) can be found roosting on structures within Humboldt Bay. Abundance of some species within the bay varies seasonally: Forster's terns are most abundant in winter and spring, elegant terns occur in fall, and pelicans peak in late summer/fall. While double-crested cormorants and gulls are generally abundant year-round, they show a significant increase in species diversity and numerical abundance in winter (eBird 2015). These birds may roost on rafts or other structures associated with aquaculture, and pelicans have been reported roosting on Sand Island located in close proximity to existing shellfish culture areas, as well as on oyster racks in North Bay (Jaques et al. 2008).

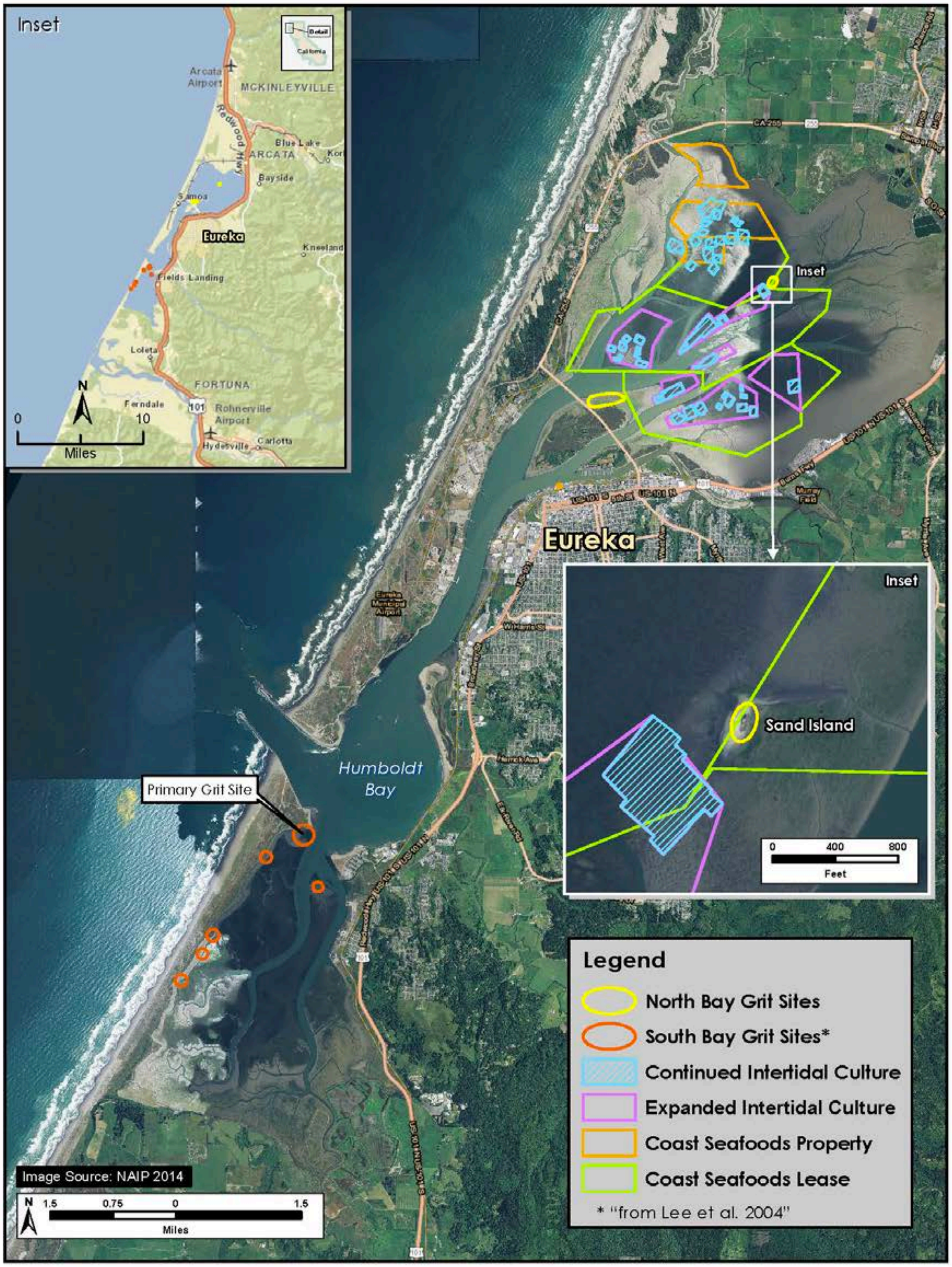

Figure 6.5.12 Map of Humboldt Bay Depicting Potential Black Brant Grit Sites in South Bay and North Bay.

Noise and boat traffic have the potential to disturb roosting birds and cause them to flush from the area. As further described in Section 6.12, Noise, the Project has the potential to result in small increases in noise associated with harvest activities and increased boat traffic. The frequency and degree of this disturbance will vary by culture activity. Intertidal oyster culture areas will experience a higher degree of culture-associated disturbance during the planting and harvesting cycle, which occurs only every 1.5-3 years. Between harvests, bed maintenance is minimal, occurring only once per month for cultch-on-longline (up to 522 acres of the expansion area). Basket-on-longline plots (up to 96 acres of the expansion area) receive more frequent visits with crews working through some parts of most beds on an almost daily basis. Visits to rack-and-bag sites will be most frequent, occurring on an almost daily basis (see Table 6.5.6). As described above, the Project would require a maximum of 18 additional boat trips/week. The noise generated during boat trips and maintenance activities will be similar to what occurs from other existing uses on the bay including recreational users (e.g., hunters, fishermen, and paddle and motor boaters) and commercial users (e.g., shippers and commercial fishermen), and represents a moderate increase in boat activity over existing conditions. Activity at the FLUPSY is more frequent, with daily crew visits by boat to maintain the seed; however, activity on the existing FLUPSY is not expected to increase as a result of placing additional bins.

Further, the increase in activity to maintain and operate Coast's intertidal beds will generally not be located near roosting sites. As shown in Figures 4.4 and 4.5 of the Project Description, Coast's intertidal sites are located in different parts of North Bay than their subtidal raft locations; generally, most culture activity will take place at a distance that would not disturb birds roosting on Coast's existing rafts or other structures where birds roost. Although culturists will traverse the main channels via boat to access intertidal sites, birds are unlikely to flush from roosts when boats move through the channels, as any roosting birds would be acclimated to regular occurrences of boats passing by. Culture activity would also take place at a significant distance from nearshore or onshore roosting activities, at a distance where noise or human presence associated with the Project would not likely disrupt roosting birds. As noted in Section 6.12, Noise, noise generated by Project operations is generally within existing ambient background noise conditions, although passing skiffs and longline harvesters may result in short and localized noise increases above ambient conditions, particularly at roosting sites that are located in areas of North Bay significantly removed from roads, bridges, or the shoreline.

While Coast's increased activity on Humboldt Bay will be limited, some birds may react to disturbance caused by culture activities by flushing to nearby sites and possibly returning after the activity is complete, whereas others may flush at greater distances and abandon the immediate area if they are warier of humans or noise. These disturbances have energetic costs associated with flight while birds search for alternative roost sites. However, it is expected that roosting birds in the bay are generally habituated to human disturbance, given that birds often roost on sites that are near human activity (e.g., docks, piers, etc.). It is also expected that individuals that are not habituated to regular human disturbance will roost in more remote areas of the bay. Because roosting birds are regularly observed on subtidal aquaculture gear, it is likely that those individuals have habituated to disturbance and are not significantly disturbed by aquaculture activities. Roost sites in the bay, which include docks, posts, and other structures, are not a limited resource, as there are numerous unoccupied roost sites in the bay year-round. Therefore, the effects of human disturbance on roosting birds is considered less than significant under CEQA.

IMPACT BIO-29: Potential impacts to nesting birds from the expansion of oyster aquaculture in Humboldt Bay.

As described above, culture areas will be visited for planting, harvest, inspection, and maintenance activities. One of the existing shellfish culture areas (cultch-on-longline) is located approximately 320 ft from the southwestern edge of Sand Island (see Figure 6.5.12), which supports a nesting colony of Caspian terns and double-crested cormorants. The proposed expansion area will not occur closer to Sand Island than existing operations. In 2001-03, 809 double-crested cormorant nests (representing 13% of the statewide total and the largest colony in northern California), and 262 individual Caspian terns, were counted on Sand Island (Capitolo et al. 2004). In 2008, only 103 cormorant nests were counted (Caspian terns were not counted), reflecting a reduction in nests from previous counts; it is possible some birds may have moved to Teal Island in the South Bay where their numbers increased (365 nests in 2003 to 485 nests in 2008) (Adkins and Roby 2010). In 2014, more than 400 cormorant nests were counted and over 300 Caspian tern nests were estimated on Sand Island; the colony was also active in 2015, although numbers are not yet available (P. Capitolo, University of California Santa Cruz, Unpubl. Data). The colony is presumed to still be active.

Human disturbance associated with Project operations in the vicinity of Sand Island has the potential to flush nesting Caspian terns and double-crested cormorants. Such disturbances could result in the loss of eggs and/or chicks, and even cause permanent nest or colony abandonment (Ellison and Cleary 1977, Shuford and Craig 2002). However, to avoid impacts to nesting birds on Sand Island, the Harbor District imposed a condition as part of Coast's existing permit to locate its shellfish beds at least 100 m from the mean higher high water (MHHW) line of Sand Island. This condition would be continued and applied to the current Project as well (Mitigation Measure BIO-2). Areas proposed for expanded intertidal culture would not be located any closer to Sand Island than existing culture areas and the frequency of boat trips to the area is not expected to increase. Impacts to nesting Caspian terns and double-crested cormorants on Sand Island as a result of shellfish culture operations are therefore considered less than significant under CEQA.

IMPACT BIO-30: Potential impacts to birds from artificial lighting.

Artificial lighting has been attributed to adverse effects on terrestrial, aquatic, and marine birds, fish, and mammals (Rich and Longcore 2006). Potential effects on marine and migratory birds include attraction to lights, disorientation, and injury or death due to collision with structures (Rich and Longcore 2006). When birds fly into lighted areas at night, they may become disorientated and circle artificial lights (Herbert 1970). Floodlights are known to attract and kill migratory birds, particularly on cloudy or misty nights during fall and spring (Rich and Longcore 2006). However, no additional permanent lighting will be installed as a result of the Project. Additional lighting will be limited to lighting that will be infrequently used by culturists and by workboats accessing shellfish culture areas at night. For this reason, this potential impact is considered less than significant under CEQA.

IMPACT BIO-31: Potential impacts to birds from human disturbance.

Leased areas will be visited with varied frequency for routine maintenance and inspection and, in intertidal culture areas, every 1.5-3 years for harvest and planting. Related to these activities, noise will be generated from small boats, movement and maintenance of equipment, generators and mechanical harvesters, and communication among aquaculture workers. The frequency of boat trips to each shellfish bed will not increase with the expanded intertidal culture; however, additional boats, crew and boat trips will likely be necessary to maintain and operate the expanded culture area. Boat traffic and the presence of personnel associated with visits to shellfish culture sites could disturb waterfowl and cause birds to flush from foraging areas and reduce temporal and/or spatial access to food.

As described above in IMPACT BIO-26, a recently-developed model used to assess the sensitivity of black brant to disturbance in Humboldt Bay predicted a reduction in the potential for brant emigration at disturbance levels of greater than 30% (i.e., a loss in 30% of foraging time), and a reduction in mass gain and increase in stopover time was predicted at a 10% level of disturbance (Stillman et al. 2015). Although energetic requirements and ability to gain mass are likely different for other waterfowl, including wigeon, that have different (and more varied) diets, the Stillman et al. energetics model represents a valid framework for assessing effects of disturbance.[8] The Stillman model provides that brant are likely to experience energetic constraints when disturbance levels exceed 10%. Using the same threshold of significance for species like wigeon is appropriate given that wigeon are likely to experience similar energetic constraints at those disturbance levels, although the threshold is likely conservative for two reasons: first wigeon have a more varied diet and second wigeon body mass is approximately half that of brant (DeVault et al. 2003) and thus their metabolic rates and energetic costs associated with flight are lower.

Although aquaculture expansion will result in some increase in human disturbance, given the limited increase in boat trips and activity as compared to existing conditions, the Project is not anticipated to result in a greater than 10% increase in disturbance time above existing conditions. As explained above, there will be a maximum of 18 additional boat trips per week throughout North Bay (totaling an additional 74 hours per week), however the number of hours each boat is active in the bay will remain the same. Waterfowl in the bay are already somewhat habituated to the current level of human disturbance from boat traffic and other activities. For example, the highest densities of American wigeon in Humboldt Bay (relative to other known habitat types around the bay) coincide with winter waterfowl hunting that also occurs on the bay, suggesting their winter habitat use of the bay is not particularly influenced by disturbance (Brendan 2015). Therefore, any additional energetic costs to waterfowl associated with increased human disturbance generated by the Project are considered less than significant.

IMPACT BIO-32: Potential impacts to waterfowl foraging from the expansion of oyster aquaculture in Humboldt Bay.

The Project could reduce the amount of available eelgrass foraging habitat for waterfowl by precluding them from entering all or portions of shellfish culture sites. The Project includes 492 acres of shellfish cultivation in dense (≥85% cover) eelgrass and 108 acres in patchy eelgrass (>10% to <85% cover) (see Table 6.5.5). There is evidence that waterfowl avoid moving amongst shellfish culture structures during low tides, which coincide with the period when eelgrass beds are most available for foraging. In an Irish estuary, wigeon fed on green algae attached to oyster culture structures, which indicates a willingness to enter and utilize the structures, but only when the tide was high enough to allow them to swim amongst the structures (Higerloh et al. 2001). This behavior was also observed by black brant in North Bay (HTH 2015) and wigeon likely exhibit a similar behavior (i.e., swimming through and

[8] It is unlikely that brant and wigeon will compete for available eelgrass resources, given that brant typically arrive in Humboldt Bay in late winter and spring, and wigeon consume eelgrass in tidal habitats primarily in mid-winter.

foraging on rooted or floating eelgrass in aquaculture areas when water levels are sufficiently high). Thus, wigeon are not likely to be constrained from foraging in shellfish beds except when tide levels are too low to allow access to shellfish beds by water.

Wigeon occur in much lower numbers and forage in lower densities than brant, indicating that there are unlikely to be food shortages associated with eelgrass depletion when they utilize that resource. In addition, unlike brant wigeon and other waterfowl are much more plastic in their ability to forage on a wide variety of vegetation, and they forage on intertidal areas for a much shorter duration of their annual cycle (i.e., in mid-winter). There is no indication that other foraging resources are limited for waterfowl in the Humboldt Bay region and thus there are alternative foraging opportunities. A reduction in eelgrass foraging potential during low tides is not expected to restrict foraging to the extent that waterfowl ability to emigrate and breed is impacted. Therefore, the potential loss of waterfowl foraging habitat as a result of temporal or spatial exclusion at shellfish culture structures is considered less than significant.

IMPACT BIO-33: Potential impacts to shorebird foraging from the expansion of oyster aquaculture in Humboldt Bay.

Recent analysis of the Humboldt Bay's carrying capacity (see Appendix G and IMPACT BIO-9 above) indicate that filtration by current and proposed oyster culture activities will not significantly affect phytoplankton levels in the Bay. Because the phytoplankton turnover rate is too fast to be substantially affected by current and proposed shellfish culture, any impact that might result to shorebird foraging from affects to phytoplankton (e.g. reduced forage availability) is anticipated to be negligible.

While some shorebirds may be attracted to intertidal aquaculture areas due to an increase in foraging resources (Caldow et al. 2004, Forrest et al. 2009) or favorable changes in substrate heterogeneity (Quintino et al. 2012, Trianni 1996), much of the Project is at suboptimal tidal depths for shorebird foraging. The vast majority of the Project is proposed to occur in low-elevation areas that are frequently inundated such that they are unavailable for foraging shorebirds during a large proportion of the tidal cycle, relative to the higher, unvegetated mudflats. In particular, shorebirds are unlikely to forage in the 492 acres of the Project proposed in dense eelgrass beds; those areas experience frequent inundation and are of lower value to shorebirds compared to unvegetated mudflats, where shorebirds typically forage. Some areas, such as those classified as "patchy eelgrass" (108 acres) may support shorebird foraging to some extent, as they include some unvegetated mudflats that shorebirds may forage in, but, in general, the elevation of the Project footprint is low in the tidal frame.

The most relevant study in assessing whether shorebirds forage in aquaculture longline plots was conducted by Connolly and Colwell (2005) in North Bay. The study compared low-tide shorebird use of aquaculture plots (cultch-on-longline) to adjacent intertidal flats without the presence of aquaculture (as control sites). Connolly and Colwell's results indicate greater bird species diversity on cultch-on-longline oyster plots than on the tidal flats without oyster culture (i.e., control plots), although there was variation in species use of longline and control plots.[9] Where differences occurred, five species (willet, whimbrel [*Numenius phaeopus*], dowitchers, small sandpipers, and black turnstone [*Arenaria melanocephala*]) were more abundant on longline plots than control plots during the study (Connolly and Colwell 2005). The authors suggest that increased abundance of these shorebirds on longline plots may be related to an increase in foraging opportunity or an increase of prey density or diversity. One species (black-bellied plover) was more abundant only on control plots. The authors suggest that greater use of control plots by black-bellied plovers may be a result of greater abundance of their principle prey items occurring on control plots, or factors related to reduced foraging efficiency related to their visual foraging methods. Although little is known about invertebrate prey in Humboldt Bay, prey may be less available to black-bellied plovers under long-lines because there is a higher concentration of shorebirds that are attracted to food resources under the lines (compared to non-aquaculture sites), or prey may be less detectable due to visual obstructions in long-line plots.

Results of recent monitoring efforts in North Bay also suggest that shorebirds readily forage under aquaculture longlines. Wildlife-monitoring cameras were deployed in North Bay to observe bird behavior in existing aquaculture plots (as well as in non-developed areas for comparison) in relation to tide height and aquaculture infrastructure (HTH 2015). Cameras were deployed in April 2015 such that time-lapse photography could be recorded for approximately 3 days. In imagery taken by one camera on a longline plot, shorebirds were observed in large numbers foraging in and adjacent to the aquaculture plots when water levels were low enough for shorebirds to access the site. Although no quantitative assessment of the camera imagery was conducted, shorebird use within and outside of the aquaculture plots (i.e., within view of the camera) appeared to be similar. No behavioral differences in shorebird use within the plot were observed (e.g., shorebirds readily foraged under the lines). Shorebirds were observed first accessing the area when water levels were low enough for shorebirds to stand and forage and they continued to forage until water levels rose to levels that forced them to cease foraging and leave the site. During the recordings, larger marbled godwits would arrive before small species (i.e., small sandpipers [*Calidris spp.*]), as the smaller birds can only access the sites when fully exposed or in very shallow water. Although the camera imagery represents a small sample size, the recordings confirm the previous findings of Connolly and Colwell and suggest that shorebird foraging occurred irrespective of the presence of longlines. Shorebird presence in or out of aquaculture areas was primarily dependent on water levels and access to food resources in shallow water or exposed mudflat.

Although some species of shorebirds may avoid culture areas and some culture techniques may have a greater exclusive effect, avoidance of aquaculture areas is unlikely to result in adverse effects such as increased competition for food and reduced body condition for most species. Many shorebird species

[9] Note that the Connolly and Colwell results may be less applicable to long-billed curlews, as many individuals of this species will occupy non-breeding territories in Humboldt Bay (Colwell and Mathis 2001) and the study plots were established irrespective of curlew territories (Colwell, pers. comm., 2015). Thus, although long-billed curlews may have shown no preference for longline or control plots in the study, use or avoidance of aquaculture areas is difficult to assess because few territories likely overlapped with study plots (Connolly and Colwell 2005).

(e.g., western sandpipers) demonstrate plasticity in selecting stopover sites, thus allowing them to opportunistically exploit food resources when available and to avoid predators. This is evidenced by large flocks of small sandpipers that are routinely observed foraging on mudflats throughout Humboldt Bay for brief durations during migration. Because sandpipers demonstrate low site fidelity and rely on a very small proportion of the bay during migration, the Project (particularly given its generally low elevation) is unlikely to restrict foraging opportunities.

If exclusion from forage sites occurs, it may have a greater impact on larger species such as long-billed curlews: large, territorial birds that rely on intertidal foraging areas for extended periods during the non-breeding season. Curlews maintain wintering foraging territories in North Bay, particularly along channel edges, and it is possible that some curlews may be displaced from newly developed aquaculture areas. Curlews use pastures as alternative habitats during wet periods, and thus some of their energetic needs may be satisfied from foraging in other habitats; however, their territoriality on mudflats during low tides suggest those areas represent important foraging areas for meeting their energetic needs for migration and reproduction. Loss of available habitat could also result in increased competition and reduced foraging efficiency in alternative foraging areas, such as pastures, or altered activity patterns that reduce energy reserves and increase predation risk. Further, if curlews do maintain territories in aquaculture areas, they will be periodically displaced by the presence of humans (see Table 6.5.6). Larger shorebirds, such as curlews, experience higher energetic costs when forced to fly than smaller species, thus they are likely to be impacted more by human disturbance than smaller species.

The wintering population of curlews in Humboldt Bay has been estimated to be approximately 200-300 individuals (Leeman and Colwell 2005) and the long-billed curlew range-wide population has been estimated to be over 161,000 individuals (Jones et al. 2008). Black-bellied plovers are relatively common in Humboldt Bay: observations (based on high counts conducted November 1998-January 1999) totaled 1,752 birds (Danufsky and Colwell 2003). The population of black-bellied plovers (*P. s. squatarola*; those breeding in Alaska) has been estimated 262,733 individuals (considered a conservative estimate) and is considered a stable population, although the Atlantic population (*P. s. cynosurae*), estimated at 100,000 individuals, is thought to be declining (Andres et al. 2012). Both species demonstrate territoriality in wintering habitats that can make them more susceptible to human disturbance and habitat exclusion than non-territorial shorebirds.

Curlews have been observed in intertidal habitats in densities ranging from 0.05 to 0.09 birds per hectare (or 0.02 to 0.04 birds per acre; Mathis et al. 2006). Density was estimated at 0.36 birds per hectare (0.15 birds per acre) in the Elk River estuary, where density of curlews was highest. Within the Project footprint, areas located on the southwest side of Bird Island and south of Sand Island include areas of high density curlew use (>20 birds in an approximately 61 acre-area) along with other areas of lower curlew densities; however, it should be noted that longlines already occur (and occurred during the study period) within those high-density grid-cells mapped by Mathis et al. (as well as other areas with curlew use). While the coexistence of high-density curlew sites and Coast's existing aquaculture gear provides some evidence that curlews may not be adversely affected by the gear and culture activities, the resolution of the Mathis et al. study does not lend itself to any definitive conclusions regarding whether curlews are affected by longline gear. However, it should be noted that Mathis et al. also found that curlews were generally absent from low intertidal habitats in the center of Humboldt Bay that are exposed for shorter intervals than higher elevations, suggesting that curlews are less likely to rely on dense eelgrass beds for foraging. Therefore, curlews may not regularly forage in the majority of the Project area, given that it is mostly characterized by dense eelgrass at low intertidal elevations that is unlikely to be used frequently (if much at all) due to regular tidal inundation and low potential as foraging habitat. While curlews have been identified in a variety of habitats in Humboldt Bay, there is a general preference to forage near the edges of tidal channels. Conservation Measure BIO-10 will further reduce impacts to curlew habitat near subtidal channels through requiring that Coast maintain a 10-foot buffer from subtidal channels for shellfish plots within the expansion area.

While use of the Project area by curlews may be limited, it is likely that the Project area will overlap with some sites currently used by curlews for foraging. Curlews may be flushed during some activities (particularly planting and harvesting); however direct access to most culture sites will occur infrequently (see Table 6.5.6) and boat traffic in subtidal channels results in little disturbance to shorebirds using nearby intertidal areas at low tide. Therefore, impacts to curlews are expected to be less than significant.

Black-bellied plovers are also susceptible to human disturbance. As noted above, black-bellied plovers were found under longlines less than in control sites (i.e., undeveloped plots), the only species documented to demonstrate a potential avoidance of longline sites by Connolly and Colwell (2005). This species also demonstrates territoriality in wintering areas (Danufsky and Colwell 2003) and their distribution in intertidal areas may be spaced to reflect winter territories. However, it should be noted that black-bellied plovers were observed foraging within Coast's existing longline areas during a reconnaissance site visit performed by H. T. Harvey & Associates in April 2015, suggesting there is some acclimation by this species to longlines. Similar to curlews, they are unlikely to use much of the Project area because most of the expansion area occurs in low-elevation dense eelgrass beds that provide limited foraging access for shorebirds during most portions of the tide cycle. Further, they are unlikely to experience substantial human disturbance given the infrequent access to individual beds within the proposed expansion area, and boat traffic in subtidal channels results in little disturbance to shorebirds. Although some territories of curlews and black-bellied plovers may be impacted, the small potential for impact is not expected to result in population-level impacts that are sufficient to meet the CEQA criteria for significance. Further, most species of shorebirds have been shown to readily forage in aquaculture plots and may benefit from resources associated with the culture. Thus the Project is expected to result in less-than-significant impacts to shorebirds under CEQA standards.

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meet the CEQA criteria for significance. Further, most species of shorebirds have been shown to readily forage in aquaculture plots and may benefit from resources associated with the culture. Thus the Project is expected to result in less-than-significant impacts to shorebirds under CEQA standards.

6.5.5 Conservation Measures

Avoidance of potential impacts, where possible, is the first priority. Avoidance included Project siting, longline spacing, and culture practices, which are discussed in more detail in the Eelgrass Technical Report (Appendix D). This section identifies specific Conservation Measures that have been incorporated into the Project by Coast and are intended to minimize the Project's biological resources impacts. The Conservation Measures are intended to ensure that the Project maintains a high standard that is environmentally responsible. Given their critical importance in ensuring that significant impacts are avoided, Conservation Measures are treated similarly to Mitigation Measures and will be included in the Mitigation and Monitoring Plan for this EIR. The following Conservation Measures are incorporated into the Project:

Conservation Measure BIO-1: Coast will not cause the intentional deposition of shells or any other material on the seafloor.

Conservation Measure BIO-2: Longline spacing for new shellfish culture plots would occur at 5-ft intervals.

Conservation Measure BIO-3: Coast will implement in-kind and out-of-kind habitat restoration, as described below.

Conservation Measure BIO-4: Monthly inspection of aquaculture plots will occur to ensure that gear is properly maintained.

Conservation Measure BIO-5: Rack-and-bag culture plots would not be planted within 10 feet of an existing eelgrass bed.

Conservation Measure BIO-6: No anchoring of the longline harvester would be done so as to shade the same area of eelgrass for a period exceeding 12 hours.

Conservation Measure BIO-7: Larger work boats would be anchored in the channel outside of eelgrass beds and smaller skiffs would be used to access longlines where eelgrass is present when the area is inundated.

Conservation Measure BIO-8: Boats will be operated in such a way as to minimize the degree of sediment mobilization and avoid propeller scarring in areas of eelgrass.

Conservation Measure BIO-9: No dredging, hydraulic harvesting, "bed cleaning," or any other activities with a hydraulic harvester would occur.

Conservation Measure BIO-10: New shellfish culture plots will not be planted within 10 feet of a subtidal channel.

Conservation Measure BIO-11: Coast will not conduct any activity when a marine mammal is observed hauled out in or near a culture area ready for planting, scheduled maintenance, or harvesting until the mammal has left on its own and without provocation from Coast.

6.5.5.1 Habitat Restoration (Conservation Measure BIO-3)

Four habitat restoration options were identified for the Project (Table 6.5.7, Figure 6.5.13). Using a watershed approach (e.g., Schlosser et al. 2009), the Project proposes to do a combination of in-kind mitigation (e.g., Buoy-Deployed Seeding System) and one of three out-of-kind coastal salt marsh restoration projects (e.g., Parcel 4 Restoration, Elk River Estuary Enhancement, Hoff Parcels). Special consideration was afforded salt marsh both due to its decline from historical levels and because few coastal salt marsh sites in Humboldt Bay have the potential to migrate or adjust in response to potential sea level rise (e.g., Shaughnessy et al. 2012).

Table 6.5.7 Summary of Mitigation Options for the Project.

Option	Name	Location	Habitat to be Modified	Potential Partners	Total Area (acres)
1	Buoy-Deployed Seeding (BuDS) System	North Bay	• Former dredge harvest locations • Patchy eelgrass habitat • Locations of wind/wave disturbance	• Harbor District • Humboldt State University • San Francisco State University	1-5
2	Parcel 4 Restoration	Bayshore Mall, PALCO Marsh	• Degraded freshwater wetlands • Intertidal areas with eelgrass • Deep water channel	• City of Eureka • California State Coastal Conservancy • Redwood Regional Audubon Society	10*
3	Elk River Estuary Enhancement	Eastern shore of Entrance Bay	• Elk River estuary • Intertidal channels • Brackish water wetlands	• City of Eureka • Harbor District • PG&E • Private owners	23**
4	Hoff Parcels, Eureka, California	Entrance Bay	• Undeveloped pasture land with former tidally-influenced channels	• Westervelt Ecological Services • Harbor District	53***

Sources: Pickerell et al. 2006, RCAA and GreenWay Partners 2012, Westervelt 2014, City of Eureka 2015
*This acreage is related to the potential restoration portion, not associated with the recreational component of the Project.
**The total Project would be 223 acres, but Coast would fund approximately 23 acres associated with a "Phase 1" portion of the restoration effort.
***The acreage to be used for Coast's mitigation Project to be determined in coordination with Westervelt Ecological Services and other potential partners.

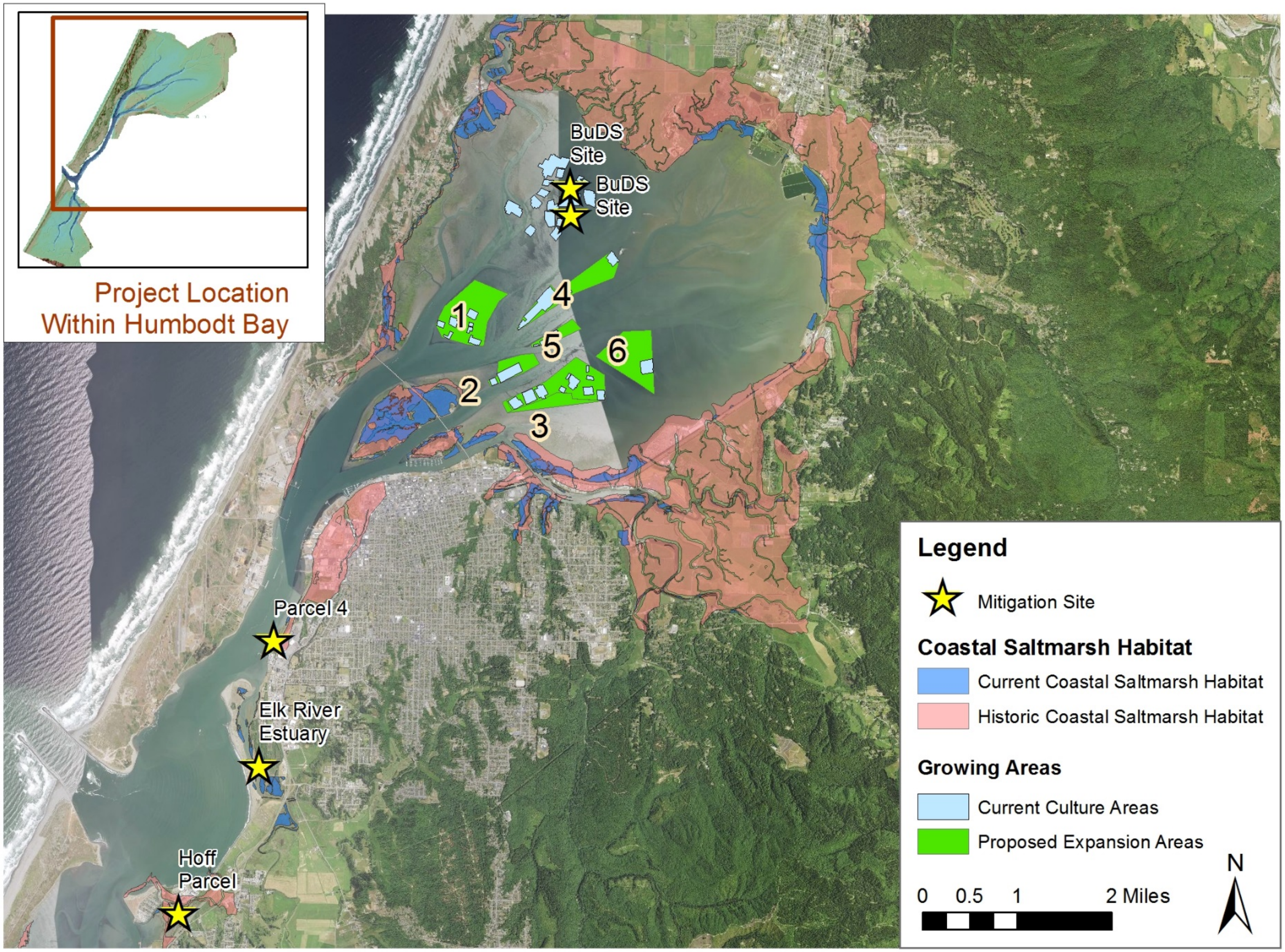

Figure 6.5.13 Locations for Potential Habitat Restoration in Humboldt Bay.

A mitigation accounting system was developed for Coast that draws from existing mitigation frameworks to describe an effective method for characterizing impacts (debits) and mitigation (credits) to identify the adequacy of proposed mitigation to compensate for changes from the Project (see Appendix B of the Eelgrass Technical Report, attached as Appendix D). This framework provides an effective analytical tool to evaluate the Project's impact to eelgrass habitat and habitat gained through the selected mitigation options, which can support an adaptive management component of the Project. As further described in Appendix C to the Eelgrass Technical Report, the salt marsh restoration projects proposed as Conservation Measure BIO-3 would adequately compensate for lost habitat value associated with the reduction in eelgrass turion density.

Option 1: Buoy-Deployed Seeding (BuDS) System

A primary impact associated with the Project is a reduction in eelgrass shoot density (see IMPACT BIO-3). A BuDS system takes advantage of the natural reproduction of eelgrass shoots to release seeds over a period of 4 weeks in order to boost eelgrass density within a 6 ft to 8 ft arc or broken circle from the BuDS, depending on the length of anchor line. The general methods involve harvesting eelgrass shoots with seedlings present, dispersal of seeds using a BuDS, and monitoring the site to validate effectiveness (Pickerell et al. 2006). While it is possible that eelgrass is growing in all suitable areas of the bay (see discussion in Appendix D regarding eelgrass carrying capacity), it is also possible that there are areas in Humboldt Bay where microtopography or energy may be impeding seed dispersal and/or seed recruitment. The BuDS system improves the chances that seeds will fall into or remain in areas that may not currently be recruiting or retaining seeds. While there is uncertainty in how effective the BuDS system may be, and it is considered experimental, it may provide suitable in-kind mitigation that directly addresses the primary impact of the Project (e.g., eelgrass density reduction).

Mature reproductive shoots are easily distinguished from the surrounding leaf canopy because of their color (brighter green), texture, size, and epiphytic fouling. According to Pickerell et al. (2006), because it is easy to train individuals to recognize mature shoots, it allows for the possibility of incorporating individuals that are not experienced with eelgrass biology (e.g., shellfish employees) to collect flowering shoots. Collection of mature shoots could be easily incorporated into standard routine maintenance activities for Coast. Determining harvest times for flowering shoots is based on natural timing of flowering at the donor sites, as described by DeCock (1980).

The BuDS is a simple construction using the following materials: (1) 6.4 mm floating polypropylene line, (2) cement block, (3) 28 cm buoys, (4) 36 cm x 36 cm pearl nets with 6- or 9-mm mesh size, (5) used garden hose, and (6) wire ties. BuDS assembly is described in Pickerell et al. (2006).

There would be a total of 10 BuDS deployed throughout North Bay to develop a feasibility study for this system in Humboldt Bay. If successful, then additional BuDS would be used to result in a total of 1 to 5 acres of density enhancement.[10] The locations for deployment would be prioritized in the following manner:

- Former mechanical dredge harvest locations.
- Patchy eelgrass habitat.

[10] The total amount of acreage will be determined based on the effectiveness of the buoys deployed in the feasibility study and number of available sites in Humboldt Bay.

- Success Criteria

Figure 6.5.13 (above) provides an example of two starting locations for BuDS deployment.

Success Criteria and Contingency Measures: The goal of the BuDS mitigation option is to boost eelgrass density within 5 acres of North Bay that appear to be less dense due to various historical and natural stressors. The following success criteria would be used for this mitigation option:

- **Success Criteria:** Native eelgrass cover will be 30% (Year 1), 50% (Year 2), and 80% (Year 3) within a 5 m radius of the BuDS.
- **Contingency Measure:** If the percent cover success criteria are not met by Year 1, the cause will be investigated and corrected. Correction measures may include moving the BuDS to a new location. Up to 10 locations will be tested. If no success criteria can be met by Year 2, then the Project's out-of-kind mitigation will be re-evaluated pursuant to the Estuarine Habitat Credit-Debit Mitigation Accounting Framework to determine if additional mitigation is necessary.
- **Success Criteria:** Native eelgrass shoot density will be 20 turions/m^2 (Year 1), 50 turions/m^2 (Year 2), and 80 turions/m^2 (Year 3) within a 5 m radius of the BuDS.
- **Contingency Measure:** If the shoot density success criteria are not met by Year 1, the cause will be investigated and corrected. Correction measures may include moving the BuDS to a new location. Up to 10 locations will be tested. If no success criteria can be met by Year 2, then the Project's out-of-kind mitigation will be re-evaluated pursuant to the Estuarine Habitat Credit-Debit Mitigation Accounting Framework to determine if additional mitigation is necessary.

Monitoring: Monitoring of the BuDS sites would be added to the monitoring effort associated with the Project (SHN 2015). The protocol typically monitors for seedlings during late winter and early spring (Pickerell et al. 2006). The perimeter of potential seedling dispersal would be monitored at least once a year to determine mitigation success. BuDS sites would be located within similar areas as the Project monitoring locations in order to reduce access concerns. The Eelgrass Monitoring Plan attached as Appendix H provides a description of this monitoring effort.

Option 2: Parcel 4 Restoration

A feasibility study funded by the California State Coastal Conservancy was conducted on Parcel 4 in the City of Eureka to understand the restoration potential for natural resource enhancement and public access of the site (RCAA and GreenWay Partners 2012). Parcel 4 is located behind the Bayshore Mall, adjacent to the PALCO Marsh section of waterfront open space and the Chevron petroleum storage facility. The site is approximately 14.8 acres, which includes approximately 10 acres of significantly degraded freshwater wetlands and a former salt marsh channel. The site is also adjacent to a deep water channel and eelgrass habitat. The site is owned by the City of Eureka, includes an open space easement that is controlled by the Redwood Regional Audubon Society, and is currently zoned for coastal-development industrial uses.

The Parcel 4 project has a number of goals and priorities, including the following that relate to the natural environment and use of the site:

- Re-establish wetland areas and enhance wildlife habitat at the site.

- Integrate the site into the Elk River Trail and corresponding Truesdale/Vista Point parking area and trail head facilities to the south.
- Assess and clean up brownfields contaminants.
- Remove invasive species (e.g., *Spartina*).
- Improve the natural experience, including clean-up of on-site debris and buffering visitor experience against surrounding development and industry.

Using these goals and priorities, a conceptual site plan was developed for the project (Figure 6.5.14). The work completed, to date, does not include specific designs. If this option is selected, Coast will work with the City of Eureka and other stakeholders to develop a final design plan. A key priority would be to reconnect the former salt marsh habitat. This would be accomplished by opening up holes in the existing bulkhead, excavating fill closest to the existing waterline, and removing concrete structures. There is eelgrass habitat in and around the pilings on site, which would be enhanced through removal of the in-water structures and bulkhead. Coast would partner with the City of Eureka and other public agencies to fund and implement the restoration of former salt marsh habitat on the site.

Success Criteria and Contingency Measures: The goal of the Parcel 4 restoration would be to restore and enhance 10 acres of Humboldt Bay coastal salt marsh habitat. The following success criteria would be used for this mitigation option:

- **Success Criteria:** Native plant survival will be 90% (Year 1), 80% (Year 2), and 75% (Year 3). **Contingency Measure:** If the percent survival success criteria is not met, the cause will be investigated and corrected. Correction measures may include increased watering, soil amendments, or additional plantings.
- **Success Criteria:** Native plant cover will be 30% (Year 1) and 50% (Year 3). **Contingency Measure:** If the percent cover of success criteria is not met, the cause will be investigated and corrected. Correction measures may include increased watering, soil amendments, or additional plantings.
- **Success Criteria:** Invasive plant species cover will not exceed 20% (Year 1) and 10% (Year 3). **Contingency Measure:** If more than 10% of area is covered by invasive species, the cause of infestation will be investigated and corrective actions will be taken before weeds are removed. Contingency measures could include increasing the frequency of weeding until native vegetation can grow and dominate the area or increasing the density of native vegetation with additional plantings.

Monitoring: Because this project is still in the design phase, a monitoring plan has not yet been developed. However, the basics of a monitoring plan would include the following elements to ensure that plantings survive and establish successfully. In addition, the monitoring plan would provide enough data to establish whether the success criteria were achieved. The following are suggested components of the monitoring plan:

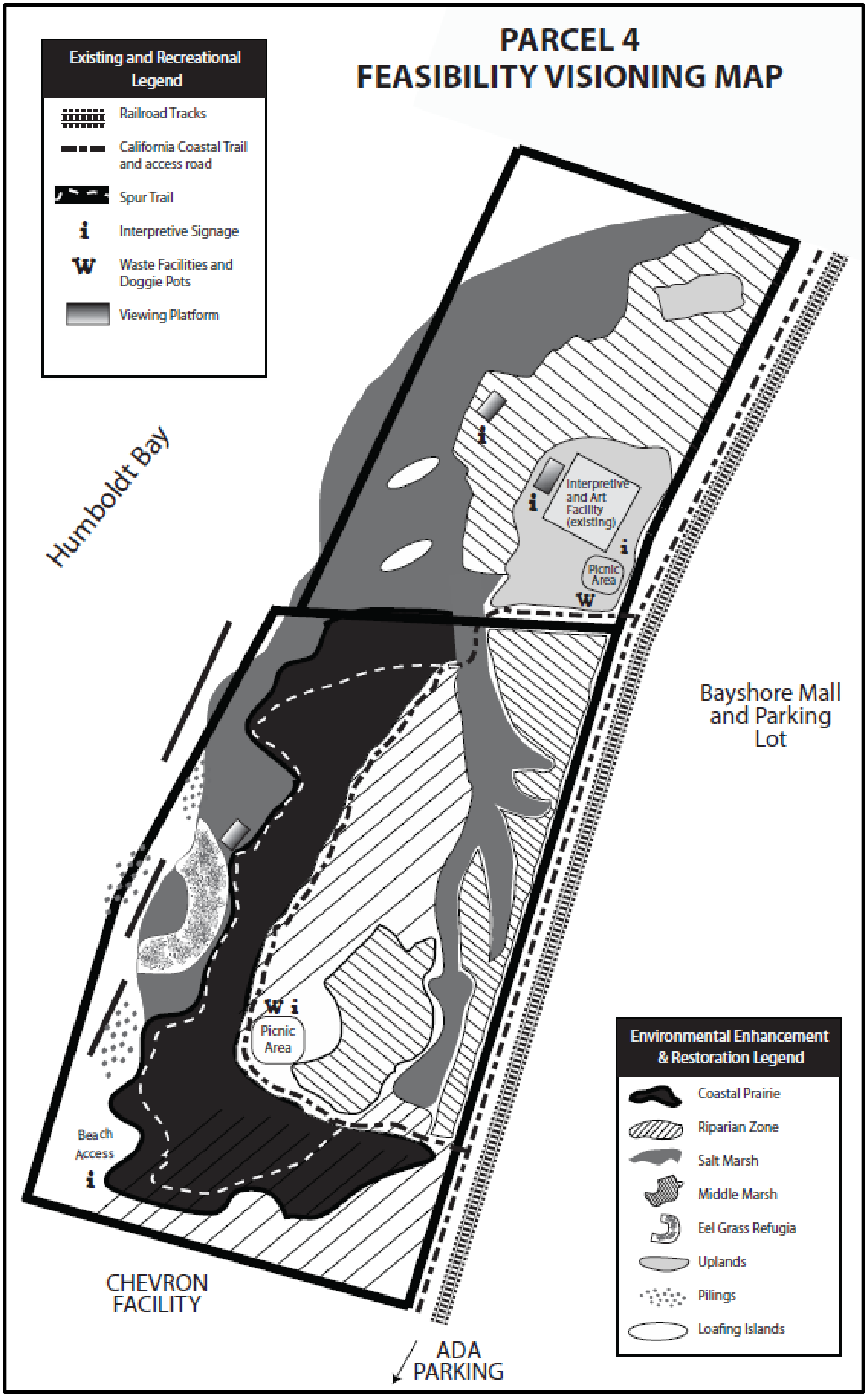

Figure 6.5.14 Conceptual Site Plan for Parcel 4 Restoration.
Source: RCAA and GreenWay Partners 2012.

- **Transects and Photo Point:** Using rebar sheathed in white PVC pipe, two permanent, 100-foot-long transects will be established. At two points along each transect, permanent circular plots 15 feet in diameter, will be marked (T1-A, T1-B, T2-A, and T2-B). Coordinates for the location of the end points of each transect will be recorded using a global positioning system (GPS) system. Permanent photo points will be established at each end of each transect (P1, P2, etc.). At each of the photo points, a fixed-lens digital camera will be used to take four photographs, one at every 90 degrees of the compass.
- **Line Intercept Method:** The line-intercept method will be used to record the percent cover of trees and shrubs along each of the permanently marked transects. After laying a tape measure along a transect line, the lengths of tape directly under the branches and foliage of a tree or shrub will be recorded along with the species. The percent cover of each species is then calculated by dividing the sum of lengths intercepted for that species by the total length of the transect line.
- **Percent Cover Method:** In each circular plot (two along each transect), the percent cover of herbaceous species, including bare ground, will be recorded.
- **Frequency:** Monitoring will occur during the growing season after deciduous plants have flowered or leafed-out for a total of 3 Years. The Year 0 monitoring event will occur within 30 days after trees and shrubs have been installed. Each of the subsequent monitoring events will occur within 30 days of the calendar date of the Year 0 monitoring.

Option 3: Elk River Estuary Enhancement and Intertidal Wetlands Restoration

The Elk River Estuary Enhancement and Intertidal Wetlands Restoration Project (Elk River project) is a restoration project that would expand the Elk River estuary by 223 acres and increase habitat diversity by creating intertidal wetlands/channels, coastal salt marsh habitat, and brackish water wetlands. The Elk River project is located in Humboldt Bay along the eastern shoreline of Entrance Bay. The project would include 23 acres north of Elk River, and 200 acres south of Elk River and west of U.S. Highway 101 (Figure 6.5.15). The site is owned by the City of Eureka, the Harbor District, PG&E, and several private land owners.

The Elk River project has a number of goals and priorities, including the following that relate to the natural environment and use of the site:

- Remove the dike on the north bank of Elk River Slough to restore tidal inundation to former coastal salt marsh habitat.
- Excavate intertidal channels and brackish water ponds to the south of Elk River.
- Grade the salt marsh plains as “living shorelines” that would protect Highway 101 and the Northwest Pacific railroad from wind-induced erosion.

The City of Eureka City Council has indicated that it would be willing to move forward with the 23-acre portion of the project north of Elk River in partnership with Coast for salt marsh restoration. If this option is selected, Coast would work with the City of Eureka to develop a salt marsh restoration plan and monitoring plan for the mitigation project.

Figure 6.5.15 Elk River Estuary Enhancement and Intertidal Wetlands Restoration Project Area (yellow shading) along the Eastern Shoreline of Entrance Bay.
Source: City of Eureka 2015.

Success Criteria and Contingency Measures: The goal of this mitigation option is to create a 23-acre area that increases the habitat diversity of the Elk River estuary and is dominated by coastal salt marsh vegetation. The success criteria for this project would be the same as for Mitigation Option 2: Parcel 4 Restoration.

Monitoring: A monitoring plan has not been developed for this mitigation option, but it would follow the same guidelines as discussed for Mitigation Option 2.

Option 4: Hoff Parcels, Eureka, California

A feasibility study was conducted on the Hoff Parcels in the City of Eureka to identify opportunities and constraints associated with developing a mitigation bank or permittee-responsible mitigation project on land owned by James Hoff (Westervelt 2014). The Hoff Parcels are located near Humboldt Bay between Elk River and Humboldt Hill (Figure 6.5.16). The site is approximately 53 acres, which includes undeveloped pasture land with former coastal salt marsh habitat. While Coast would need to work with Mr. Hoff and other adjacent property owners, it is anticipated that a portion of the site could be used by Coast and other partners for salt marsh restoration.

Opportunities for mitigation on the Hoff Parcels could include the following:

- Re-establish coastal salt marsh habitat and allow tidal influence to be restored. While there is no direct connection between the Hoff Parcels and Humboldt Bay; connection to the bay could be established in partnership with PG&E or the Harbor District.
- Creation of upland freshwater wetlands.

Success Criteria and Contingency Measures: The goal of this mitigation option is to create a 53-acre area that is dominated by coastal salt marsh vegetation. Coast's mitigation commitment would be to develop and implement salt marsh restoration on a portion of the overall project. The success criteria for this project would be the same as for Mitigation Option 2: Parcel 4 Restoration.

Monitoring: A monitoring plan has not been developed for this mitigation option, but it would follow the same guidelines as discussed for Mitigation Option 2.

6.5.6 Level of Significance Before Mitigation

Compliance with the Conservation Measures identified above would reduce potential impacts associated with IMPACT BIO-1 through IMPACT BIO-20, IMPACT BIO-22, IMPACT BIO-24, IMPACT BIO-26 through IMPACT BIO-28, and IMPACT BIO-30 through IMPACT BIO-33 to a level that is less than significant. IMPACT BIO-21, IMPACT BIO-23, IMPACT BIO-25, and IMPACT BIO-29 are potentially significant impacts without mitigation.

6.5.7 Mitigation Measures

Mitigation Measure BIO-1 is intended to reduce impacts to Pacific herring (IMPACT BIO-21).

> **Mitigation Measure BIO-1:** During the months of December through March, Coast will visually survey those beds to be worked on each day to determine whether herring have spawned on eelgrass, culture materials, or substrate. If herring spawn is observed, Coast will: (1) notify the CDFW's Eureka Marine Region office within 24 hours, and (2) postpone activities on those beds until all eggs have hatched.

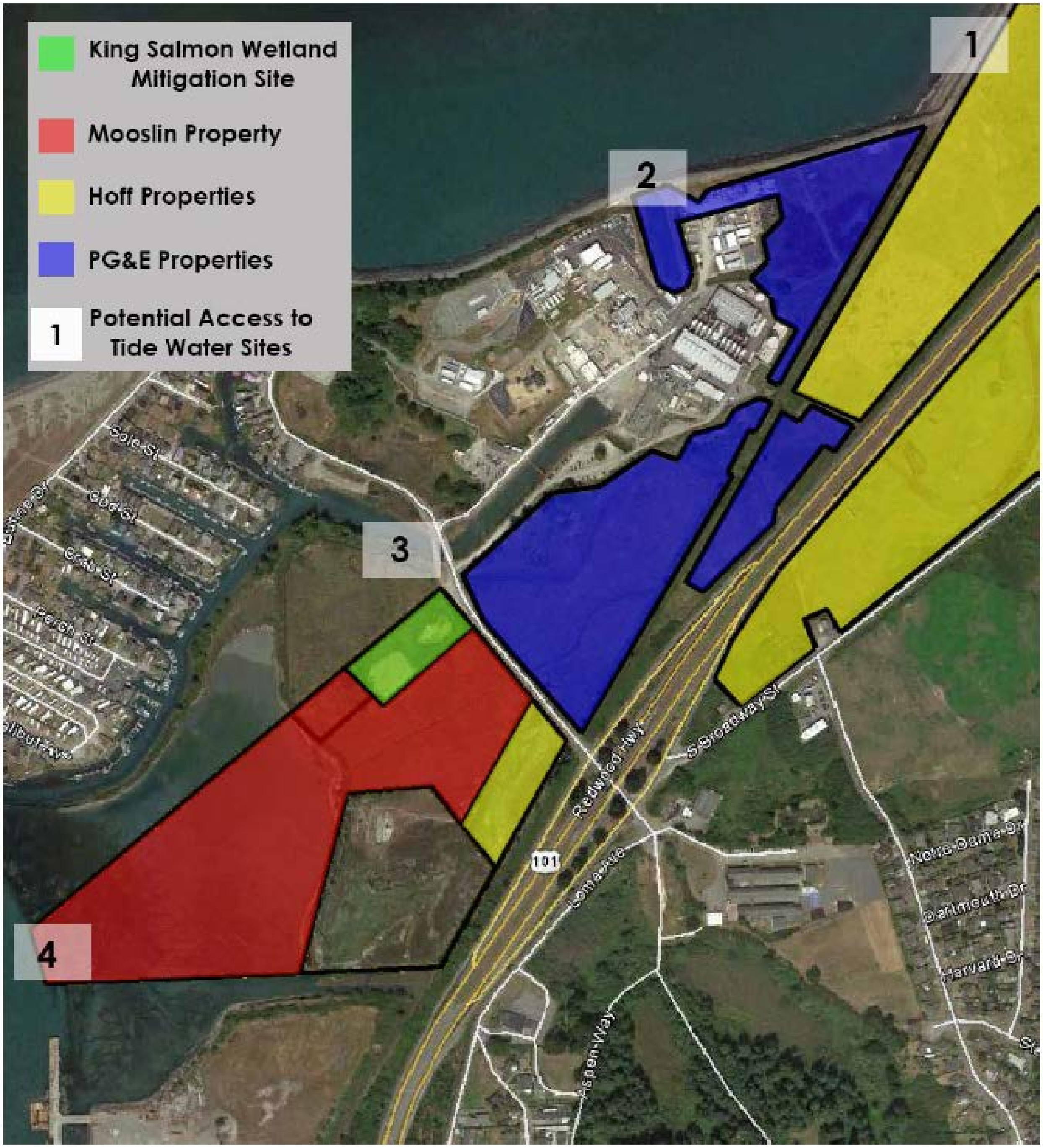

Figure 6.5.16 Tidal Access Sites adjacent to the Hoff Parcels in the City of Eureka, California.
Source: Westervelt (2014)

Mitigation Measure BIO-2 is intended to reduce impacts to marine mammals and nesting birds (IMPACT BIO-23 and IMPACT BIO-29).

> **Mitigation Measure BIO-2:** No activity involving human disturbance will occur within 100 m of the area of Sand Island that is above mean higher high water to avoid the harbor seal haul-out location and nesting birds on Sand Island.

Mitigation Measure BIO-3 is intended to reduce impacts to black brant foraging opportunities (IMPACT BIO-25).

> **Mitigation Measure BIO-3:** For new shellfish culture equipment, Coast will maintain a maximum longline height of 1-ft above the surface or lower for cultch-on-longline and 40-inches above the surface or lower for basket-on-longline culture.

6.5.8 Level of Significance After Mitigation

Upon implementation of Conservation Measures BIO-1 through BIO-11 and Mitigation Measures BIO-1 through BIO-3, impacts associated with biological resources would be less than significant under CEQA. Therefore, no significant and unavoidable adverse impacts concerning biological resources remain.

6.5.9 Effects Analysis of the Alternatives – Marine Habitat, Benthic Communities, and Aquatic Marine Species

6.5.9.1 Impacts to Marine Habitat

The potential impacts for each alternative are discussed below for unstructured habitat, areal extent of eelgrass, eelgrass density, working practices, and other habitat concerns. For the most part, potential impacts are similar to what is discussed above in relation to the Project. Where differences exist between the Project and proposed alternatives, those will be discussed individually.

Changes to Unstructured Habitat

As noted above, aquatic marine species (especially mobile species), depend on a mosaic of habitat that includes edges or transitional zones between two habitat types. Unstructured habitat provides locations where the habitat transitions to subtidal channel habitat or eelgrass habitat in North Bay. Alternative 3 (Existing Footprint) and Alternative 4 (No Action) do not have expansion areas, and effects to unstructured habitat from these alternatives would be less than significant. Alternative 1 (10-Foot Spacing) and Alternative 2 (Reduced Acreage) would overlap with unstructured habitat, patchy eelgrass habitat, and continuous eelgrass habitat according to the values presented in Table 6.5.8. Alternative 1 overlaps with more than twice the unstructured habitat (or non-eelgrass habitat) compared to the Project, and Alternative 2 overlaps with 27.5% less unstructured habitat. The following is a discussion of the difference between these two alternatives to unstructured habitat.

Table 6.5.8 General Habitat Categories by Alternative.									
Alternative		**Existing Culture (acres)**				**Expansion Area (acres)**			
		Non-Eelgrass†	**Patchy Eelgrass**	**Continuous Eelgrass**	**Total**	**Non-Eelgrass**	**Patchy Eelgrass**	**Continuous Eelgrass**	**Total**
Project	Cultch	8.5*	249.5	25.5	**283.5***	18	91	413	**522**
	Basket	0	10	1	**11**	4	17	79	**100**
	Total	**8.5***	**259.5**	**26.5**	**294.5***	**22**	**108**	**492**	**622**
Alt. #1	Cultch	8.5*	249.5	25.5	**283.5***	39	159	604	**802**
	Basket	0	10	1	**11**	8	30	115	**153**
	Total	**8.5***	**259.5**	**26.5**	**294.5***	**47**	**189**	**719**	**955**
Alt. #2	Cultch	8.5*	249.5	25.5	**283.5***	10	49	141	**200**
	Basket	0	10	1	**11**	5.5	24.5	70	**100**
	Total	**8.5***	**259.5**	**26.5**	**294.5***	**15.5**	**73.5**	**211**	**300**
Alt. #3	Cultch	14	249.5	25.5	**289**	No expansion			
	Basket	0	10	1	**11**				
	Total	**14**	**259.5**	**26.5**	**300**				
Alt. #4	Cultch	14**	249.5**	25.5**	**289****	No expansion			
	Basket	0	10**	1**	**11****				
	Total	**14****	**259.5****	**26.5****	**300****				

† Non-eelgrass habitat in Coast's existing acreage includes culture areas occupied by Coast's intertidal nursery (4.8 acres), FLUPSY (0.04 acres), wet storage floats (0.04 acres) and clam rafts (0.93 acres). These culture methods are not separately identified in this Table, but rather subsumed in the "Cultch" figures for the Project and Alternatives 1-4.
*Does not include the 5.5 acres to be removed from non-eelgrass habitat, as indicated in the Project Description.
**All existing culture would be removed.

As discussed above, the main change associated with adding structure to sandflat or mudflat habitat includes the potential to change species composition. Effects would be similar as the Project effects, but would partially scale with the acreage associated with the Alternatives. For example, the amount of unstructured habitat potentially affected in Alternative 1 (36 acres) represents approximately 0.8% of the unstructured habitat available in North Bay and the amount of habitat in Alternative 2 (11.3 acres) represents 0.2% of unstructured habitat in North Bay. However, Alternative 1 provides larger spaces between longlines (10 ft vs. 5 ft), which would reduce the number of structure-associated organisms likely attracted to the longlines. Overall, this change is still a small fraction of unstructured habitat in North Bay. In addition, the intertidal habitat of North Bay primarily represents nursery habitat for smaller organisms, and both the 5 ft and 10 ft spacing would provide suitable space for smaller organisms. Therefore, no significant differences were identified between the various alternatives and potential changes to unstructured habitat.

Changes to Eelgrass Areal Extent

There is no predicted change of an eelgrass bed by adding oyster longlines at 5 ft. This effect would not be altered at the 10-foot spacing. Therefore, this potential impact would not change based on the spacing proposed in Alternatives 1, 2, and 3. As described for the Project, potential changes to areal extent will be verified through a robust monitoring plan pre- and post- Project implementation (SHN 2015). If changes to the areal extent are observed, Coast would modify the Project or mitigate for these areas. Comparatively, construction impacts associated with Alternative 4 (No Action) would likely result in a temporary loss of areal extent from the removal of shellfish gear, particularly if Coast is required to immediately remove all shellfish gear without the implementation of conservation measures. This effect would likely be similar to impacts associated with mechanical dredge harvesting and recovery would vary depending on site conditions. Depending on the level of asexual vs. sexual reproduction, recovery would likely occur within 2 to 4 years, unless gear removal results in sediment deposition or scouring that would alter the elevation of the bay bottom.

Changes to Eelgrass Density

Gear and shellfish products associated with longline aquaculture can lead to shading, abrasion, and desiccation of eelgrass blades. The type and concentration of gear can influence the level of this effect, which is why the alternatives include an analysis of impacts under different spacing regimes. The primary difference, in terms of eelgrass habitat, between the proposed alternatives is the size of the expansion area (see Table 6.5.8).

Similar to the Project impacts discussed above, this analysis assumes that oyster longlines can reduce eelgrass density directly under the lines themselves, while the space between longlines would not show a reduction in density. For longlines spaced 5 ft apart (i.e., Project and Alternative 2), a density reduction of 47% was used for cultch-on-longline areas and 70% was used for basket-on-longline areas. For longlines spaced 10 ft apart (i.e., Alternative 1), a density reduction of 46% was used for cultch-on-longline areas and 67% was used for basket-on-longline areas. The values used to estimate density reduction under longlines spaced 10 ft apart were based on an average of the density reduction values discussed by Rumrill (2015) from the 2001 to 2003 WRAC data and more recent data collected by SHN (unpublished data) in May of 2015. Density reduction due to gear removal was based on slightly different calculations, as described below. Table 6.5.9 provides a summary of the potential reduction in eelgrass density by alternative.

Table 6.5.9 Summary of Potential Eelgrass Density Reduction by Alternative.

Alternative		Culture Area (%)	Eelgrass Bed Area (%)	North Bay (%)
Project	Cultch*	-4.7%	-1.3%	-0.7%
	Basket*	-6.6%	-0.4%	-0.2%
	Total*	**-5.0%**	**-1.7%**	**-0.9%**
Alt. #1	Cultch*	-2.4%	-0.9%	-0.5%
	Basket*	-3.4%	-0.2%	-0.1%
	Total*	**-2.6%**	**-1.0%**	**-0.7%**
Alt. #2	Cultch*	-2.5%	-0.2%	-0.1%
	Basket*	-3.3%	-0.1%	-0.1%
	Total*	**-2.8%**	**-0.3%**	**-0.2%**
Alt. #3	Cultch	No change beyond baseline conditions.		
	Basket			
	Total			
Alt. #4	Cultch**	**-32.2%**	**-6.0%**	**-1.8%**
	Basket**	**-6.6%**	**-0.1%**	**-0.01%**
	Total**	**-31.2%**	**-4.1%**	**-1.8%**

Table 6.5.9 Summary of Potential Eelgrass Density Reduction by Alternative.			
Alternative	**Culture Area (%)**	**Eelgrass Bed Area (%)**	**North Bay (%)**
*Only includes values for eelgrass density reduction to existing baseline conditions. **Width of effect was increased by 1.0 ft above other alternatives due to site access during gear removal. Reductions associated with Alternative 4 are an estimate of impacts due to gear removal; and impacts would likely be temporary (i.e., eelgrass would recolonize the areas).			

Gear removal activities (Alternative 4: No Action) would result in a higher impact to eelgrass density because (1) this activity is more intensive than placing gear; (2) it would likely occur all at the same time following permit expiration; and (3) all gear would be immediately removed regardless of conservation measures. It is estimated that gear removal would take 3 to 6 months if everything had to be removed right away or over approximately 18 months if removed after the oysters reached market size. Continuous removal activities would result in impacts to water quality from increased turbidity, even with the use of floating silt curtains. Relatively long-term increases in suspended sediments and increased turbidity from gear removal operations also would temporarily reduce water clarity, light transmittance through the water column, and could reduce primary production by eelgrass. Depending on the tidal cycle, turbidity may not be flushed out of the bay in a short time period. Reductions in eelgrass primary production during the active growth period (April through October) also could have cascading effects on organisms associated with or dependent on eelgrass. These impacts would be limited to the year that gear is removed. The same impacts would not be associated with any of the other alternatives or with the Project because the intensity and frequency of access would be orders of magnitude lower for general operations.

Working Practices

Trampling is the primary working practice impact that may change with the different alternatives. For example, trampling associated with Alternative 1: 10-Ft Spacing, may become more significant based on the expanded geographical extent. However, because access would still be a maximum of 3 to 4 trips every 2 years at a culture plot, this is unlikely to be a significant impact even at this broader scale. Trampling associated with Alternative 2 (Reduced Acreage) is anticipated to be slightly less than the Project due to the reduced expansion area. However, the trampling associated with gear removal under Alternative 4 is likely to be more significant because of the intense time frame that this would have to occur (e.g., 3 to 6 months). At that scale, the impacts would be more similar to the high intensity level reported by Eckrich and Holmquist (2000) in a recreational estuary in Puerto Rico.

Changes to Other Habitat Concerns

As discussed for the Project above, the three other habitat concerns associated with shellfish aquaculture in Humboldt Bay includes: (1) sediment distribution and tidal circulation, (2) water quality, and (3) sediment quality. Changes to these habitat concerns, by alternative, are summarized in Table 6.5.10.

Table 6.5.10 Summary of Impacts to Other Habitat Concerns by Alternative.			
Alternative	**Sediment Distribution and Tidal Circulation**	**Water Quality**	**Sediment Quality**
Project	• Some evidence of increased sedimentation under rack-and-bag culture but overall, changes do not appear to result in seabed elevation changes for rack-and-bag culture. • Lack of evidence that longlines significantly change sediment distribution, especially for culture within eelgrass habitat which already alters circulation and flows.	• Potential to reduce turbidity/sequester nutrients, but likely small compared to input into the system. • Potential increase in oil spills or engine failures if the number of boats increases with operations, but Conservation Measures in place to avoid potential release of contaminants.	• Some changes to sediment nutrients but not to the level that results in anoxia. • Circulation and energy in the system provides circulation of sediments.
Alt. 1 (10-Foot Spacing)	• Rack-and-bag would not increase; remains at 4 acres. • Majority of culture proposed in eelgrass, so changes to sediment distribution and circulation likely similar to eelgrass habitat.	• Expansion of oysters into habitat that is slightly closer to upland habitat could potentially increase potential to gain benefits from sequestration, but still likely small compared to input into system.	• While the area of where sediment enrichment could occur would increase, an increase in longline spacing would reduce the potential for any one area to accumulate organics.
Alt. 2 (Reduced Acreage)	• Same as Project.	• Same as Project.	• Same as Project.
Alt. 3 (Existing Footprint)	No change beyond baseline conditions.		
Alt. 4 (No Action)	• Removal of gear would reduce the amount of structure in North Bay that could potentially affect sediment distribution and circulation. • This would likely be similar to current conditions because the effect is similar to what eelgrass provides.	• Removal of existing culture would eliminate potential hazardous material spills by removing vessels associated with the culture operations. • Removal of existing culture would remove the potential filtration capacity in the system. It is unlikely that other filter feeders could compensate for even the small amount of benefit being provided by cultured oysters.	• There would not be as many nutrients being deposited into the sediment, which could affect benthic-pelagic coupling, but would likely not result in significant changes.

In general, there are very few differences between the Project, Alternative 1, and Alternative 2 in terms of potential impacts to these habitat concerns. Alternative 4 would generally have a greater magnitude but shorter duration impact.

The primary impact from Alternative 4 (No Action) that is substantially different than the other alternatives would be on nutrient loading and availability, particularly nitrogen and phosphorus from existing non-point sources of pollution (e.g., cattle ranches and stormwater runoff) within the watershed. One of the main ecosystem services provided by cultured shellfish is nitrogen removal. Cultured shellfish mitigate for non-point pollution sources through filtration, nitrogen sequestration, and total removal of nutrients from the system during harvest of the shell and tissue where the nutrients are sequestered (Newell et al. 2002, Newell 2004, Kellogg et al. 2013). For example, based on nitrogen sequestration values presented in Higgins et al. (2011), the harvest of approximately 2,700 tons of oysters annually by Coast results in the direct removal of approximately 219 tons nitrogen[11].

There is potentially even greater nutrient removal than this calculation. A recent paper by Kellogg et al. (2013) partially quantified the removal of nutrients from the water column at a subtidal oyster reef restoration site compared to an adjacent control site in the Choptank River within Chesapeake Bay, Maryland. The authors indicated that denitrification rates at the oyster reef in August were "among the highest ever recorded for an aquatic system." In addition, a significant portion (47 and 48% of total standing stock) of the available nitrogen and phosphorous were sequestered in the shells of live oysters and mussels. Newell (2004) commented that bioextraction (e.g., shellfish harvest or macroalgae harvest) represents the only method of nitrogen removal once it has entered the system, which can then make that system more resilient to nutrient loading. Loss of the nutrient removal function performed by cultivated shellfish, especially in relation to the mitigation of upland sources of nutrients, could lead to cultural eutrophication in parts of Humboldt Bay. Notably, Humboldt Bay isn't currently eutrophied, which may be at least partly due to existing cultured shellfish in the bay. However, this has not been studied.

Many researchers have identified water clarity as the most important factor limiting eelgrass distribution and abundance (Fonseca and Bell 1998, Cho and Poirrier 2005, Fonseca and Malhotra 2006). Similarly, Burkholder et al. (2007), have documented nutrient enrichment (eutrophication) as a major cause of degradation of water clarity and loss of seagrass (including eelgrass) habitat in estuaries. By consuming phytoplankton and particulate organic matter, shellfish increase the amount of light reaching the sediment surface that is available for photosynthesis (Koch and Beer 1996). The loss of the shellfish under the No Action Alternative could affect the spatial distribution of eelgrass habitat. However, the potential for cultured shellfish to improve conditions in West Coast estuaries may be limited (e.g., Dumbauld et al. 2009), and the benefits provided by shellfish in Humboldt Bay have not been studied.

6.5.9.2 Impacts to Benthic Communities

Impacts to benthic communities, both invertebrate resources and fish distribution, were discussed in the impacts section above according to: (1) changes to species composition, (2) trampling effects, (3) introduction of non-indigenous species (NIS) and fouling organisms, and (4) establishment of non-native bivalves. The differences between these four impacts are summarized, by alternative, in Table 6.5.11.

[11] This conclusion is based on 7.9% nitrogen in oyster tissue and 0.2% nitrogen in oyster shell (Higgins et al. 2011).

Table 6.5.11 Summary of Impacts to Benthic Communities by Alternative.				
Alternative	**Species Composition**	**Trampling**	**Introduction of NIS and Fouling**	**Establishment of Non-native Bivalves**
Project	• According to food-web modeling (e.g., Leguerrier et al., 2004), the system remained stable even when rack-and-bag culture was doubled (up to 1,265 acres). • Slight changes in species composition, but not likely to result in population shifts of species.	• The frequency and intensity of disturbance is minor and a fraction of the amount of activity in one area compared to locations where effects are reported in the literature.	• Given management conditions, minimal likelihood for introduction of NIS. • Fouling can be a benefit to fish and wildlife species foraging from the organisms that colonize aquaculture gear.	• Water temperature conditions naturally limit conditions for establishment. • Hydrology and lack of suitable substrate further reduces the likelihood of establishment.
Alt. 1 (10-Foot Spacing)	• While overall acreage of culture would increase from the Project, biomass of organisms would decrease per area.	• Intensity within one area similar to the Project, but frequency within subtidal channels (transiting) would increase.	• Same as Project.	• Same as Project.
Alt. 2 (Reduced Acreage)	• The overall acreage would decrease from the Project, as would the potential to alter species composition.	• Intensity within one area same as the Project, and frequency within subtidal channels would decrease.	• Same as Project.	• Same as Project.
Alt. 3 (Existing Footprint)	No change beyond baseline conditions.			
Alt. 4 (No Action)	• Removal of gear would allow the system to function without the additional structure. • Species that benefit from the habitat provided by shellfish culture would be impacted.	• Possible changes to species composition associated with trampling during gear removal operations. • Effects likely temporary, but intensity and frequency would be orders of magnitude	• Decreased risk of NIS introduction. • NIS would continue to be introduced via shipping operations associated with the marina, which is the dominant form of introduction into bays and estuaries.	• The removal of non-native oysters would eliminate the potential for populations to naturalize in Humboldt Bay.

Table 6.5.11 Summary of Impacts to Benthic Communities by Alternative.				
Alternative	**Species Composition**	**Trampling**	**Introduction of NIS and Fouling**	**Establishment of Non-native Bivalves**
	• Species impacted by shellfish culture would benefit.	greater than typical operations.		

As above, Alternative 4 (No Action) represents the highest potential for change to the benthic communities in Humboldt Bay. One of the best examples at trying to predict changes to the benthic community associated with removal of oyster aquaculture in North Bay is provided by a study that identified the changes from removal of an oyster cultivation operation in Tapong Bay (Lin et al. 2009). The operations included rack-and-bag culture in a eutrophic and poorly flushed lagoon (flushes in between 8 and 13 days). In comparison, Humboldt Bay is a well-flushed system (flushes between 2.5 and 14 days, see Appendix G). Through mass-balance trophic model simulations and field sampling, removal of the aquaculture operation was shown to result in a substantial increase in phytoplankton and zooplankton biomass and decrease in benthic infaunal biomass. The increased abundance of plankton resulted in greater detritus accumulations from undigested material. Oyster removal also resulted in a decrease in herbivorous and zooplanktivorous fish (e.g., forage fish), and an increase in detritivorous fish (e.g., sculpin, flatfish). Removal of oyster culture in North Bay would likely result in changes to the fish community associated with removal operations, including essential forage fish that can use shellfish aquaculture as nursery and feeding habitat. While the system would eventually find a new equilibrium, removal of an oyster operations that has been in North Bay for over 80 years is likely to change the species that are supported in the system.

6.5.9.3 Impacts to Special Status Marine Aquatic Species

Aquaculture has the ability to affect biological resources in both negative and positive ways, with effects having the capacity to influence primary and secondary productivity and community structure (Simenstad and Fresh 1995). Manipulation of estuarine habitats to support aquaculture can disturb endemic communities (Pillay 1992). However, disturbances associated with shellfish aquaculture are typically infrequent and low intensity, which allows organisms to recover from or adapt to the changes associated with aquaculture activities. More importantly, eelgrass has been highly variable throughout the history of Humboldt Bay, and species within the intertidal zone are adapted to a high degree of habitat variation. Therefore, a minor change in eelgrass density will not change species use of these habitats.

The metrics used to estimate potential impacts to special status marine aquatic species was spatial overlap with habitat types present in North Bay and human presence (refer to Appendix E for a complete description). Potential impacts were then discussed according to four categories: (1) human disturbance, habitat degradation or alteration, (3) reduction in prey resources, and obstructions to access or migration corridors. Potential impacts, by alternative, are summarized for special status marine aquatic species in Table 6.5.12.

In general, conditions are similar between the Project, Alternative 1, and Alternative 2. The majority of short-term impacts to special status species would be in Alternative 4 during gear removal activities.

As above, this is due to the intensity and frequency of disturbance. However, after gear removal, the system would be allowed to return to a new equilibrium.

The major potential long-term change would be from removal of structured habitat. Coen et al. (2007) reported that oyster reefs provided more interstitial spaces for predator refugia and increased fitness due to the presence of suitable prey items. Dealteris et al. (2004) reported that shellfish gear supported native species of recreationally and commercially important fish and invertebrates in their early life history stages. Food-web modeling of intertidal oyster culture at much higher densities than is proposed for the Project (e.g., Leguerrier et al. 2004) also support the conclusion that off-bottom culture could benefit fish due to an enhanced food supply. Finally, Castel et al. (1989) indicated that the presence of oysters on rack-and-bag structures augmented meiofauna biomass. The authors also reported a reduction in macrofaunal abundance associated with the racks, but indicated that this may have been a product of increased predation, which benefited the slightly larger organisms (e.g., fish and birds) rather than the benthic invertebrates present in the sediment. Removal of shellfish aquaculture gear would remove this additional provision of prey resources that support fish and wildlife in Humboldt Bay. While there is no indication that food resources are limited in the bay, and the system would find a new equilibrium, the loss of structured habitat would result in at least an initial reduction.

Table 6.5.12 Summary of Impacts to Special Status Marine Aquatic Species by Alternative.					
Alternative	**Pacific Lamprey**	**Sturgeon**	**Salmonids**	**Forage Fish**	**Marine Mammals**
Project	• Aquaculture overlaps with 5.8% of potential habitat (all habitat types). • 33.9% increase in boat hours* (+74 hours). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 4.4% of potential habitat (channel and near channel habitat types). • 33.9% increase in boat hours* (+74 hours). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 4.4% of potential habitat (channel and near channel habitat types). • 33.9% increase in boat hours* (+74 hours). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 5.8% of potential habitat (all habitat types). • 33.9% increase in boat hours* (+74 hours). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 4.4% of potential habitat (channel and near channel habitat types). • 33.9% increase in boat hours* (+74 hours). • LTS impacts to habitat, prey resources, or migration corridor.
Alt. 1 (10-Foot Spacing)	• Aquaculture overlaps with 8.8% of all habitat types. • 61.5% increase in boat hours (+134 hours).	• Aquaculture overlaps with 7.3% of channel/ near channel habitat. • 61.5% increase in boat hours (+134 hours).	• Aquaculture overlaps with 7.3% of channel/ near channel habitat. • 61.5% increase in boat hours (+134 hours).	• Aquaculture overlaps with 8.8% of all habitat types. • 61.5% increase in boat hours (+134 hours).	• Aquaculture overlaps with 7.3% of channel/ near channel habitat. • 61.5% increase in boat hours (+134 hours).
Alt. 2 (Reduced Acreage)	• Aquaculture overlaps with 2.8% of all habitat types. • 31.2% increase in boat hours* (+68 hours).	• Aquaculture overlaps with 2.0% of channel/ near channel habitat. • 31.2% increase in boat hours* (+68 hours).	• Aquaculture overlaps with 2.0% of channel/ near channel habitat. • 31.2% increase in boat hours* (+68 hours).	• Aquaculture overlaps with 2.8% of all habitat types. • 31.2% increase in boat hours* (+68 hours).	• Aquaculture overlaps with 2.0% of channel/ near channel habitat. • 31.2% increase in boat hours* (+68 hours).
Alt. 3 (Existing Footprint)	No change beyond baseline conditions.				
Alt. 4 (No Action)	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.
LTS = less than significant					

6.5.9.4 Impacts to Commercially Important Aquatic Marine Species

Similar to the potential impacts to special status species, impacts to commercially important aquatic marine species can be both positive and negative. Potential impacts, by alternative, are summarized for commercially important aquatic marine species in Table 6.5.13. No alternatives were identified as resulting in potential impacts to commercially important aquatic marine species. As above, gear removal has the most potential for disturbance during the timeframe that activities occur and change to forage potential in North Bay. The system would reach a new equilibrium following gear removal activities.

6.5.10 Effects Analysis of the Alternatives – Avian Resources

Effects to eelgrass and other biological resources that use eelgrass habitat also affect avian resources. This section discusses the effects to birds that use the various habitats in North Bay by alternative.

6.5.10.1 Impacts to Special Status Bird Species

Aquaculture may affect special status birds in a variety of ways including human disturbance, affects to prey resources (both increases and decreases), and alteration of foraging areas. Potential impacts are outlined in detail in the Avian Resources Technical Report (Appendix F) and in section 6.5.4. A summary of impacts to special status birds is outlined in Table 6.5.14 below.

6.5.10.2 Impacts to Other Birds

Similar to impacts to special status species, potential impacts to birds without special status include human disturbance, affects to prey resources (both increases and decreases), and alteration of foraging areas. Potential impacts to other birds are outlined in detail in the Avian Resources Technical Report (Appendix F) and in section 6.5.4. A summary of impacts to other birds is outlined in Table 6.5.15 below.

Table 6.5.13 Summary of Impacts to Commercially Important Marine Aquatic Species by Alternative.			
Alternative	**Dungeness Crab**	**Pacific Herring**	**Groundfish**
Project	• Aquaculture overlaps with 4.4% of channel/near channel habitat. • 33.9% increase in boat hours* (+74 hours). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 10.1% of channel and eelgrass habitat. • 33.9% increase in boat hours* (+74 hours). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 4.4% of potential habitat (channel and near channel habitat types). • 33.9% increase in boat hours* (+74 hours). • LTS impacts to habitat, prey resources, or migration corridor.
Alt. 1 (10-Foot Spacing)	• Aquaculture overlaps with 7.3% of channel/near channel habitat. • 61.5% increase in boat hours (+134 hours).	• Aquaculture overlaps with 15.2% of channel and eelgrass habitat. • 61.5% increase in boat hours (+134 hours).	• Aquaculture overlaps with 7.3% of channel/near channel habitat. • 61.5% increase in boat hours (+134 hours).
Alt. 2 (Reduced Acreage)	• Aquaculture overlaps with 2.0% of channel/near channel habitat. • 31.2% increase in boat hours* (+68 hours).	• Aquaculture overlaps with 4.8% of channel and eelgrass habitat. • 31.2% increase in boat hours* (+68 hours).	• Aquaculture overlaps with 2.0% of channel/near channel habitat. • 31.2% increase in boat hours* (+68 hours).
Alt. 3 (Existing Footprint)	No change beyond baseline conditions.		
Alt. 4 (No Action)	• No overlap of aquaculture with potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of aquaculture with potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of aquaculture with potential habitat. • No human presence associated with aquaculture activities following removal of gear.
LTS = less than significant			

Table 6.5.14 Summary of Impacts to Special Status Bird Species by Alternative.

Alternative	Marbled Murrelet	Western Snowy Plover	California Brown Pelican	Black Brant
Project	• Aquaculture does not overlap potential habitat (channel habitat types). • 33.9% increase in boat hours (+74 hours). • LTS impacts from human disturbance (with avoidance). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture does not overlap potential habitat (open, sandy beaches). • LTS impacts from human disturbance (with avoidance). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 5.8% of potential habitat (all habitat types). • 33.9% increase in boat hours (+74 hours). • LTS impacts from human disturbance (with avoidance). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 15.3% of potential foraging habitat (all habitat with patchy or continuous eelgrass). • Potential 3% eelgrass biomass reduction. • 33.9% increase in boat hours (+74 hours). • LTS impacts from human disturbance (with avoidance). • LTS impacts to habitat, prey resources, or migration corridor.
Alt. 1 (10-Foot Spacing)	• Aquaculture does not overlap potential habitat (channel habitat types). • 61.5% increase in boat hours (+134 hours). • LTS impacts from human disturbance (with avoidance). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture does not overlap potential habitat (open, sandy beaches). • LTS impacts from human disturbance (with avoidance). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 8.8% of potential habitat (all habitat types). • 61.5% increase in boat hours (+134 hours).	• Aquaculture overlaps with 23.2% of potential foraging habitat (all habitat with patchy or continuous eelgrass). • 61.5% increase in boat hours (+134 hours).
Alt. 2 (Reduced Acreage)	• Aquaculture does not overlap potential habitat (channel habitat types). • 31.2% increase in boat hours (+68 hours). • LTS impacts from human disturbance. • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture does not overlap potential habitat (open, sandy beaches). • LTS impacts from human disturbance (with avoidance). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 2.8% of all habitat types. • 31.2% increase in boat hours (+68 hours).	• Aquaculture overlaps with 7.3% of potential foraging habitat (all habitat with patchy or continuous eelgrass). • 31.2% increase in boat hours (+68 hours).
Alt. 3 (Existing Footprint)	No change beyond baseline conditions.			

Table 6.5.14 Summary of Impacts to Special Status Bird Species by Alternative.				
Alternative	**Marbled Murrelet**	**Western Snowy Plover**	**California Brown Pelican**	**Black Brant**
Alt. 4 (No Action)	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.
LTS = less than significant				

Table 6.5.15 Summary of Impacts to Other Birds by Alternative.				
Alternative	**Roosting Birds**	**Nesting Birds**	**American Wigeon and Other Waterfowl**	**Migratory Shorebirds**
Project	• Aquaculture overlaps with 5.8% of potential habitat (all habitat types) • 33.9% increase in boat hours (+74 hours). • Beneficial increase in roosting structures. • LTS impacts from human disturbance. • LTS impacts to prey resources, or migration corridor.	• No overlap of potential habitat. • LTS impacts from human disturbance (with avoidance). • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 5.8% of potential habitat (all habitat types). • 33.9% increase in boat hours (+74 hours). • LTS impacts from human disturbance. • LTS impacts to habitat, prey resources, or migration corridor.	• Aquaculture overlaps with 5.8% of potential habitat (all habitat types) • 33.9% increase in boat hours (+74 hours). • LTS impacts from human disturbance (with avoidance). • LTS impacts to habitat, prey resources, or migration corridor.
Alt. 1 (10-Foot Spacing)	• Aquaculture overlaps with 7.3% of channel/ near channel habitat. • 61.5% increase in boat hours (+134 hours).	• No overlap of potential habitat. • 61.5% increase in boat hours (+134 hours).	• Aquaculture overlaps with 8.8% of all habitat types. • 61.5% increase in boat hours (+134 hours).	• Aquaculture overlaps with 8.8% of all habitat types. • 61.5% increase in boat hours (+134 hours).
Alt. 2 (Reduced Acreage)	• Aquaculture overlaps with 2.0% of channel/ near channel habitat. • 31.2% increase in boat hours (+68 hours).	• No overlap of potential habitat. • 31.2% increase in boat hours (+68 hours).	• Aquaculture overlaps with 2.8% of all habitat types. • 31.2% increase in boat hours (+68 hours).	• Aquaculture overlaps with 2.8% of all habitat types. • 31.2% increase in boat hours (+68 hours).

Table 6.5.15 Summary of Impacts to Other Birds by Alternative.				
Alternative	**Roosting Birds**	**Nesting Birds**	**American Wigeon and Other Waterfowl**	**Migratory Shorebirds**
Alt. 3 (Existing Footprint)	No change beyond baseline conditions.			
Alt. 4 (No Action)	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.	• No overlap of potential habitat. • No human presence associated with aquaculture activities following removal of gear.
LTS = less than significant				

6.6 Aesthetic and Visual Resources

This section describes present and possible future conditions of visual resources in the Project area. The significance of effects on visual resources is defined by CEQA Appendix G criteria, based on standards found in the California Coastal Act, and on policies within the Humboldt County General Plan, Local Coastal Program, and its supporting documents.

6.6.1 Existing Conditions

Visual resources and scenic views occur in a diverse array of environments in the Humboldt Bay area, ranging in character from views of all-natural aesthetic features to views that mainly consist of the built environment. As stated in the Natural Resources and Hazards Report (DBURP 2002), scenic resources in Humboldt Bay include "coastline views, mountains, hills, ridgelines, inland water features, forests, agricultural features, idyllic rural communities," and combinations of these features. The many streams, sloughs and one small river (Elk River) that empty into Humboldt Bay provide a land/water interface that is generally visually appealing. Views of the natural aquatic environment provide much of the bay's visual quality, including views of areas such as the National Wildlife Refuge Complex, the City of Arcata's Marsh and Wildlife Sanctuary, and the Department of Fish and Wildlife Areas. Many views that combine natural and built components also have scenic appeal, such as the marina views of Woodley Island, and views of the bay environment from locations such as the City of Eureka's Old Town Boardwalk and Waterfront Trail. The former pulp mill is a conspicuous industrial element on the North Spit (HBMP DEIR 2006).

Specific to the Project, scenic resources of interest are Humboldt Bay and coastal area views. State Highway 101, along the eastern shore of Arcata Bay, is eligible for designation as a State Scenic Highway and there are numerous scenic vistas from both the shores and surface waters of Humboldt Bay. The built environment that is visible from the Project area includes industrial development, billboards, residential housing, wharfs/marinas, pilings, bridges, mariculture, roads, highways, farmland, and ranch land.

Present visual resource conditions are described in numerous documents including:

- Humboldt County General Plan, Volume II, Humboldt Bay Area Plan of the Humboldt County Local Coastal Program. Certified 1982, Revised December 2014. Humboldt County Department of Community Services Development.
- Humboldt County General Plan, Update Natural Resources and Hazards Report. 2002. Dyett & Bhatia Urban and Regional Planners.
- Humboldt County Local Coastal Plan, Issue Identification Report. September 2003. Humboldt County Planning and Building Department.
- Humboldt Bay Management Plan Draft EIR. April 2006. Humboldt Bay Harbor, Recreation and Conservation District (HBMP DEIR 2006).
- Humboldt Bay Management Plan. 2007. Humboldt Bay Harbor, Recreation and Conservation District.

6.6.2 Pertinent Laws and Regulations

The Humboldt Bay Area Plan of the Humboldt County Local Coastal Program (Volume II of the Humboldt County General Plan) contains the following Visual Resources Protection policies (HBAP Section 3.40.B) relevant to the proposed Project:

> **Physical Scale and Visual Compatibility (3.4.B.1).** No development shall be approved that is not compatible with the physical scale of development as designated in the Area Plan and zoning for the subject parcel; and the following criteria shall be determinative in establishing the compatibility of the proposed development.
>
> **Protection of Natural Landforms and Features (3.4.B.2)**. Natural contours, including slope, visible contours of hilltops and treelines, bluffs and rock outcroppings, shall suffer the minimum feasible disturbance compatible with development of any permitted use.
>
> **Coastal Scenic Area (3.4.B.3).** In the Coastal Scenic Area designated in the Area Plan Map (Indianola area), it is the intent of these regulations that all developments visible from Highway 101 be subordinate to the character of the designated area.
>
> **Coastal View Areas (3.4.B.4)**. In Coastal View Areas as designated in the Area Plan, it is the intent of these regulations that no development shall block coastal views to the detriment of the public.
>
> **Highway 101 Corridor (3.4.B.5)**. The following Scenic Highway Element goals outlined in the County's 1984 Framework Plan remain relevant for local scenic roadways:
>
> - To establish a system of scenic routes.
> - To conserve scenic views observable from the routes.
> - To provide multiple recreational uses on publicly owned lands adjacent to the routes.
> - To recognize the dual scenic and economic value of lands planned for the growing and harvesting of timber, and agricultural products.
>
> **Natural Features (3.4.B.8).** Significant natural features within the Humboldt Bay Planning Area, and specific protection for retention of these resources are as follows: Arcata Bottoms, Bottomlands between Eureka, and Arcata, South Spit, Table Bluff, Dune Forests along the North Spit, Bottomlands along South Bay, and Ryan and Freshwater Sough.

6.6.3 Definition of Significance and Baseline Conditions

Significance criteria for effects on visual resources are defined in the CEQA checklist in combination with the consideration of goals and policies contained within the Humboldt County General Plan and its supporting documents.

According to CEQA, effects on visual resources are considered significant if the project:

1. Has a substantial adverse effect on a scenic vista.

2. Substantially damages scenic resources, including trees, rock outcroppings, and historical buildings within a state scenic highway.
3. Substantially degrades the existing visual character or quality of the site or surroundings.
4. Creates a new source of substantial light or glare.

In the Humboldt County General Plan and its supporting documents, additional criteria to determine significance are proposed. According to the Humboldt County General Plan, effects on visual resources are considered significant if the project:

- Disturbs physical scale and visual continuity.
- Does not protect natural landforms and features.
- Is within a Coastal scenic area, is "visible from Highway 101" and causes change that is not "subordinate to the character of the designated area…".
- Results in vegetation clearing that is not minimized.
- Results in development of these resources: Arcata Bottoms, Bottomlands between Eureka and Arcata, South Spit, Bottomlands around South Bay, Ryan and Freshwater Slough, Eel River and associated riparian vegetation, Eel River estuary bottomlands.[12]

The term "visual quality" refers to the character, condition, and quality of a scenic landscape, vista point, natural or built environment, scenic roadway, or other significant or unique visual feature within a viewshed, as well as how such "visual resources" are perceived and valued by the public. A "viewshed" is the area within the field of view of an observer, and this term is used to describe the extent of a scenic resource. The extent of a viewshed can be limited by a number of intervening elements, including structures, topography, and vegetation (HBMP DEIR 2006).

In general, most forms of visual quality assessments consider such attributes as unity or cohesion, intactness, context, variety, uniqueness, and vividness (the overall qualities of the view); and texture, color, contrast, line, mass, and scale (descriptive elements). Variables associated with the users or observers are also considered, including the distance from the observer to the visual features, the observer's position or angle of view, the duration of the view, the time of season, whether it is day or night, and the observer's expectations and background (HBMP DEIR 2006).

6.6.4 Effects Analyses of the Proposed Project

Visual effects from the proposed Project would include changes in visual character to the Project area due to the presence of mariculture workers and vessels and the addition of shellfish culture equipment and cultured shellfish to intertidal and subtidal locations in Humboldt Bay.

IMPACT AV-1: Effect on scenic vistas and visual character from worker and vessel presence.

Increased activity on the bay as a result of the Project may temporarily impact the visual character of the proposed intertidal expansion sites. The Project would increase the area of culture activities adjacent to current growing areas and a small amount of additional boats and crew would be necessary

[12] Aquaculture uses are an exception to this standard; aquaculture uses are permitted in lands zoned for Natural Resources (NR) and Coastal Wetlands (W) by the County (Humboldt County Code §§ 313-5.4, 313-38).

to maintain and operate the expansion area. However, the frequency of site visits to any one bed for planting, harvesting and maintenance activities is not expected to change.

In addition, the proposed intertidal expansion areas are located at least 0.5 miles from the nearest transportation corridor/public viewshed. Due to this distance from shore, the appearance of workers at these intertidal sites would be subordinate to the extensive saltmarsh, mudflat, and water between observers and subjects, rendering the workers and vessels difficult to see. Growing Areas 1, 2, and 3 (see Figures 3.1 & 4.4) would be most visible to passing motorist, bicyclists, and pedestrians on the Samoa Bridges. However, the Highway 255 Samoa Bridges cross major navigation channels with frequent recreational, commercial and aquaculture boat use. Other shellfish culture and industrial areas are also viewable from this portion of Highway 255. The presence of vessels and shellfish culture workers is not expected to negatively impact scenic vistas or visual character because the workers and vessels are very small in scale compared to the expansive tidal areas, and these uses are consistent with what already occurs and is expected in these areas of Humboldt Bay. The visual effect of increased worker and vessel traffic would be a minor change from current conditions and is a less than significant impact.

The eight-bin expansion proposed for Coast's subtidal FLUPSY site is not expected to result in an increase in boat traffic or culturist activity on the bay. While the FLUPSY will be visited by work crews on a daily basis, there is already daily human activity in and around the water in the FLUPSY's vicinity.

IMPACT AV-2: Effect on scenic vistas and visual character from shellfish culture equipment presence.

The Project would expand shellfish culture operations within Coast's existing leased footprint in and around areas that Coast already uses for shellfish cultivation. Portions of the proposed intertidal expansion areas removed from Coast's current culture footprint would appear similar to current activities on the bay, including adjacent areas. Under existing conditions, there are stakes, markers, rafts, and other aquaculture equipment visible from various public vantage points, including Highway 255 around Mad River Slough, the Manila area, Samoa Bridges, and the Eureka-Arcata Highway 101 corridor.

The shellfish culture equipment to be placed in intertidal expansion sites would be similar in scale and materials to existing equipment in the bay. Longline culture areas have linear features that often appear slightly darker than the surrounding tidal substrate, depending on the angle of the observer, time of day, tides, and sunlight glare. However, mariculture equipment has a low profile—elevated above the substrate by 1 ft (cultch-on-longline) to 26 or 40 inches (basket-on-longline)—and blends in to the surrounding environment unless viewed up close. Representative photographs showing the low visual profile of cultch- and basket-on-longline culture are presented in Figures 6.6.1 and 6.6.2.

Figure 6.6.1 Photograph of basket-on-longline oyster culture at Coast's farm in Humboldt Bay, California.

Figure 6.6.2 Photograph of cultch-on-longline oyster culture with mariculture workers.

In addition, all existing and proposed growing areas are located at least 0.5 miles from nearby Highways (Highway 101, Highway 255), making them difficult to see from shore. From this distance, the view of shellfish culture equipment at the intertidal sites would be subordinate to the extensive saltmarsh and mudflat features in the bay thereby rendering them difficult to see from typical vantage points (see Figures 6.6.3 – 6.6.7). Intertidal culture equipment would also only be visible when exposed by low tides, or approximately 11 percent of the time for the expansion area. During high tides, the culture equipment will be submerged and invisible.

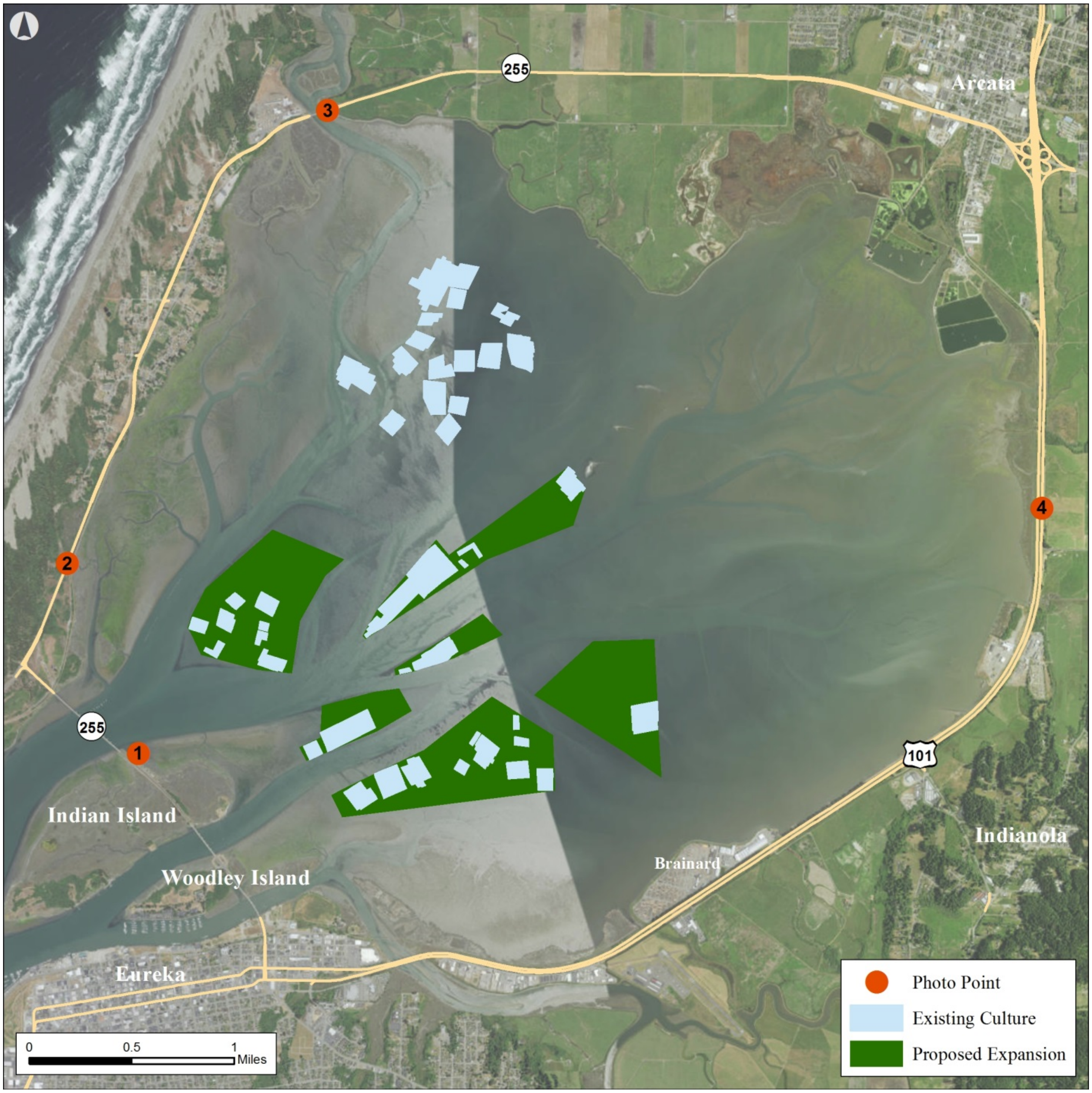

Figure 6.6.3 Photographs depicted in Figures 6.6.4-6.6.7 were taken from the public vantage points marked above (Photograph Locations 1, 2, 3 and 4).

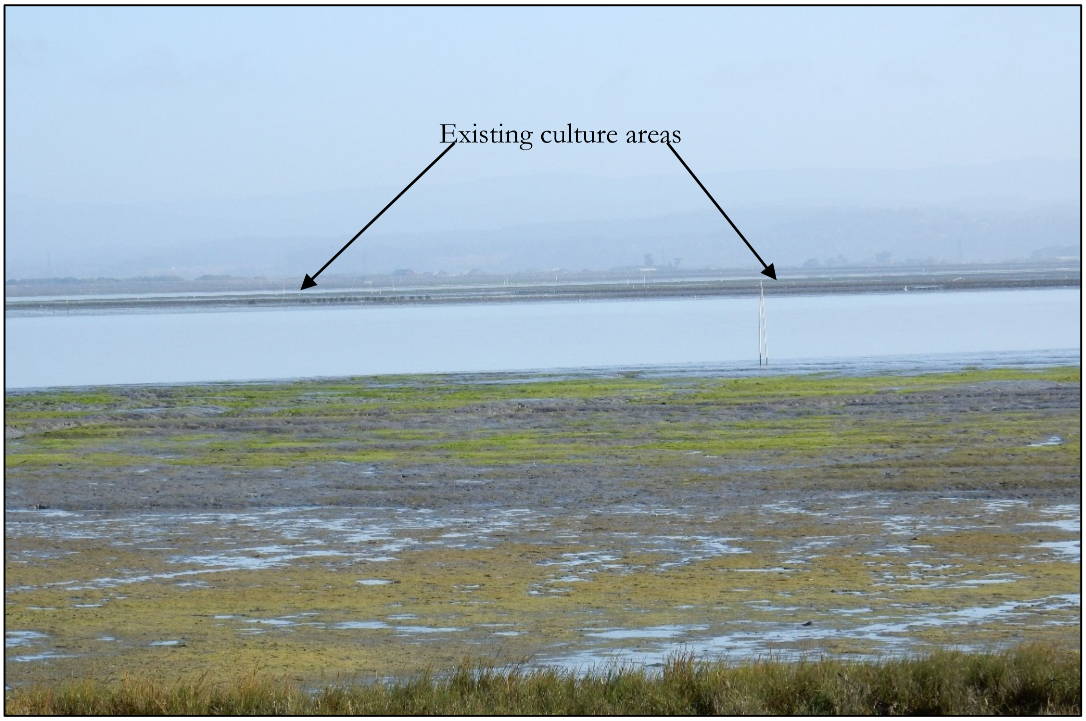

Figure 6.6.4 View from Highway 255 on Indian Island (Photograph Location 1).

Figure 6.6.5 View from Highway 255 south of Manila (Photograph Location 2).

Figure 6.6.6 View from Highway 255 near Mad River Slough (Photograph Location 3). Existing culture is not visible from this vantage point.

Figure 6.6.7 View from Arcata-Eureka Highway 101 corridor (Photograph Location 4). Existing culture is not visible from this vantage point.

As shown in the above photographs, which were taken at low tide, culture equipment cannot be seen from many public vantage points around the bay and visibility is affected by light conditions, angle of the sun, tides, and position of the observer. Additionally, views of shellfish culture operations are common in Humboldt Bay and consistent with the current visual character of the area. The views and visual profile of the bay from the above public vantage points (Photograph Locations 1-4) are not expected to change significantly as a result of the Project.

IMPACT AV-3: Effects of glare and artificial lighting.

The infrastructure proposed for placement in the intertidal areas would not be constructed of materials which produce substantial amounts of glare. Nighttime work occurs during existing culture operations in order to take advantage of low tides and would continue under the proposed Project. Nighttime work on the Project would involve the use of LED or high-pressure sodium work lights on boats and personal illumination devices such as headlamps and flashlights used by workers. Work lights on boats illuminate an area approximately 50 yards around the boat.

Lighting used during nighttime site visits would be at least 0.5 miles from shoreline viewers; therefore, the effect would be negligible. People on the bay (i.e., boaters) at night would be exposed to the lights at a closer distance, but the increased lighting would generally improve boating safety, and views would not be adversely affected. Moreover, as with daytime site visits, nighttime site visits with lights are temporary—harvest boat trips last between 4-6 hours and site visits by smaller boats last approximately 4 hours (Tables 4.4, Project Description). The frequency of visits to any one site is also limited, with the majority of the proposed expansion area (cultch-on-longline) receiving only approximately 1 visit per month in between planting and harvesting (Tables 4.2 and 4.3, Project Description). The visual effect of additional lighting used during nighttime operations is therefore considered less than significant.

No additional lights are contemplated as a result of the FLUPSY expansion.

6.6.4 Conservation Measures

This section identifies specific Conservation Measures that have been incorporated into the Project by Coast and are intended to ensure that the Project maintains a high standard that is environmentally responsible. Given their critical importance in ensuring that significant impacts are avoided, Conservation Measures are treated similarly to Mitigation Measures and will be included in the Mitigation and Monitoring Plan for the Final EIR. The Project incorporates the following Conservation Measure to ensure that potential impacts to visual resources are minimized to the extent practicable.

Conservation Measure AV-1: Reflective materials such as shiny metals will not be used.

In addition, Mitigation Measure BIO-3, adopted to minimize the Project's potential impacts to avian resources and marine mammals, requires that longlines be installed at a maximum height of 1 foot (cultch) and 40 inches (basket) from the substrate, making them visually unobtrusive and difficult to distinguish when viewed at a distance.

6.6.5 Level of Significance Before Mitigation

With incorporation of the Conservation Measure AV-1, and because culture equipment is low-profile and part of the existing visual landscape, IMPACTS AV-1, AV-2, and AV-3 are considered less than significant without mitigation.

6.6.6 Mitigation Measures

No Mitigation Measures are necessary.

6.6.7 Level of Significance After Mitigation

Due to the low profile of the proposed intertidal shellfish culture equipment, which is invisible during high tides, and because of the historic and expected presence of shellfish culture in North Bay, IMPACTS AV-1, AV-2, and AV-3 would be less than significant without mitigation.

6.6.8 Effects Analyses of Alternatives

Alternative 1: 10-Foot Spacing Alternative
The potential visual and aesthetic impacts associated with Alternative 1 would be similar to those described above. However, the expansion area footprint would be 333 acres larger than under the Project. The additional acreage proposed under Alternative 1 would include two additional areas of intertidal culture: the first, in the northern portion of Coast's leased and owned footprint, coincides with areas already cultured by Coast; the second, in the easternmost portion of Coast's leased footprint, would be in an area that is not currently being cultured. The additional intertidal culture areas proposed under Alternative 1 could make the Project more visible from public vantage points around the bay, particularly from Photograph Locations 3 and 4. However, as with the Preferred Alternative, the culture equipment proposed is in keeping with the current visual landscape and the expanded culture areas would be at least 0.5 miles from public vantage points and roadways. From this distance, views of the additional culture areas would be subordinate to the extensive saltmarsh and mudflat features in the bay. In addition, the use of 10-ft spacing will make the longlines less visually intrusive from a distance, as there will be greater opportunity to see undeveloped tidal flats between the longlines.

Alternative 1 also presents an increase in boat activity and human presence on the bay that could impact scenic vistas and the visual character of the bay. Although culturists and boats would be visible on the bay more often under Alternative 1 than under the Preferred Alternative, workers and boats associated with aquaculture are a frequent sight on the bay and in keeping with the visual character of the area. In addition, while an increase in worker and boat activity is necessary to operate and maintain the increased area proposed under Alternative 1, the frequency of visits to any given bed will not change (e.g., monthly visits to cultch-on-longline beds for maintenance—see Tables 4.2-4.4, Project Description).

For these reasons, IMPACTS AV-1, AV-2 and AV-3 are considered less than significant under Alternative 1.

Alternative 2: Reduced Acreage Alternative

Alternative 2 would be less likely to impact visual resources than the Preferred Alternative due to the smaller proposed expansion area (300 acres for Alternative 2 compared to 622 acres for the proposed Project). The areas proposed for intertidal culture expansion would be the same as under the Project; however, the acreage of each expansion area would be reduced and there would be no additional culture placed on Indian Island. Potential impacts associated with increases in culture equipment, worker presence, and lighting would thus be very similar to those described above but smaller in scale due to the reduced project footprint. Therefore, the overall potential impact to visual resources would be less than under the Preferred Alternative and, as with the Preferred Alternative, IMPACTS AV-1, AV-2 and AV-3 are considered less than significant under Alternative 2.

Alternative 3: Existing Footprint Alternative

Because Alternative 3 does not propose a change from baseline conditions, there would be no significant impacts to visual resources. IMPACTS AV-1, AV-2 and AV-3 would thus be less than significant under Alternative 3.

Alternative 4: No Project Alternative

Under the No Project Alternative, Coast's existing permits would not be renewed and existing infrastructure related to shellfish culture would be removed. There would be temporary impacts to visual resources under the No Project Alternative during the time necessary to remove culture equipment from the bay (3-6 months if Coast were required to remove everything immediately, and 18 months if oysters were allowed to grow to market size before harvest). While removal is taking place, there may be more intense activity on the bay, including increased numbers of workers and boats. Thereafter, no culture equipment, personnel or boats would be visible on the bay. IMPACTS AV-1, AV-2 and AV-3 would thus be less than significant under Alternative 4.

6.7 Air Quality

This section describes the regulatory framework under which air pollutant emissions are controlled and the potential effects of the Project on air quality.

6.7.1 Existing Conditions

The Project area is located in the North Coast Air Basin (NCAB) and is under the jurisdiction of the North Coast Unified Air Quality Management District (AQMD). The NCAB is in attainment of all federal and state air quality standards except for particulate matter smaller than 10 microns in diameter (PM_{10}) under California regulations.[13] PM_{10} pollutants may be generated by transportation sources (tire wear, emissions, etc.); by construction-generated dust or smoke; and by smoke from appliances like woodstoves, barbecues, or fireplaces. PM_{10} can be a health hazard, especially for children, the elderly, and people with heart or lung disease.

6.7.2 Pertinent Laws and Regulations

A number of state and federal air quality laws and regulations are relevant to the proposed Project including the Federal Clean Air Act and the California Air Pollution Control Law. In addition, the AQMD has adopted a set of regulations governing air quality in the Project area. Specifically, AQMD has adopted Regulation 1, which stipulates requirements for air quality management within the NCAB. Further, AQMD's Particulate Matter Attainment Plan adopts a number of control strategies for achieving particulate matter reductions, including transportation control measures (intended to reduce vehicular pollutant generation from all modes), land use measures, regulation of open burning, and residential burning controls.

The Harbor District's Humboldt Bay Management Plan also sets policy objectives relevant to the Project, including the following:

- HTM-1: Assure compliance with North Coast Air Quality Management District Rules for Particulates.

6.7.3 Definition of Significance and Baseline Conditions

Significance criteria are those listed in the CEQA checklist. A project's effects on air quality would be significant if the project would:

1. Conflict with or obstruct implementation of the applicable air quality plan adopted by the AQMD.
2. Contribute pollutants that would violate an existing air quality standard, or contribute substantially to non-attainment of air quality objectives in the NCAB.
3. Produce pollutants that would result in a cumulatively considerable net increase of any criteria pollutant for which the NCAB is in non-attainment.
4. Expose sensitive receptors to substantial pollutant concentrations.
5. Create odors that would affect a substantial number of people.

[13] Compliance with air quality standards for criteria pollutants is based on attainment of relevant state or federal standards. If any standard is not met, the pollutant is considered "non-attainment" for that standard.

6.7.4 Effects Analysis of Proposed Project

The Project would create a small amount of emissions from two additional small boats that are expected to be used for Project operations and up to 18 additional boat trips per week throughout the bay (Table 4.4, Project Description). It would not create any substantial pollution concentrations or objectionable odors. Additionally, there are no sensitive receptors or substantial numbers of people in the Project vicinity.

IMPACT AQ-1: Contribution to PM_{10} levels.

Small boats associated with mariculture operations have combustion engines that generate particulate matter. The Project is expected to involve the use of two additional small boats (one scow and one skiff) to maintain culture areas: the skiff will make 5 additional 4-hour trips through the bay per week and the Scow 10 additional 4-hour trips per week. The number of boat trips performed by Coast's harvest vessels (the Mary Elizabeth and Elusive) will also increase under the Project, from 7 per week to 10 per week. In total, there will thus be an additional 18 boat trips throughout the bay per week (an increase of 74 boat hours per week). As a result of increased boat traffic, there would be a minor net increase in emissions of particulate matter from vessel engines. The Project would also involve a small number of additional vehicle trips to and from Coast's facilities as a result of additional truck trips to accommodate increased production and additional employee trips associated with the approximately 50 additional employees Coast anticipates hiring. However, given the small size of the vessels at issue, the limited quantity of vessels (2 additional boats; 11 total boats), and the limited number of additional vehicle trips, Coast's contribution to PM_{10} levels in Humboldt Bay is negligible.

6.7.5 Conservation Measures

There are no proposed Conservation Measures.

6.7.6 Level of Significance Before Mitigation

IMPACT AQ-1 is considered potentially significant without mitigation.

6.7.7 Mitigation Measures

The District lacks direct jurisdiction over air quality, and thus lacks direct authority to require mitigation for potential air quality impacts. However, the AQMD regulates vessel engine emissions pursuant to several air quality plans. In such circumstances, CEQA allows the lead agency to rely on the regulatory oversight of responsible agencies carrying out statewide policy. Specifically, pursuant to Section 15064(h) of the CEQA Guidelines, the District may rely on air quality management plans promulgated by the AQMD, including the AQMD's PM_{10} Attainment Plan.

The following Mitigation Measure was thus identified to minimize the Project's potential impacts on air quality.

Mitigation Measure AQ-1: Coast shall comply with the requirements of all adopted air quality plans, including plans covering particulate emissions, and shall implement all actions required by the AQMD for Coast's mariculture operations.

6.7.8 Level of Significance After Mitigation

The District finds that Coast would not contribute to a cumulatively significant air quality impact if it complies with the PM_{10} Attainment Plan adopted by the AQMD and all attendant regulations established thereto. Mitigation Measure AQ-1 would require Coast to comply with AQMD regulations. Therefore, no significant and unavoidable adverse impacts relating to air quality remain and IMPACT AQ-1 is considered less than significant.

6.7.9 Effects Analysis of Alternatives

Alternative 1: 10-Foot Spacing Alternative
In order to service the expansion area footprint under Alternative 1, Coast could operate a maximum of 33 additional boat trips throughout the bay per week (above current conditions); this represents a 45% increase in boat trips over the Preferred Alternative. Under this alternative, Coast would add 4 additional small craft to its operation and would increase the total number of boat hours on the bay by 134 hours over current conditions or 60 hours over the Preferred Alternative. Potential impacts to air quality generated by boat engine emissions would increase commensurate with the expected increase in boat traffic on the bay. Vehicle trips are expected to be approximately the same as compared to the Preferred Alternative. However, with incorporation of Mitigation Measure AQ-1, IMPACT AQ-1 would be less than significant under Alternative 1.

Alternative 2: Reduced Acreage Alternative
Because the footprint of the expansion area would be reduced to 300 acres (from 622) under Alternative 2, fewer boat trips would be required throughout the bay in order to maintain and operate culture equipment. As with the Preferred Alternative, Coast would increase the number of small vessels in its operation by two boats under Alternative 2. However, the number of boat trips throughout the bay per week would be increased by only 17 trips or 68 boat hours per week over existing conditions—slightly less than under the Preferred Alternative. Given the reduced expansion, the additional vehicle trips associated with truck traffic and employee trips would also be slightly reduced. As with the proposed Project, Coast would implement Mitigation Measure AQ-1 under Alternative 2. With incorporation of Mitigation Measure AQ-1, IMPACT AQ-1 would be less than significant under Alternative 2.

Alternative 3: Existing Footprint Alternative
Under Alternative 3, there would be no impact on air quality compared to baseline conditions, but existing uses and related impacts to air quality in the bay would continue. IMPACT AQ-1 is thus considered less than significant under Alternative 3.

Alternative 4: No Project Alternative
Under Alternative 4, there would be a potential short-term impact to air quality as a result of intense activity on the bay necessary to remove culture equipment (over a 3-6 month period if Coast were not permitted to grow out shellfish to market size, 18 months if Coast were permitted to grow shellfish to market size). Thereafter, there would be a minor benefit to air quality due to cessation of all regular boat trips through the bay. Because potential impacts as a result of Alternative 4 would be short term and because an overall reduction in vessel running time would occur once culture equipment was successfully removed, IMPACT AQ-1 is considered less than significant under Alternative 4.

6.8 Greenhouse Gas Emissions

6.8.1 Existing Conditions

Coast's existing culture activities generate a relatively small amount of greenhouse gases (GHG) associated with the use of small watercraft, motorized equipment including generators, and the use of personal motorized transportation. Coast uses 6 small boats (4 skiffs and 2 scows) to operate and maintain its existing intertidal culture areas (Table 4.1, Project Description). Each skiff makes one 4-hour trip per day, 5 days per week. Each scow makes two 4-hour trips per day, 5 days a week. Trip time represents the maximum possible time during which the boat engine is running—boat running time is likely less than trip time as the boat will be stopped while work is performed. In addition, Coast operates three larger vessels (two harvesters and a clam boat). The clam boat is active twice per day, 5 days a week, for a 2-hour trip. Respectively, the two harvest vessels operate one 6-hour trip five days a week and one 4-hour trip two days a week. During a 4 or 6 hour harvester trip, the boat engine is shut down during harvest and a gas-powered generator used to run harvest equipment. In addition, Coast employs 68 people, approximately 38 of whom regularly utilize motorized transportation to get to/from work.

6.8.2 Pertinent Laws and Regulations

Following passage of California Senate Bill 97 (SB 97) in 2007, CEQA requires analysis of impacts associated with a project's GHG emissions. The CEQA Guidelines were updated by the Governor's Office of Planning and Research (GOPR) to reflect passage of AB 97 in 2009. Actions by both the State of California and by the U.S. Supreme Court support the need to include analysis of GHG emissions and a project's contribution to global climate change in environmental impact reports:

- In 2005, California Governor Arnold Schwarzenegger issued Executive Order S-3-05, which set two GHG reduction targets: meet 1990 GHG levels by the year 2020 and meet 20% below 1990 levels by the year 2050. The following year, California passed comprehensive climate change legislation detailing how these goals would be accomplished. The "Global Warming Solutions Act of 2006" requires California to reduce carbon emissions by 25% by 2020.
- In 2007, the U.S. Supreme Court issued its decision in *Massachusetts vs. EPA*,[14] holding that GHGs are pollutants and must be regulated under the Federal Clean Air Act.

6.8.3 Definition of Significance and Baseline Conditions

The CEQA Guidelines recommend consideration of the following factors when assessing the significance of a project's GHG emissions:

1. The extent to which the project may increase or reduce GHG emissions as compared to the environmental setting.
2. Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project.

[14] *Massachusetts v. U.S. Environmental Protection Agency*, 549 U.S. 497 (2007).

3. The extent to which the project complies with regulations or requirements adopted to implement statewide, regional or local GHG reduction or mitigation plans.[15]

In the context of GHG and global climate change, the GOPR recognizes that statewide thresholds of significance for GHG emissions have not been set (GOPR 2008). The GOPR recommends that lead agencies should consider significance in the context of direct, indirect, long- and-short term, and cumulative impacts. However, "although climate change is ultimately a cumulative impact, not every individual project that emits GHGs must necessarily be found to contribute to a significant cumulative impact on the environment" (GOPR 2008).

6.8.4 Effects Analysis of Proposed Project

The Harbor District and AQMD have not established a threshold of significance for GHG emissions. Consistent with CEQA Guidelines Section 15064.4, the Harbor District has opted for a qualitative assessment of GHG emissions and found that the following impacts should be assessed.

IMPACT GHG-1: Generation of GHGs.

The Project would involve direct generation of GHGs through burning of gasoline and other fuels from power boats, small generators, and vehicular traffic. Under the Project, Coast would use up to two additional small boats to operate and maintain intertidal harvest areas (1 scow and 1 skiff) (Table 4.4, Project Description). The two additional small craft would operate on the same schedule as Coast's existing scows and skiffs, increasing the number of boat trips per week by small vessels to 55 from 40 and the number of hours of vessel operation to 220 from 160. Coast would also operate its existing harvest vessels more frequently, adding one additional 6-hour trip per week and two additional 4-hour trips per week.

The Project would also result in a negligible increase in GHG emissions generated during processing/cleaning of shellfish and during transportation (primarily trucking) and refrigerated storage of the product. Storage is expected to occur primarily at existing Coast facilities on Humboldt Bay. Finally, the Project would employ approximately 50 additional local workers who would likely travel to and from work sites using personal motor vehicles.

The amount of GHGs generated by all of the above activities is considered less than significant, particularly relative to the amount of food that will be produced and to other, more intensive activities in the region (the existing setting).

IMPACT GHG-2: Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

The Project does not conflict with any known plan, policy, or regulation, including AB 32 and SB 97.

6.8.5 Conservation Measures

There are no identified Conservation Measures.

[15] 14 Cal. Code Reg. § 15064.4(b).

6.8.6 Level of Significance Before Mitigation

IMPACTS GHG-1 and GHG-2 are considered less than significant without mitigation.

6.8.7 Mitigation Measures

No Mitigation Measures are necessary.

6.8.8 Level of Significance After Mitigation

IMPACTS GHG-1 and GHG-2 are considered less than significant without mitigation.

6.8.9 Effects Analysis of Alternatives

Alternative 1: 10-Foot Spacing Alternative
Direct GHG emissions would increase under Alternative 1 due to the need for additional boats and boat trips to service intertidal culture areas. Because the area cultivated would be approximately 1.5 times larger than for the Project (955 acres for Alternative 1 compared to 622 acres for the proposed Project), Coast would need to operate 4 additional small boats (2 skiffs and 2 scows) instead of 2, which would collectively make 30 4-hour trips per week. However, Coast harvest vessels would be run with the same frequency as under the Project. In total, there would be 15 more boat trips under Alternative 1 than under the Project and 33 more trips than under current conditions. Indirect GHG impacts (related to processing/cleaning, transportation, and storage of the product) would be slightly lower than for the proposed Project because fewer oysters would be cultivated under Alternative 1 due to a reduction in the total number of oyster longlines.

Despite more small boats and boat trips, Alternative 1 is expected to result in a less than significant increase in GHG emissions and thus IMPACT GHG-1 is expected to be less than significant. As with the Project, Alternative 1 would not conflict with any known plan, policy or regulation, including AB 32 and SB 97, and no IMPACT GHG-2 is expected.

Alternative 2: Reduced Acreage Alternative
Direct GHG emissions under Alternative 2 would decrease as compared to the Project. Like the Project, Alternative 2 would require two additional small watercraft (1 scow and 1 skiff) operating a total of 15 additional 4-hour trips per week. However, the frequency of harvest vessel operation would be slightly reduced—Alternative 2 would require only two additional 4-hour trips per week (rather than one 6-hour and two 4-hour trips). Because Alternative 2 would generate less GHG emissions than the Project due to a reduction in boat trips and operating hours, IMPACT GHG-1 is considered less than significant without mitigation. As with the Project, Alternative 2 would not conflict with any known plan, policy or regulation, including AB 32 and SB 97, and thus no IMPACT GHG-2 is expected.

Alternative 3: Existing Footprint Alternative
Under Alternative 3, there would be no GHG impact compared to baseline conditions, but existing uses and related GHG impacts would continue. IMPACT GHG-1 is thus expected to be less than significant under Alternative 3 and there is expected to be no IMPACT GHG-2.

Alternative 4: No Project Alternative

Under Alternative 4, there would be a minor benefit to GHG emissions because all current cultivation activities would cease and the proposed expansion of cultivation would not occur. While GHG emissions would be generated during operations necessary to remove Coast's aquaculture equipment from the bay and to harvest remaining shellfish product, these emissions are less than what would be generated during the life of the Project. IMPACT GHG-1 is thus expected to be less than significant under Alternative 4 and there is expected to be no IMPACT GHG-2.

6.9 Hydrology and Water Quality

This section describes the present and possible future conditions regarding hydrology and water quality in the Project area. The significance of effects regarding hydrology and water quality is defined by CEQA Appendix G criteria.

6.9.1 Existing Conditions

Hydrology and water quality in Humboldt Bay are described in the Humboldt Bay Management Plan (HBMP 2007) and Humboldt Bay Management Plan Draft Environmental Impact Report (HBMP DEIR 2006) and those documents are incorporated by reference. As described in those documents, the ambient water quality in Humboldt Bay is good, with quality determined based on the general quality of water entering the bay from the nearshore Pacific Ocean. On average, bay water is slightly warmer than incoming Pacific water. There are also seasonal and geographic variations in water quality in the bay, with North Bay being both fresher and colder in winter and warmer and saltier in summer than Entrance Bay. Coast's owned and leased areas are certified by the California Department of Public Health for shellfish cultivation, which has classified Coast's areas as "Conditionally Approved" areas fit for healthy shellfish cultivation.

6.9.2 Pertinent Laws and Regulations

There are a variety of state and federal laws pertinent to water quality and hydrology in Humboldt Bay. The Water Quality Control Plan for the North Coast Region (Basin Plan)[16] establishes multiple objectives for Humboldt Bay in order to ensure that beneficial uses and existing water quality parameters are maintained (RWQCB 2011). There are 18 beneficial uses identified for Humboldt Bay, including water contact recreation, navigation and aquaculture. The Basin Plan also includes numerical criteria for a number of pollutants, including fecal coliform, and narrative criteria for water quality parameters such as temperature and pH. The narrative criteria, together with the basic antidegradation policy and the required maintenance of beneficial uses, constitute the overarching state mandate for water quality in Humboldt Bay (HBMP 2007).

The Humboldt County General Plan (County of Humboldt 1984), City of Arcata General Plan (City of Arcata 2008), and City of Eureka General Plan (City of Eureka 1997) contain additional goals and policies related to water quality. Further, Section 303(d) of the Federal Clean Water Act (CWA) includes requirements for water bodies that are "impaired," and that, consequently, do not meet adopted state and/or federal water quality requirements. Such impaired water bodies or segments of water bodies are subject to the development of total maximum daily load (TMDL) waste allocations pursuant to requirements in the CWA and the State Porter-Cologne Water Quality Control Act.[17] Humboldt Bay is included in the U.S. Environmental Protection Agency-approved 303(d) list of impaired waters in California. Humboldt Bay is listed as impaired for polychlorinated biphenyls (PCBs) and dioxin toxic equivalents.[18]

[16] The Basin Plan was most recently updated in 2011. Many water quality plans and policies exist in California, including a number that affect Humboldt Bay. See URL: http://www.swrcb.ca.gov/plans_policies/ (viewed September 2015).

[17] See URL: http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/303dlist.shtml (viewed September 2015).

[18] See URL: http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/category5_report.shtml (viewed September 2015).

Although the source(s) of PCBs in Humboldt Bay is/are unknown, PCBs are known to be associated with a number of adverse health and environmental effects. Dioxins were historically generated primarily by timber and pulp mill operations, through wood preservatives that have active ingredients consisting of cyclic (aromatic) hydrocarbon molecules with multiple substituted chlorine atoms. Such chemicals were used in many wood product manufacturing facilities or mills in the 1950s and 1960s as anti-fungal or preservative agents. The most widely known of these compounds (or mixtures of chemically similar compounds) was pentachlorophenol (also known as penta or PCP). PCP is itself a toxic material that is now banned from use in the United States. Dioxin-contaminated PCP is known to have been used at several lumber-processing mills in the Humboldt Bay region (HBMP DEIR 2006).

However, neither the State Water Resources Control Board nor the U.S. Environmental Protection Agency identified apparent adverse effects on any of the beneficial uses identified for Humboldt Bay (including shellfish harvesting), and the priority for developing a TMDL for the impaired bay was determined to be low (HBMP DEIR 2006). The current 2010 303(d) list shows an expected TMDL completion date of 2019.[19]

6.9.3 Definition of Significance and Baseline Conditions

Significance criteria are those listed in the CEQA checklist. A project's effects on hydrology and water quality would be significant if the project would:

1. Violate federal, state, regional, or local water quality standards set for water quality and for discharge of waste water.
2. Use, or interfere with, ground water such that the amount of flow of groundwater is adversely impacted.
3. Cause drainage changes that would alter or cause an increase in volume or flow of tidewater or surface flow that would cause or lead to a substantial increase in erosion or sedimentation either in the project area or elsewhere.
4. Alter drainage patterns of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner, that would result in flooding on- or off-site.
5. Add runoff from the project area that would exceed the capacity of drainage facilities.
6. Create polluted runoff or other general adverse water quality impacts that could affect beneficial uses or degrade water quality in waters of the state.
7. Place housing or other structures within the 100-year flood plain, or other area subject to flooding.
8. Place structures within a 100-year flood hazard area that would impede or redirect flood flows.
9. Expose people or structures to a significant risk or loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.
10. Be developed in such a manner or location that it would be adversely affected by seiche, tsunami, or mudflow.

[19] See Section 6.10, Hazards and Hazardous Materials, for a discussion of dioxin contamination and shellfish safety.

6.9.4 Effects Analysis of Proposed Project

The majority of the significance criteria listed above pertain to upland uses and are not applicable to the Project; therefore, all impacts other than Criteria 1 and 3 are not further discussed below. The following potentially significant impacts were identified for the Project.

IMPACT WQ-1: Water Quality.

Shellfish are filter feeders that have a positive impact on water quality by filtering pollutants and contaminants from the water column. Shellfish remove excess nitrogen and phosphorous from the water column, nutrients that play a role in enhancing phytoplankton production and blooms of both toxic and nontoxic microalgae. As Rice (2008) summarizes, bivalves are an essential component of estuarine systems in that they exert "bottom-up" control through biodeposition and promotion of nutrient removal (i.e., burial and denitrification); sequester nitrogen in the form of proteins in tissues and shells; and stabilize phytoplankton growth dynamics through moderation of ammonia cycling in the water column.[20] Ecosystem modeling and mesocosm studies indicate that restoring shellfish populations to even a modest fraction of their historical abundance could improve water quality and aid in the recovery of seagrasses (Newell and Koch, 2004). However, Humboldt Bay is not currently characterized as a eutrophic system with excess nitrogen and phosphorus; therefore, this benefit may be limited, at least based on the bay's current composition and level of discharges from anthropogenic sources. Therefore, the Project is anticipated to have a minor positive impact on water quality.

IMPACT WQ-2: Sedimentation.

Project activities will temporarily mobilize a minor amount of sediment. For example, when stakes are placed or a vessel comes in contact with the bay bottom, sediment may be mobilized. However, the amount of sediment mobilized during mariculture operations is likely very low compared to the quantities of sediment mobilized during storm conditions (that is, strong winds and storm surges).

Oyster culture has a localized effect on sediment distribution and tidal circulation. As water is slowed by frictional effects of the culture structure, sediment deposition and organic content increases (Rumrill and Poulton 2004).[21] A study of sedimentation in Humboldt Bay at locations similar to Project sites reported that "fine sediments were deposited and eroded in an inconsistent manner at cultch-on-longline sites." The greatest elevation change measured was an increase of 95 mm (Rumrill and Poulton 2004). Localized changes of this magnitude would not have a substantially adverse effect on the surrounding environment. Given that the typical detection limit for this type of study is 80 mm (Hannam and Mouskal 2015), it is unlikely that the change observed by Rumrill and Poulton (2004) would be considered significant. Therefore, this impact is less than significant.

[20] See Section 6.5.4, Effects Analysis of the Project, for a discussion of the Project's potential to cause changes in the abundance of suspended organic matter and potential competition for this food source between cultured shellfish and other filter feeders.

[21] A more in-depth discussion of scouring and sediment accumulation associated with longline aquaculture is provided in Section 6.5.4, Effects Analysis of the Project.

6.9.5 Conservation Measures

No Conservation Measures have been identified.

6.9.6 Level of Significance Before Mitigation

IMPACT WQ-1 and WQ-2 are considered less than significant without mitigation.

6.9.7 Mitigation Measures

No Mitigation Measures are necessary.

6.9.8 Level of Significance After Mitigation

No mitigation is necessary. IMPACT WQ-1 and WQ-2 are considered less than significant without mitigation.

6.9.9 Effects Analysis of Alternatives

Alternative 1: 10-Foot Spacing Alternative
The footprint of Alternative 1 (955 acres) would be larger than the proposed Project (622 acres), increasing the area in which potential hydrology and water quality impacts may occur. However, the general project area would be comparable and impacts would be similar to the proposed Project. IMPACTS WQ-1 and WQ-2 would be less than significant under Alternative 1.

Alternative 2: Reduced Acreage Alternative
Although impacts would be similar, Alternative 2 would be slightly less likely to create sedimentation than the proposed Project due to the reduced acreage of cultivation (300 acres for Alternative 2 compared to 622 acres for the proposed Project). IMPACTS WQ-1 and WQ-2 would be less than significant under Alternative 2.

Alternative 3: Existing Footprint Alternative
Under Alternative 3, there would be no impact to hydrology and water quality compared to baseline conditions; however, existing uses and related hydrology and water quality impacts would continue. IMPACTS WQ-1 and WQ-2 would be less than significant under Alternative 3.

Alternative 4: No Project Alternative
Under Alternative 4, there could be a minor benefit regarding hydrology and water quality, because all current cultivation activities would cease and the proposed expansion of cultivation would not occur. IMPACTS WQ-1 and WQ-2 would thus be less than significant under Alternative 4.

6.10 Hazards and Hazardous Materials

This section describes the present and possible future conditions regarding hazards and hazardous materials in the Project area. The significance of effects regarding hazards and hazardous materials is defined by CEQA Appendix G criteria.

6.10.1 Existing Conditions

There are relatively few hazards or hazardous materials in Humboldt Bay, which is dominated by natural landscapes. However, Humboldt Bay has historically been used for industrial processes such as bleaching of paper pulp, pesticide and herbicide manufacturing and waste incineration, which likely contributed chemicals such as dioxins to the bay (Pacific Shellfish Institute 2007). In addition, Humboldt Bay is frequently transited by recreational and commercial watercraft with internal combustion engines, which pose a hazard associated with the potential release of fuel and lubricants into the bay.

6.10.2 Pertinent Laws and Regulations

The Humboldt Bay Management Plan (HBMP 2007) contains the following goals and objectives related to toxic materials management for Humboldt Bay:

Goals:

- Prevent spills in Humboldt Bay.
- Minimize the impact of spills on Humboldt Bay.
- Minimize water-borne debris in Humboldt Bay.
- Eliminate illegal dumping.

Objectives:

- Spill response and cleanup procedures will be enhanced in Humboldt Bay through increased coordination among local, state, and federal agencies and personnel.
- Planning measures and implementation procedures for spill prevention and response will continue to be improved.
- The level of public involvement in, and knowledge about, the effects of illegal dumping on the bay's environmental resources will be improved, leading to reduced dumping, protecting water quality and environmental resources.
- Compensation obtained through environmental resource damage assessments and potential penalties or fines will be applied to improving spill prevention and cleanup capabilities.

The Harbor District is a member of the Humboldt Bay Oil Spill Cooperative, responsible for responding to marine-related releases of petroleum products and related toxic materials into Humboldt Bay. The District does not have direct responsibility for spill prevention or cleanup. The United States Coast Guard maintains the primary responsibility for spill prevention and cleanup in marine waters pursuant to the Oil Pollution Act of 1990. NOAA Fisheries is responsible for responding to potential effects to marine mammals. CDFW's Office of Spill Prevention and Response is responsible for state-level spill responses regarding wildlife and habitat (HBMP 2007).

6.10.3 Definition of Significance and Baseline Conditions

Significance criteria are those listed in the CEQA checklist. An impact would be considered significant if it meets any of the following criteria:

1. Creates a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.
2. Creates a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.
3. Emits hazardous emissions or handling of hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.
4. Is located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment.
5. For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, the project would result in a safety hazard for people residing or working in the project area.
6. For a project within the vicinity of a private airstrip, the project would result in a safety hazard for people residing or working in the project area.
7. Impairs implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.
8. Exposes people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

6.10.4 Effects Analyses of the Proposed Project

The Project site is not located within a quarter-mile of an existing or proposed school; further, given that the Project is located entirely on tidelands, there is no potential for an accidental release of hazardous materials to affect upland school uses. The Project area is not located on a hazardous materials site. While a portion of the Project site is located approximately 0.9 miles from Murray Field, a public airfield, all Project operations would occur on the tidelands at sea level and would not interfere with airfield operations. Further, given that the Project would take place on tidelands, there is no potential to affect an established emergency response plan or risk wildfires. Thus, Impacts 3 through 8 are not discussed in further detail below. The following potential hazard-related impacts have been identified for the Project.

IMPACT HAZ-1: Hazard to people or the environment through the routine transport, use, emission, or release of hazardous materials.

The only hazardous materials that would be associated with the Project are fuel and lubricants for boats, generators and other mechanical equipment, including for internal combustion engines on small boats. Use of these materials is common on Humboldt Bay and does not represent a significant hazard to the environment or people. Project personnel will follow all current and standard safety and cleanup protocols for fueling and lubricating engines. Further, Coast will implement Conservation Measures HAZ-1, HAZ-2 and HAZ-3, below, to further reduce the risk of pollution or oil or hazardous materials spills.

IMPACT HAZ-2: Hazard from the abandonment or loss of marine debris.

The Project may result in accidental loss of mariculture gear or other debris into Humboldt Bay. Because the equipment is placed in intertidal areas, it is subject to various natural forces including tide, wind, waves and ultraviolet radiation. As a result, there is potential for equipment to become loose, wash away or otherwise escape into the environment. Escaped mariculture gear may pose a hazard to biological resources and to other users of the bay, including boaters (kayakers, stand-up paddle boarders, canoers, wind surfers) and scuba divers. When encountered, marine debris associated with mariculture equipment may damage boat bottoms or engines, snag on trailing lines or otherwise impair navigation. Recreational users of the bay may encounter escaped mariculture equipment in shallow intertidal areas, which may make transit of these areas more hazardous, particularly if escaped equipment is wholly or partially buried in the substrate and thus hidden from view.

Longline oyster culture involves installation of PVC tubes in the substrate, which are strung with monofilament line and hung with oysters or oyster baskets (polyethylene sleeves). Coast inspects cultch-on-longlines during monthly maintenance work and during harvest. Any pipes disturbed during the harvest are re-secured or removed if damaged. Any identified loose pipes or debris are removed from the culture area. During replanting, pipes are straightened out and replaced as needed. Basket-on-longlines are inspected and maintained each time the oysters are inspected for grading. Baskets are lashed in bins during transport to prevent loss.

Rack-and-bag culture utilizes 3’ x 12’ rebar frames on which are placed polyethylene mesh bags full of oysters. The bags are attached to the racks using industrial rubber bands. Worn, strained, or damaged rubber bands are routinely replaced during daily inspection and maintenance of the rack-and-bags. Any debris is removed during inspections. Coast also performs a monthly inspection of its owned and leased area for marine debris at both low and high tide and picks up any identified debris, regardless of the source of the identified items.

Mitigation Measures HAZ-1 through HAZ-5 have also been incorporated to address this impact.

IMPACT HAZ-3: Health hazard from bioaccumulation of dioxins in shellfish meat.

The Project has the potential to bioaccumulate dioxins present in the bay in shellfish meat, potentially posing a health hazard to shellfish consumers. In recent years, oyster growers in Humboldt Bay have seen their products come under increased scrutiny for a group of organic compounds known informally as dioxins stemming, in part, from past operations of pulp and lumber mills in the area. This has been perceived as a potentially serious issue due to: 1) the extremely low levels of these chemicals permitted in foodstuffs; 2) the recognized ability of oysters and other bivalve shellfish to bioaccumulate the chemicals; and 3) the heightened sensitivity of the public and environmental regulators to the significance of the chemicals in the environment (Pacific Shellfish Institute 2007).

A dioxin is one of a number of chemical compounds that are created as byproducts or contaminants when chemically complex hydrocarbon structures are reacted commercially to add chlorine to one or more of the constituents.[22] That is, dioxin is not a formulated product, but it occurs as a constituent in a variety of commercial grade products containing chlorine, including herbicides and pesticides, as well as compounds used to inhibit biological activity in other contexts. One of the categories of compounds in which dioxin has been found is wood preservatives that have active ingredients consisting of cyclic (aromatic) hydrocarbon molecules with multiple substituted chlorine atoms. Such chemicals were used in many wood product manufacturing facilities or mills in the 1950s and 1960s as anti-fungal or preservative agents. The most widely known of these compounds (or mixtures of chemically similar compounds) was PCP. PCP is itself a toxic material that is now banned from use in the United States.[23] Dioxin-contaminated PCP is known to have been used at several lumber-processing mills in the Humboldt Bay region (HBMP DEIR 2006).

In 2002, two studies analyzed commercially grown oysters and mussels from Humboldt Bay for the presence of dioxins, metals, and semivolatile organic compounds. The initial study in June 2002 was conducted in response to concerns raised by Coast and other local commercial shellfish businesses about possible contamination of commercial oyster beds located in Humboldt Bay. The final study in October 2002 was completed to comply with a specific request made by the California Department of Health Services (CDHS) to Coast (EnviroNet and ENVIRON 2003).

The results of the 2002 studies and other sampling in Humboldt Bay by CDHS in 2003 were summarized in a 2007 status report prepared by the Pacific Shellfish Institute (PSI). The 2007 PSI study concluded that the dioxins were not a concern in the areas identified:

> Studies of dioxin levels in bivalve shellfish indicate in most regions of the United States and other countries, concentrations are well below levels considered by the USFDA and USEPA to be a human health risk. Most long-term studies demonstrate a decline in dioxin levels, and for [the] large part, industries releasing these pollutants have come under more stringent regulation. A 2002 survey of dioxins and other chemicals in shellfish from the Mad River Slough and Humboldt Bay found their levels to be the same as or marginally higher than those detected in the majority of studies at other locations. CDHS sampling from Humboldt Bay in 2003 indicated much lower levels, with dioxin concentrations in shellfish at or near the detection limits. Although there are no similar long-term data from Humboldt Bay shellfish to offer a historical perspective of dioxin levels, trends in recent years suggest that in the absence of continued inputs, dioxins are continuing to decrease to naturally occurring levels.
>
> The available literature indicates there is no risk of contamination from consuming shellfish from Humboldt Bay…. After review of pertinent studies, reports and health criteria, it is concluded that Mad River Slough and Humboldt Bay, as shellfish growing areas, meet all standards of safe harvest and consumption of commercially grown shellfish within the wet and dry weather standards administered by CDHS. The Humboldt Bay Harbor Recreation and Conservation District as the state tideland trustee is meeting its obligations under the trusteeship to ensure that shellfish culture

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[22] For additional information about dioxin (more formally designated as "2,3,7,8-tetrachlorodibenzo-p-dioxin" or TCDD), see URL: http://www.epa.gov/safewater/contaminants/dw_contamfs/dioxin.html (viewed September 2015).
[23] For additional information about pentachlorophenol, see URL: http://www.epa.gov/safewater/contaminants/dw_contamfs/pentachl.html (viewed September 2015).

activities presently permitted on leased tidelands conform with human health criteria as they relate to dioxin (Pacific Shellfish Institute 2007).

There is no indication that dioxin levels in Humboldt Bay have increased or changed since the 2002 studies were completed or since the Pacific Shellfish Institute published its summary in 2007. In fact, it is likely that levels will continue to decrease as the time since cessation of dioxin-producing pulp mill activities increases.

6.10.5 Conservation Measures

This section identifies specific Conservation Measures that have been incorporated into the Project by Coast and are intended to minimize the Project's hazard or hazardous materials impacts. The Conservation Measures are intended to ensure that the Project maintains a high standard that is environmentally responsible. Given their critical importance in ensuring that significant impacts are avoided, Conservation Measures are treated similarly to Mitigation Measures and will be included in the Mitigation and Monitoring Plan for this EIR. The following Conservation Measures are incorporated into the Project:

Conservation Measure HAZ-1: Coast will not discharge any feed, pesticides, or chemicals (including antibiotics and hormones) into Humboldt Bay waters.

Conservation Measure HAZ-2: Coast will implement an equipment maintenance program for all vessels used in mariculture activities in order to limit the likelihood of release of fuels, lubricants, paints, solvents, or other potentially toxic materials associated with vessels as a result of accident, upset, or other unplanned events.

Conservation Measure HAZ-3: Coast will continue to fuel boats at commercial fuel dock facilities, carry oil spill absorption pads and seal wash decks or isolate fuel areas prior to fueling so as to prevent contaminants from entering the water.

6.10.6 Level of Significance Before Mitigation

Compliance with the Conservation Measures identified above would reduce potential impacts associated with IMPACTS HAZ-1 and HAZ-3 to a level that is less than significant. IMPACT HAZ-2 is potentially significant impact without mitigation.

6.10.7 Mitigation Measures

Mitigation Measures HAZ-1 through HAZ-5 are intended to mitigate for impacts associated with IMPACT HAZ-2 concerning potential hazards generated by marine debris.

Mitigation Measure HAZ-1: Following storm or adverse weather events, Coast will patrol mariculture areas for escaped or damaged mariculture equipment, promptly retrieve any equipment encountered and, if it cannot be repaired and placed back into service, properly dispose of the escaped equipment on land. In addition, Coast will retrieve or repair any escaped or damaged mariculture equipment that it encounters while conducting routine daily and/or monthly maintenance activities associated with shellfish culture (e.g. bed inspections, shellfish grading and sorting). If the escaped gear cannot be repaired and replaced on the shellfish bed, it will be properly disposed of on land.

Mitigation Measure HAZ-2: Within 30 days of harvest on any area that is being discontinued or taken out of production for one year or more, Coast will remove all shellfish culture apparatus from the area, including but not limited to, stakes, racks, baskets, and pallets.

Mitigation Measure HAZ-3: Coast will implement annual employee training regarding marine debris issues and how to identify loose culture gear and proper gear repair and removal methods.

Mitigation Measure HAZ-4: Coast will conduct quarterly bay cleanups in coordination with other interested parties or organizations, which will include walking portions of the bay and shorelines to pick up escaped shellfish gear and other trash (regardless of whether it is generated by the Project). The volume of shellfish gear collected shall be recorded.

Mitigation Measure HAZ-5: Coast will not leave tools, loose gear, or construction materials on its owned and leased tidelands or surrounding areas for longer than one tide cycle. All gear installed in the Project area will be kept neat and secure.

6.10.8 Level of Significance After Mitigation

IMPACTS HAZ-1 and HAZ-3 are less than significant without mitigation. Upon implementation of Mitigation Measures HAZ-1, HAZ-2, HAZ-3, HAZ-4, and HAZ-5, IMPACT HAZ-2 is less than significant. Therefore, no significant and unavoidable adverse impacts concerning hazards or hazardous materials remain.

6.10.9 Effects Analysis of Alternatives

Alternative 1: 10-Foot Spacing Alternative
Because Alternative 1 would involve approximately 352 hours of watercraft use per week compared to 292 hours per week with the Project, it would have a slightly greater risk of release of fuel and lubricants from watercraft. However, given the implementation of Conservation Measures HAZ-1, HAZ-2 and HAZ-3 and adherence to all current and standard safety and cleanup protocols for fueling and lubricating engines, IMPACT HAZ-1 is less than significant under Alternative 1.

Because Alternative 1 would involve fewer longlines than under the Preferred Alternative (38,960 instead of 48,456), there is a reduced potential for abandonment or loss of gear or other debris into Humboldt Bay. Regardless, any such gear or debris encountered during operations will be retrieved for proper disposal. With the implementation of Mitigation Measures HAZ-1 through HAZ-5, IMPACT HAZ-2 is therefore less than significant under Alternative 1. In addition, given the documented lack of dioxin risk to people from consuming shellfish grown in Humboldt Bay, IMPACT HAZ-3 is less than significant under Alternative 1.

Alternative 2: Reduced Acreage Alternative
Because Alternative 2 would involve approximately 286 hours of watercraft use per week compared to 292 hours per week with the Project, it would have approximately the same risk of release of fuel and lubricants from watercraft. Given the implementation of Conservation Measures HAZ-1, HAZ-

2 and HAZ-3 and adherence to all current and standard safety and cleanup protocols for fueling and lubricating engines, IMPACT HAZ-1 is less than significant under Alternative 2.

Because Alternative 2 would involve the addition of up to 21,600 new longlines compared to 48,456 new longlines with the proposed Project, there would be less risk of hazard from the abandonment or loss of gear or other debris into Humboldt Bay. Regardless, any such gear or debris encountered during operations will be retrieved for proper disposal. With the implementation of Mitigation Measures HAZ-1 through HAZ-5, IMPACT HAZ-2 is therefore less than significant under Alternative 2. Given the documented lack of dioxin risk to people from consuming shellfish grown in Humboldt Bay, IMPACT HAZ-3 is also less than significant under Alternative 2.

Alternative 3: Existing Footprint Alternative
Under Alternative 3, there would be no impact regarding hazards and hazardous materials compared to baseline conditions, but existing uses and related hazard impacts in the bay would continue. IMPACTS HAZ-1, HAZ-2, and HAZ-3 are considered less than significant under Alternative 3.

Alternative 4: No Project Alternative
Long-term, there would be a minor benefit regarding hazards and hazardous materials under Alternative 4 because all current cultivation activities would cease and the proposed expansion of cultivation would not occur. However, during the removal of all of Coast's shellfish culture from the bay (both intertidal and subtidal), the risk of release or escape of equipment would be increased due to the volume of materials being removed and transported. Regardless, IMPACTS HAZ-1, HAZ-2, and HAZ-3 are considered less than significant under Alternative 4.

6.11 Recreation

6.11.1 Existing Conditions

Existing uses in the Project area are primarily mariculture and recreation. Recreation activities in and around North Bay include boating, paddling (e.g., kayaks, canoes and stand-up paddle boards), fishing, clamming, birdwatching, and hunting. Hunting for waterfowl is conducted on the bay, sloughs, marshes, and adjacent agricultural and other uplands. Hunting (regulated by CDFW) is allowed at several locations, including the State of California managed area at Fay Slough Wildlife Area, portions of the U.S. Fish and Wildlife Service (USFWS) Jacoby Creek and Eureka Slough units are open during the State of California waterfowl hunting season, which is generally October 10 through January 22 for ducks, and a variable period between October 10 and March 10 for geese, depending on the species. Hunting is generally conducted using boats, sculling in a low-profile skiff, walking along levees, and using temporary or permanent blinds along the shoreline. Boating and paddling in North Bay is somewhat limited because of the shallow water and tidal conditions; popular areas include the Mad River Slough area, with ("unofficial") access from the Highway 255 bridge and other locations (HBMP DEIR 2006).

6.11.2 Pertinent Laws and Regulations

The Humboldt Bay Management Plan recognizes that recreation encompasses a wide range of existing and potential outdoor activities in and around Humboldt Bay. The Management Plan classifies the Project area as "Combined Water Use – Mariculture". In such areas, coastal dependent uses may be given priority over recreational uses. This is consistent with the Management Plan's focus on balancing harbor, coastal industrial, commercial, conservation, and recreational uses in the bay. This means that recreational opportunities are not always maximized.

Humboldt County's General Plan recognizes recreation-tourism as one of the County's primary industries. The County's Humboldt Bay Area Local Coastal Plan similarly sets forth a number of recreation policies with relevance to the Project, including:

- 30220. Coastal areas suited for water-oriented recreational activities that cannot readily be provided in inland water areas shall be protected for such uses.

The City of Eureka's General Plan contains the following goal for recreation in the coastal zone:

- Goal 5.B. To provide for public open space and shoreline accessways throughout the Coastal Zone, consistent with protecting environmentally sensitive habitat and other coastal priority land uses.

6.11.3 Definition of Significance and Baseline Conditions

Significance criteria are those listed in the CEQA checklist, a project's effects on recreation would be significant if the project would:

1. Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.

2. Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.

6.11.4 Effects Analysis of Proposed Project

IMPACT REC-1: Effects on recreational facilities.

The Project is expected to create a small increase in boat traffic and culture activity on the bay in areas utilized for recreation, boating, and hunting (see Table 4.4, Project Description). Coast would add 2 additional small boats (1 scow and 1 skiff) to its fleet and increase the number of crew manning skiffs and scows to 7 (with the exception of Skiff 4). The frequency and duration of skiff and scow trips on the bay would remain the same as under current conditions. In addition, the number of trips per week taken by Coast's two harvesters would increase, with the Mary Elizabeth operating one additional trip per week and the Elusive two additional trips per week. In total, there would be a maximum of 18 additional boat trips per week for a total of 74 additional boat hours per week.

As described above, the Project would also increase the coverage of aquaculture-related infrastructure on intertidal areas in the bay. Longline aquaculture would occupy a maximum of 618 additional acres and rack-and-bag up to 4 additional acres.

Although the Project would expand infrastructure in tidal areas and increase boat traffic and worker presence associated with expanded culture activities, it would not result in physical impacts to recreational facilities. Because the Project is expected to employ approximately 50 individuals already living in the community, it should not increase recreational use or represent an increased demand on recreational facilities. Neither construction nor expansion of existing recreational facilities will be required. Therefore, impacts to recreational facilities would be less than significant.

IMPACT REC-2: Effects on recreational users of the bay.

Impacts to Recreational Boaters

As described above, the Project would add new structures to the bay in the form of additional FLUPSY bins and additional shellfish equipment in intertidal areas in the form of longlines and rack-and-bag equipment. The increased presence of aquaculture equipment in the bay has the potential to impact recreational users of the water including hunters, kayakers, canoers, and stand-up paddle boarders. The Project's mariculture equipment could be located in areas of watercraft (e.g., boats, kayaks) access in intertidal areas (Figure 6.11.1). This equipment would only affect watercraft when the tides are high enough for small vessels with shallow drafts to move through intertidal areas occupied by culture equipment, but so low that the vessels can't move readily over the equipment. Given the low elevation of the proposed longline culture equipment, the additional amount of time that vessels would be prevented from accessing the Project site as compared to existing conditions would be minimal. Empty space among the equipment would allow smaller watercraft (e.g., kayaks) to move through shellfish beds, but in some cases only in two directions (e.g., parallel to rows of

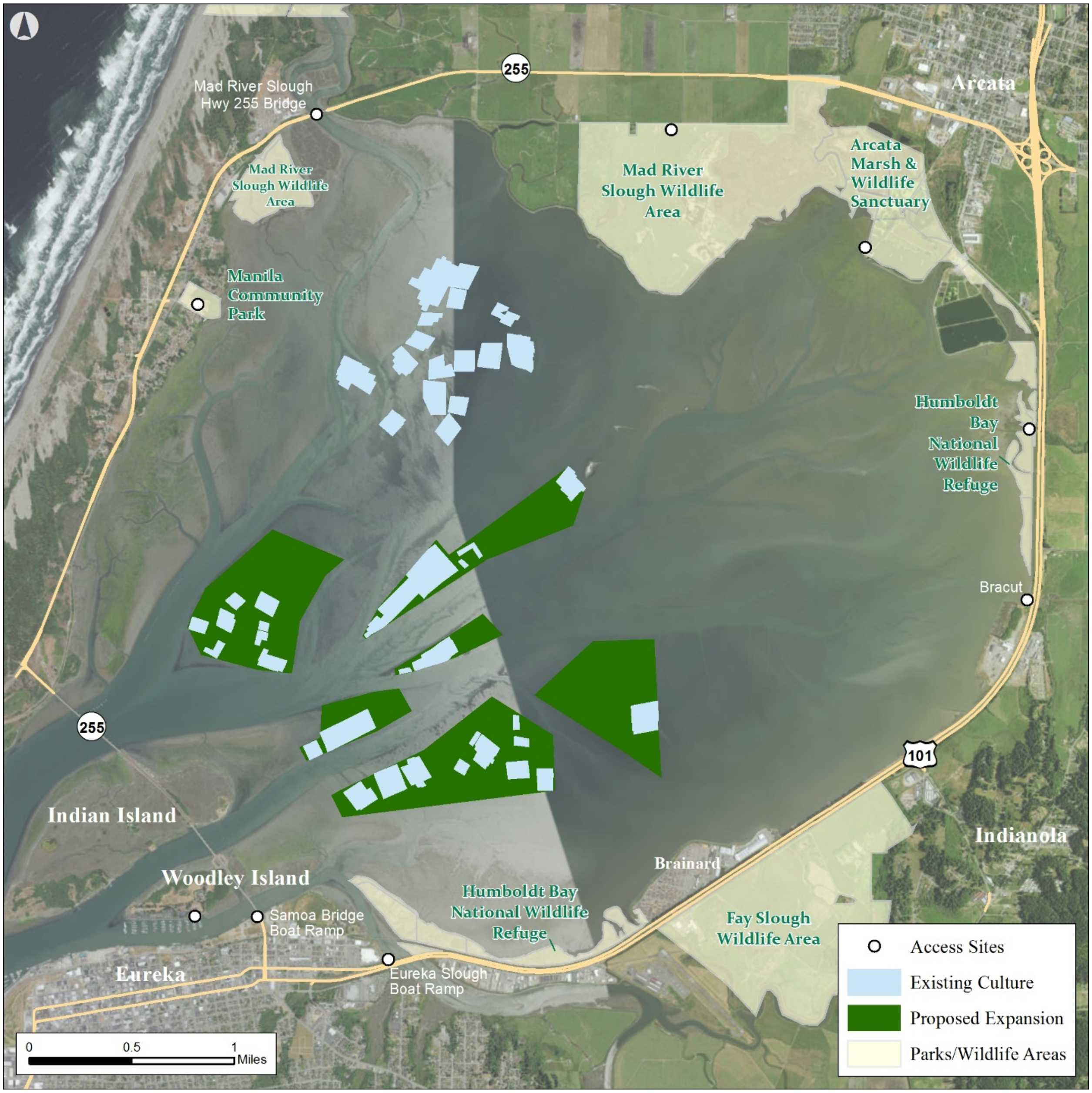

Figure 6.11.1 Preferred Alternative: Map of recreation access locations and park/wildlife areas in North Bay.

equipment). The corners of the culture areas are marked to visibly inform boaters where culture related infrastructure is located and Coast will provide a map to the Harbor District annually showing the locations of its shellfish culture plots that can be shared with recreational boaters. Watercraft movement in subtidal areas, including in the primary navigation channels for watercraft, would not be affected.

Workers will routinely visit culture areas for installation, inspections, maintenance, planting and harvesting, product grading, and other activities related to aquaculture practices (see Tables 4.2 and 4.3, Project Description). However, the Project would only involve a small number of additional boat trips per week, which would be a negligible percentage of overall boat traffic in Humboldt Bay (Table 4.4, Project Description). These activities frequently occur at low tide when recreational users will already be excluded from the culture area by the tide level. Further, Coast employees take care to avoid recreational boaters and small craft recreational users and no impact associated with additional boat trips is anticipated.

Impacts to Recreational Hunting

Waterfowl hunters are known to use intertidal areas in the Project vicinity, with a primary focus on the East Bay Management Area. Hunting is regulated by CDFW; hunters are allowed to hunt without interference. Hunting is regulated by the time of year and sometimes day of the week, depending on the species. Recreational hunting could be impacted by Project activities. This may include sporadic flushing of birds due to noise associated with boat trips and harvest activities. However, as noted above, the Project would only result in a small increase in boat trips, with an average of two to three additional boat trips per day. Therefore, the impact associated with the Project is anticipated to be less than significant. Further, as described in Section 6.11.5 below, to minimize potential interactions with waterfowl hunters, Coast will limit work in certain areas during typical brant hunting times and days of the week. This includes limiting work during early morning and daylight hours in the East Bay Management Area during brant hunting season (typically mid-November – mid-December) on Wednesdays, Saturdays, and Sundays (Figure 6.11.2).

6.11.5 Conservation Measures

This section identifies specific Conservation Measures that have been incorporated into the Project by Coast and are intended to minimize the Project's recreational impacts. The Conservation Measures are intended to ensure that the Project maintains a high standard that is environmentally responsible. Given their critical importance in ensuring that significant impacts are avoided, Conservation Measures are treated similarly to Mitigation Measures and will be included in the Mitigation and Monitoring Plan for this EIR. The following Conservation Measure is incorporated into the Project:

> **Conservation Measure REC-1:** Between November 15 through December 15, Coast shall avoid operations in the East Bay Management Area from midnight until sunset, on Wednesdays, Saturdays, and Sundays. This conservation measure shall not apply in the case of emergency conditions or other operations, such as marine debris removal, required by Coast to comply with other conditions of approval or mitigation measures, or ensure the safety of its operations.

Conservation Measure REC-2: By December 1 of each year, Coast will submit to the Harbor District a map describing the locations of each longline bed within its operational footprint.

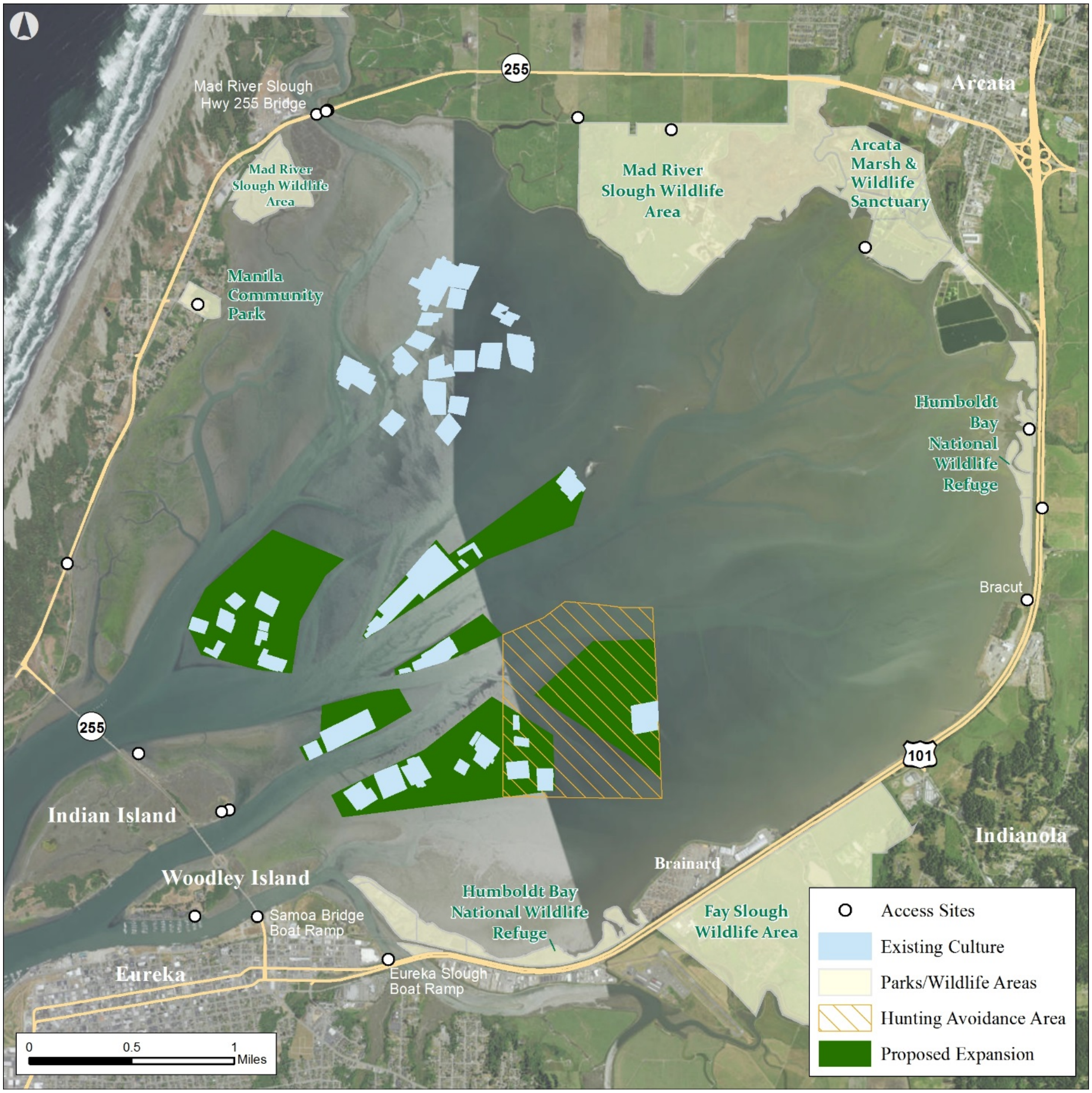

Figure 6.11.2 Area to be avoided on Wednesdays, Saturdays and Sundays during brant hunting season (Hunting Avoidance Area), as described in Conservation Measure REC-1.

6.11.6 Level of Significance Before Mitigation

Upon implementation of Conservation Measures REC-1 and REC-2, IMPACTS REC-1 and REC-2 would be less than significant.

6.11.7 Mitigation Measures

No Mitigation Measures are necessary.

6.11.8 Level of Significance After Mitigation

Compliance with the Conservation Measures REC-1 and REC-2, identified above, would reduce potential impacts associated with recreation to a level that is less than significant. Therefore, no significant and unavoidable adverse impacts relating to recreation remain.

6.11.9 Effects Analysis of Alternatives

Alternative 1: 10-Foot Spacing Alternative
Alternative 1 would have a potentially greater impact on recreational users of the bay due to its larger operational footprint (955 acres instead of 622), which would require additional boat trips throughout the bay for maintenance and other activities, additional boat hours, and additional crew (Figure 6.11.3). In total, Alternative 1 would increase the number of boat trips throughout the bay by 33 trips per week as compared to existing conditions—equal to 134 additional hours of boat activity on the bay per week, with 38 additional crew members. Boats and culturists would also frequent areas of the bay not proposed for culture under the Preferred Alternative. However, because the level of activity in any one area is not expected to increase, the potential for interaction with or impact on recreational boaters remains less than significant. Further, as with the Preferred Alternative, there is no expected impact to subtidal areas or primary navigational channels. With implementation of Conservation Measure REC-2, IMPACT REC-2 would thus be less than significant. Similarly, given that Alternative 1 would include shellfish culture on an expanded area footprint, it would have a greater impact on recreational hunting as there would be greater potential for overlap with preferred hunting sites. However, upon implementation of Conservation Measure REC-1, IMPACT REC-2 remain less than significant.

There would be no expected IMPACT REC-1 under Alternative 1.

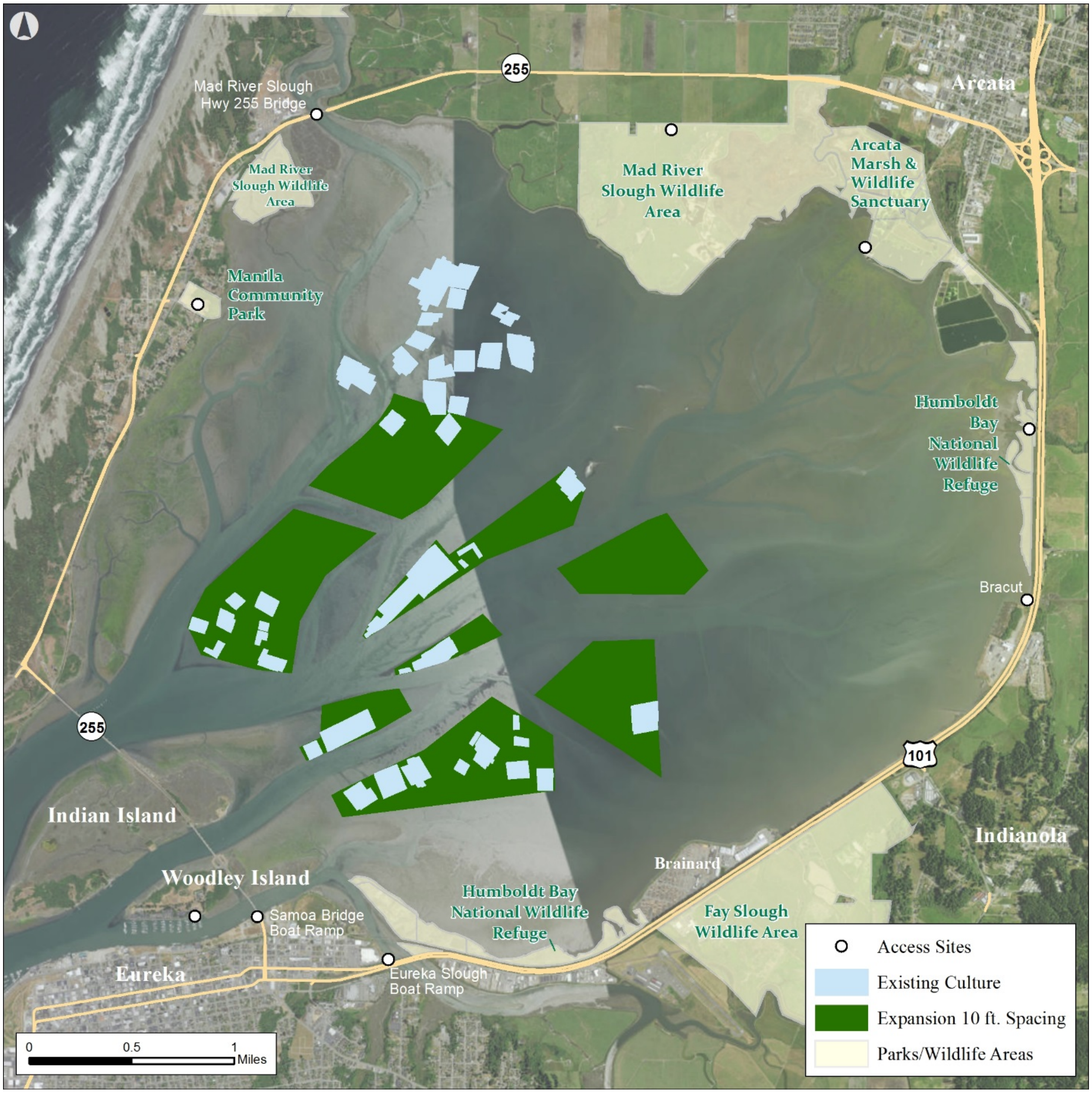

Figure 6.11.3 10-Foot Spacing Alternative: Map of recreation access locations and park/wildlife areas in North Bay.

Alternative 2: Reduced Acreage Alternative

Although impacts would be similar, Alternative 2 would be slightly less likely to impact recreation than the Preferred Alternative due to the reduced acreage of cultivation. The smaller cultivated footprint also translates into fewer boat trips and boat hours on the bay as compared to the Preferred Alternative. As compared to existing conditions, Alternative 2 would require an additional 17 boat trips through the bay per week, or 68 additional boat hours. Because these increases are less than but very close to the increases required under the Preferred Alternative, the above analysis applies equally to Alternative 2. Impacts to recreational hunting would also be slightly lessened, given that there would be less potential overlap with preferred recreational hunting areas. Under Alternative 2, Coast would continue to implement Conservation Measures REC-1 and REC-2. As with the Preferred Alternative, IMPACTS REC-1 and REC-2 to be less than significant under Alternative 1.

Alternative 3: Existing Footprint Alternative

Under Alternative 3 there would be no change to the environmental baseline. IMPACTS REC-1 and REC-2 would therefore be less than significant under Alternative 3.

Alternative 4: No Project Alternative

Under the No Project Alternative Coast's existing permit would not be renewed and existing infrastructure related to shellfish culture would be removed. Total removal of all of Coast's existing aquaculture equipment would require approximately 18 months if Coast were permitted to allow oysters to grow to market size before removal and 3-6 months if removal was required immediately. During the period of active removal, activity on the beds would be more intense than under existing conditions, with larger crews needed to harvest all remaining shellfish and remove associated equipment. This burst of activity would have the potential to impact recreational users and hunters more significantly, particularly if removal coincides with active hunting seasons. However, after removal, Alternative 4 would have less of a long-term impact as compared to the Preferred Alternative, given that it would remove all of Coast's existing structures. IMPACTS REC-1 and REC-2 are therefore considered less than significant under Alternative 4.

6.12 Noise

This section describes present and possible future conditions regarding noise in the Project area. The significance of effects regarding noise is defined by CEQA Appendix G criteria, based on noise compatibility standards from the Humboldt County and City of Eureka general plans, and by applicable noise policies from the Humboldt Bay Management Plan.

6.12.1 Existing Conditions

Although local conditions vary widely, the Humboldt Bay area is generally a relatively quiet setting, where sound created by human activities is added to a largely natural ambient acoustic setting, which varies according to location, topographic features, local meteorological conditions, and the proximity to sound sources (HBMP 2007).

Representative noise sources in the Humboldt Bay area include both stationary and mobile sources:

- Traffic noise from highways (Highway 101 and State Route 255, including the bridges over Humboldt Bay) and other traffic corridors.
- Activities associated with commercial, industrial, and recreational uses (including those associated with the Eureka waterfront, Woodley Island, the Samoa Peninsula, and the North Spit).
- Motorized watercraft, boats, ships, navigation aids, and marine-related equipment.
- Aircraft, including small planes and helicopters.

However, the overall, time-averaged noise levels appear to be relatively low throughout the area (HBMP 2007).

The primary noise from existing mariculture operations on Humboldt Bay is from small watercraft using internal combustion engines (outboard motors). Typically, six small watercraft are used for Coast's existing operations (Table 4.1, Project Description). They operate intermittently throughout the day and night, up to 365 days per year. The outboard motors typically range from 50 to 150 horsepower and generate intermittent noise similar to that generated by other small watercraft in the bay. They travel primarily between Coast's facility at 25 Waterfront Drive, Eureka and its existing mariculture locations on Humboldt Bay (see Figures 4.3 and 4.4, Project Description).

Coast's existing mariculture operations also periodically generate intermittent noise associated with generators and mechanical harvesters run during harvest activities. In order to take advantage of available low tides, harvesting occurs at any time of day or night, for an average of four or six hours total per day, on an average of approximately four days per week, year-round. Harvesting activities and associated noise occur at the mariculture sites. In total, harvest activities and small watercraft use require approximately 218 hours per week of total watercraft run time.[24]

[24] Run time is based on the average length of watercraft trips on the bay. Because watercraft are frequently stopped while work occurs on the beds, the actual time spent with the engine running is likely less than total run time.

6.12.2 Pertinent Laws and Regulations

Relevant noise standards and policies are available from three sources:

- The Humboldt County General Plan (County of Humboldt 1984);
- The City of Eureka General Plan (City of Eureka 1997); and
- The Harbor District's Humboldt Bay Management Plan (HBMP 2007).

These sources use various noise measurement units, but the measurements are broadly comparable.[25]

The Humboldt County General Plan (County of Humboldt 1984) contains a noise compatibility matrix that establishes requirements to ensure that new development is consistent with the General Plan (Table 6.12.1).

Table 6.12.1 Humboldt County General Plan Land Use/Noise Compatibility Standards.[1]

Land Use Category	Maximum Interior Exposure (Ldn)[2,3]	Land Use Interpretation for Ldn Value[4]									
		55		65	75			85			
Residential-Single Family, Duplex, Mobile Homes	45	CA	CA	NA	NU	NU	NU	CU	CU	CU	CU
Residential-Multiple Family, Dormitories, etc.	45	CA	CA	NA	NU	NU	NU	CU	CU	CU	CU
Transient Lodging	45	CA	CA	CA	CA	NA	NU	NU	CU	CU	CU
School Classrooms, Libraries, Churches	45	CA	CA	CA	NA	NU	NU	CU	CU	CU	CU
Hospitals, Nursing Homes	45	CA	CA	CA	NA	NU	NU	CU	CU	CU	CU
Auditoriums, Concert Halls, Music Shells	35	CA	NA	NA	NU	NU	CU	CU	CU	CU	CU
Sports Arenas, Outdoor Spectator Sports		CA	CA	CA	NA	NU	NU	CU	CU	CU	CU
Playgrounds, Neighborhood Parks		CA	CA	NA	NA	NU	NU	CU	CU	CU	CU
Golf Courses, Riding Stables, Water Rec., Cemeteries		CA	CA	CA	NA	NA	NU	NU	CU	CU	CU
Office Buildings, Personal, Business and Professional	50	CA	CA	CA	CA	NA	NA	NU	CU	CU	CU
Commercial-Retail, Movie Theaters, Restaurants	50	CA	CA	CA	CA	NA	NA	NU	CU	CU	CU
Commercial-Wholesale, Some Retail, Ind., Mfg., Util.		CA	CA	CA	CA	CA	NA	NA	NU	CU	CU
Manufacturing, Communications (Noise Sensitive)		CA	CA	NA	NA	NA	NU	NU	CU	CU	CU
Livestock Farming, Animal Breeding		CA	CA	CA	NA	NA	NA	NU	CU	CU	CU
Agriculture (except Livestock), Mining, Fishing		CA	CA	CA	CA	CA	CA	NA	NA	NA	NA
Public Right-of-Way		CA	CA	CA	CA	CA	CA	NA	NA	NU	NU
Extensive Natural Recreation Areas		CA	CA	CA	NA	NA	NA	NU	NU	CU	CU

1: Source: County of Humboldt, 1984

[25] The frequently used noise units in these sources are dB (decibels), dBA ("A-weighted" decibels that express relative loudness of sounds as perceived by the human ear), Lmax (the short-term maximum noise level), the CNEL (the community noise equivalent level), and the Ldn (the day-night average level).

Table 6.12.1 Humboldt County General Plan Land Use/Noise Compatibility Standards.[1]

Land Use Category	Maximum Interior Exposure (Ldn)[2,3]	Land Use Interpretation for Ldn Value[4]			
		55	65	75	85

2: Ldn: day-night average level
3. Due to exterior sources
4. Land Use Interpretations:
CA: clearly acceptable
NA: normally acceptable
NU: normally unacceptable
CU: clearly unacceptable

The City of Eureka's adopted General Plan (City of Eureka 1997) specifies standards for non-transportation and transportation noise sources. The noise exposure goal of Eureka's General Plan is to protect Eureka residents from the harmful and annoying effects of exposure to excessive noise. For non-transportation related noise, the maximum allowable noise at the property line of lands designated for noise-sensitive uses cannot exceed 65 decibels (dB) (night) to 70 dB (day).

The Humboldt Bay Management Plan (HBMP 2007) includes one policy related to noise—Harbor Element Policy HLU-7:

> ***HLU-7: Proposals for bay-related activities approved by the District shall incorporate appropriate noise control measures to avoid or reduce noise effects on events and activities carried out near the bay, to the extent feasible.***
>
> **Policy**: The District shall consider the potential noise and vibration effects of proposals that are subject to the District's jurisdiction. Should evidence indicate that the proposed actions may be associated with significant noise- or vibration-related effects on important cultural or social activities that occur near the bay (including Native American activities as well as cultural and economic events sponsored by other governments or by independent groups of bay users), the District shall require that mitigation measures be incorporated into the activities covered by the proposals in order to avoid or reduce potentially significant noise and vibration effects to the greatest extent feasible.

6.12.3 Definition of Significance and Baseline Conditions

Significance criteria are those listed in the CEQA checklist. A project's effects on noise would be significant if the project would result in:

1. Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
2. Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.
3. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
4. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

5. For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, the project would expose people residing or working in the project area to excessive noise levels.
6. For a project within the vicinity of a private airstrip, the project would expose people residing or working in the project area to excessive noise levels.

6.12.4 Effects Analysis of Proposed Project

Noise-sensitive land uses (sensitive receptors) are locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Residences, schools, hospitals, guest accommodations, libraries, churches, nursing homes, auditoriums, concert halls, amphitheaters, playgrounds, and parks are considered noise-sensitive.

To document noise levels from Coast's current operations on Humboldt Bay, noise levels were measured at several bay-side locations while Coast mariculture boats were passing or Coast harvesting activities were occurring (Figure 6.12.1). Measurements were collected by SHN Engineers & Geologists on September 8 and 9, 2015, using a Quest Technologies 2100 Sound Level Meter. To provide a conservative estimate, locations were chosen based on where Project-generated noise would be greatest, regardless of the proximity of sensitive receptors. A summary of noise readings taken is provided in Table 6.12.2.

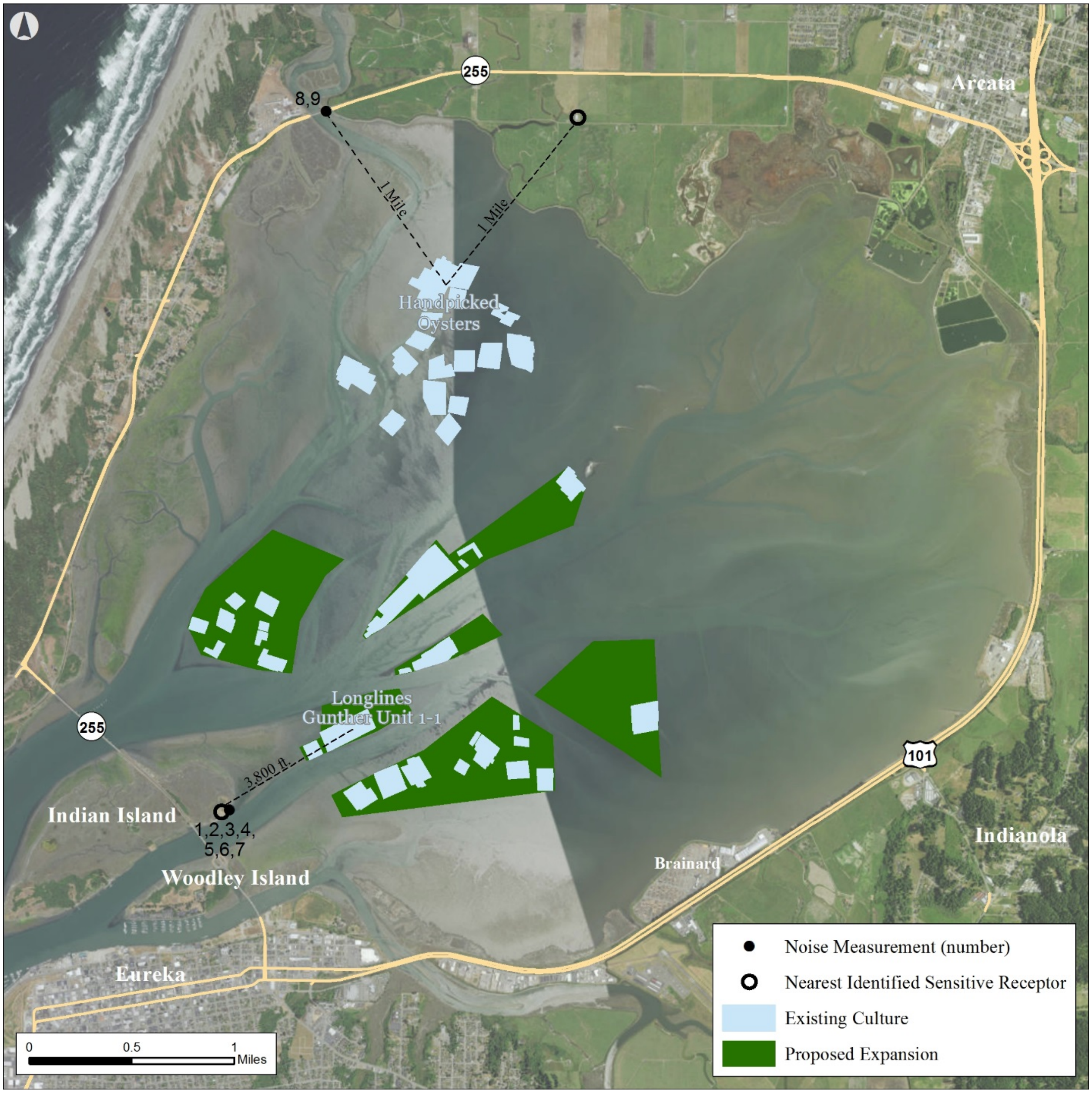

Figure 6.12.1 Locations of Noise Readings Taken of Coast's Existing Culture Operations.

Table 6.12.2 Noise Level Measurements Taken of Existing Culture Operations.					
Measurement Number	**Date**	**Location**	**Noise Source**	**Approximate Distance to Source**	**Noise Level**
1	9/8/2015	Indian Island Tuluwat Village bulkhead	Ambient background (predominantly traffic noise from Highway 255 and bird noise)	NA[1]	41.1-58.0 dB[2,3]
2	9/8/2015	Indian Island Tuluwat Village bulkhead	Skiff "Amber G" passing by (50 hp outboard motor)	183 feet	63.3 dB
3	9/8/2015	Indian Island Tuluwat Village bulkhead	Skiff "FLUPSY skiff" or "big skiff" passing by (150 hp outboard motor)	183 feet	63.8 dB
4	9/8/2015	Indian Island Tuluwat Village bulkhead	Longline harvesting vessel "Mary Elizabeth" passing by (twin 6-cylinder John Deere motors)	222 feet	59.1 dB
5	9/8/2015	Indian Island Tuluwat Village bulkhead	Longline harvesting activities at Gunther Unit 1-1 (water pump(s), bow thruster(s), mechanical harvester(s) operating on "Mary Elizabeth")	3,800 feet	41.7-55.7[2] dB
6	9/9/2015	Indian Island Tuluwat Village bulkhead	Ambient background (predominantly traffic noise from Highway 255)	NA	39.4-61.0[2] dB
7	9/9/2015	Indian Island Tuluwat Village bulkhead	Harvest scow for hand-picked oysters "Elusive" passing by (twin 6-cylinder John Deere motors)	240 feet	59.5 dB
8	9/9/2015	Humboldt Bay edge at Mad River Slough/ Highway 255 bridge	Ambient background (predominantly traffic noise from Highway 255)	NA	42.6-73.6[2] dB
9	9/9/2015	Humboldt Bay edge at Mad River Slough/ Highway 255 bridge	Handpicking harvest operations (retrieval of handpicking tubs – generator(s), motor(s), winch(es) operating on "Elusive")	1 mile	44.8 dB

1 NA: Not applicable
2 Noise minimum and maximum over a 5-minute period
3 dB: decibels
4 hp: horsepower

Project-related noise level readings ranged from 41.7 dB, recorded from a distance of 3,800 ft during longline harvesting activities, to 63.8 dB, recorded while Coast's FLUPSY Skiff, with a 150 horsepower outboard motor, passed at a distance of 183 ft. Noises from longline harvesting activities include water pump(s), bow thruster(s), and mechanical harvester(s). There was no noise detectable to the human ear from Coast's hand picking operations when measured from the nearest land-based location—the edge of Humboldt Bay at the Highway 255 bridge across Mad River Slough. In between passing traffic, a noise level of 44.8 dB was measured from this location, which would have included any detectable noise from handpicking harvest operations. Ambient sound levels at all sites in the absence of mariculture-related sources ranged from 39.4-73.6 dB and consisted predominantly of traffic noise from the Highway 255 bridge. Ambient noises were quietest from the Indian Island Tuluwat Village bulkhead (39.4 dB-61.0 dB) and included traffic and bird noises. Ambient noises were highest at the Humboldt Bay edge at Mad River Slough and were dominated by traffic noises.

The Project does not include any noise or operations that would generate groundborne vibration or noise. While a portion of the Project is located near Murray Field, a public airport located approximately 0.9 miles away from the Project boundaries, as described below, it would not generate excessive noise levels and would be within the ambient noise levels of the airfield. Therefore, these impacts are not further discussed below.

IMPACT NOISE-1: Generation of noise levels in excess of established standards.

The proposed Project would not substantially change the location or magnitude (loudness) of noise generating activities, but will slightly increase the frequency of intermittent noise generating activities (Table 4.4, Project Description). The Project would increase the number of small watercraft Coast operates from 6 vessels up to 8. As with current operations, the outboard motors would typically range from 50 to 150 horsepower and would generate intermittent noise similar to that generated by other small watercraft on the bay. The additional small watercraft would travel primarily between Coast's facility at 25 Waterfront Drive, Eureka and the mariculture locations on Humboldt Bay (see Figures 4.3 and 4.4, Project Description) and, as with existing boats, would operate intermittently during all times of day and night, up to 365 days per year. However, the number of boat trips taken throughout the bay on a weekly basis would increase by only 18 trips per week.

In addition to small watercraft, the proposed Project would generate additional intermittent noise associated with increased use of Coast's existing mechanical harvesters, the Mary Elizabeth and Elusive. The harvest vessels would make approximately 3 additional trips per week under the Project, such that harvest activities would take place on the bay 5-6 days per week instead of approximately 4 days per week. As under current conditions, harvesting activities would occur at mariculture sites at any time of day or night, for between 4 and 6 hours per day, year-round. It total, boat hours on the bay would increase by a maximum of 74 hours per week over current conditions.

All proposed expansion areas are at least 0.5 miles from nearby highways (Highway 101, Highway 255) and associated viewpoints and are not in close proximity to sensitive receptors. The sensitive receptors nearest to Project activities are the few residences along the south side of Indian Island and potentially the Wiyot Tuluwat Village site on Indian Island (during Native American ceremonial events, for example). The sensitive receptor nearest to the sound readings taken at the Mad River Slough/Highway 255 Bridge was a private residence located approximately one mile from existing culture (Figure 6.12.1). When recorded from land at points around the bay, the loudest sound recorded from Coast's operations was 63.8 dB, a level compatible with all Land Use Categories in the Humboldt County General Plan and other established noise standards. No sensitive receptors are located closer than the locations measured and the noise level measured at each location was below established noise standards. Further, most of the noise generated by the Project would be less than the recorded ambient noise and would not be discernable from existing ambient noise conditions.

Because the types of boats and equipment will not change under the Project, the magnitude (loudness) of noise generated by additional boat trips will not increase from current conditions and noise measurements collected for existing Coast mariculture operations are representative of noise levels expected from the Project. None of the noise measurements from Coast's existing operations exceeded applicable standards. Therefore, the Project will not generate noise levels in excess of established standards and this impact is considered less than significant.

IMPACT NOISE-2: Substantial periodic increase in ambient noise levels in the Project vicinity.

As described above, the proposed Project is not expected to generate higher (louder) noise levels than existing operations, although noise generating activities will occur more often. On a one-time basis, there may be a period of more frequent noise generated while culture equipment is installed in the expansion areas; however, based on the noise measurements detailed above, this noise is not anticipated to exceed ambient conditions. The Project's noise generating activities, both during longline installation and normal operating conditions, are consistent with the types of noise commonly experienced on Humboldt Bay and are generally not near sensitive receptors. Therefore, the impact is considered less than significant and no mitigation is necessary.

6.12.5 Conservation Measures

There are no proposed Conservation Measures.

6.12.6 Level of Significance Before Mitigation

IMPACTS NOISE-1 and NOISE-2 are considered less than significant without mitigation.

6.12.7 Mitigation Measures

No Mitigation Measures are necessary.

6.12.8 Level of Significance After Mitigation

IMPACTS NOISE-1 and NOISE-2 are considered less than significant without mitigation.

6.12.9 Effects Analysis of Alternatives

Alternative 1: 10-Foot Spacing Alternative

Alternative 1 would require the use of up to four additional small watercraft, two more than for the proposed Project (Table 5.1, Project Alternatives). Because the total watercraft run time per week would be approximately 1.2 times greater than for the Project, noise generating activities would potentially occur approximately 1.2 times more frequently (352 boat hours per week for Alternative 1 compared to 292 hours for the proposed Project). However, mariculture expansion areas will be in the same general areas as the proposed Project and are also located at a significant distance from potential sensitive receptors. Noise levels (loudness) generated are also expected to be the same or similar to those generated by the Project because the types of equipment used will not change. Despite the potential increase in noise frequency, IMPACTS NOISE-1 and NOISE-2 are considered less than significant for Alternative 1.

Alternative 2: Reduced Acreage Alternative
Alternative 2 would require the use of up to two additional small watercraft (the same as for the proposed Project) (Table 5.2, Project Alternatives). Alternative 2 would involve approximately 286 hours per week of watercraft run time, including harvesting operations (compared to approximately 292 hours per week for the proposed Project). The frequency of noise generating boat trips through the bay per week would increase by 17 trips under Alternative 2 rather than the 18 trips proposed under the Project. IMPACTS NOISE-1 and NOISE-2 are therefore considered less than significant for Alternative 2.

Alternative 3: Existing Footprint Alternative
Under Alternative 3, there would be no noise impact compared to baseline conditions, but existing uses and related noise impacts in the bay would continue. IMPACTS NOISE-1 and NOISE-2 are therefore considered less than significant for Alternative 3.

Alternative 4: No Project Alternative
Under Alternative 4, all current culture activities would stop and culture equipment would be removed. Equipment removal would take approximately 3-6 months if oysters were not allowed to grow to market size and approximately 18 months if market size is reached before removal. During equipment removal, there would be frequent noise generated; however, based on the noise measurements detailed above, this noise is not anticipated to exceed ambient conditions. After culture equipment is removed, there would be a minor benefit to noise levels in the bay because Coast would no longer run boats, generators, harvest vessels or other equipment and the proposed expansion would not occur. IMPACTS NOISE-1 and NOISE-2 are therefore considered less than significant for Alternative 4.

6.13 Transportation/ Traffic

6.13.1 Existing Conditions

Coast's existing facility is located at 25 Waterfront Drive in the City of Eureka (Figures 4.3 and 4.4, Project Description; there are 30 on-site parking spaces for employees. Additional parking is available along Waterfront Drive/1st Street, both on-street and in public parking areas. Roadway capacity and level of service standards are established by the City of Eureka. Highway 101 runs through the City of Eureka, approximately four blocks south of Coast's facility.

Coast has dedicated docks that provide direct Humboldt Bay access from this facility. Coast currently operates four skiffs, two scows and three harvesting vessels (one for clams, one for hand-picked oysters, and one for Kumamoto oysters). These vessels primarily travel from Coast docks to mariculture locations in the bay via main navigation channels and back to the Coast docks. Boat trips currently total approximately 57 trips per week (Table 4.1, Project Description).

6.13.2 Pertinent Laws and Regulations

The Harbor District's Humboldt Bay Management Plan (HBMP 2007) contains transportation and navigation-related policies with relevance to the Project, including:

- HWM-1: Safe navigation in Humboldt Bay is a priority.

6.13.3 Definition of Significance and Baseline Conditions

Significance criteria are those listed in the CEQA checklist; a project's effects on transportation/ traffic are significant if the project will:

1. Exceed the capacity of the existing circulation system, based on an applicable measure of effectiveness (as designated in a general plan policy, ordinance, etc.), taking into account all relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.
2. Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.
3. Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks.
4. Substantially increase hazards due to design features (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).
5. Result in inadequate emergency access.
6. Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks).

6.13.4 Effects Analysis of Proposed Project

The Project would employ approximately 50 additional people living in the local area; it would not likely increase the local population. Coast's existing facilities include 30 parking spaces and there is ample parking available in the vicinity for new employees. Parking for new employees would be accommodated at Coast's existing processing facility, in nearby public parking that is available along 1st Street where the facility is located, or in other nearby areas of Eureka. The Project would result in a small amount of additional trips from employees and trucks servicing Coast's upland facilities to process Coast's expanded production; however, the Project would not impact existing roadways or emergency access routes and would not result in substantial increases in traffic that exceed existing circulation system capacity. Therefore, these impacts are considered less than significant.

IMPACT TRANS-1: Effects of intertidal culture operations and equipment on watercraft (e.g. boats, kayaks) navigation.

The intertidal areas proposed for expansion of oyster culture are located outside of the main navigation channels, which are designated water trail routes for recreational vessels. However, mariculture equipment, including PVC pipes used to suspend longlines, and the longlines themselves, may interfere with the movement of shallow draft vessels (e.g. kayaks, canoes and stand-up paddle boards) over the Project area at certain points in the tidal cycle. This interference would occur only when the tides are high enough for watercraft to move through intertidal areas outside of the main channels, but so low that the vessels can't move readily over the equipment. At high tides, shallow draft vessels will be able to navigate freely over culture equipment. Given the low elevation of the proposed longline culture equipment, the additional amount of time that vessels would be prevented from accessing the Project site as compared to existing conditions would be minimal. In addition, wider rows intended to allow boat access by culturists will also allow passage of small vessels, but in some cases only in two directions (e.g., parallel to rows of equipment).

Further, the corners of the culture areas are marked to visibly inform boaters where culture-related infrastructure is located and Coast will provide a map to the Harbor District annually showing the locations of its shellfish culture plots that can be shared with recreational boaters. These efforts limit the possibility of inadvertent contact between small vessels and aquaculture gear.

The Project would also require the use of up to two additional small watercraft and would increase the total number of boat trips from Coast docks to mariculture areas by approximately 18 trips per week (from 57 to 75). Small motorized craft such as those proposed to service the expanded culture area are consistent with existing uses in Humboldt Bay. These additional boat trips are thus not expected to impact watercraft movement in subtidal areas, including in the primary navigation channels.

6.13.5 Conservation Measures

This section identifies specific Conservation Measures that have been incorporated into the Project by Coast and are intended to ensure that the Project maintains a high standard that is environmentally responsible. Given their critical importance in ensuring that significant impacts are avoided, Conservation Measures are treated similarly to Mitigation Measures and will be included in the Mitigation and Monitoring Plan for this EIR. Conservation Measures REC-1 and REC-2, discussed more fully in Section 6.11, Recreation, will also help to minimize potential impacts associated with Transportation/Traffic. Conservation Measure REC-1 is intended to reduce the Project's potential impacts to recreational hunting, but will also reduce Project-related boat traffic in the areas and timeframes identified. Conservation Measure REC-2 is intended to ensure that boaters and other interested parties have accurate information regarding bed locations to assist with navigation. These Conservation Measures will be incorporated into the Project and are reiterated below:

> **Conservation Measure REC-1:** Between November 15 through December 15, Coast shall avoid operations in the East Bay Management Area from midnight until sunset, on Wednesdays, Saturdays, and Sundays. This conservation measure shall not apply in the case of emergency conditions or other operations, such as marine debris removal, required by Coast to comply with other conditions of approval or mitigation measures, or ensure the safety of its operations.

> **Conservation Measure REC-2:** By December 1 of each year, Coast will submit to the Harbor District a map describing the locations of each longline bed within its operational footprint.

6.13.6 Level of Significance Before Mitigation

Upon implementation of the Conservation Measures described above, IMPACT TRANS-1 is considered less than significant without mitigation.

6.13.7 Mitigation Measures

No Mitigation Measures are necessary.

6.13.8 Level of Significance After Mitigation

No mitigation is necessary. IMPACT TRANS-1 is considered less than significant.

6.13.9 Effects Analysis of Alternatives

Alternative 1: 10-Foot Spacing Alternative
The footprint of Alternative 1 (955 acres) would be larger than the Project (622 acres) and therefore would cover a larger area of tidelands with culture related infrastructure. However, the 10-ft spacing would allow small watercraft (e.g. kayaks) to maneuver more freely between the rows. The general Project area would be the same and impacts to transportation/traffic would be similar to the Project. IMPACT TRANS-1 would be less than significant under Alternative 1.

Alternative 2: Reduced Acreage Alternative
Although impacts would be similar, Alternative 2 would be slightly less likely to impact transportation/traffic than the Project due to the reduced acreage of cultivation (300 acres for Alternative 2 compared to 622 acres for the proposed Project). Alternative 2 would require fewer additional workers and result in fewer boat trips than the Project. IMPACT TRANS-1 would be less than significant under Alternative 2.

Alternative 3: Existing Footprint Alternative
This alternative would be less likely to impact transportation/traffic than the Project because no new culture activities would occur. Existing mariculture-related equipment would remain in place and existing operations would continue. There would be no impact to transportation/traffic compared to

baseline conditions. IMPACT TRANS-1 is therefore considered less than significant under Alternative 3.

Alternative 4: No Project Alternative

Under the No Project Alternative, Coast's existing permit would not be renewed, all current cultivation activities would cease, and existing infrastructure related to shellfish culture would be removed. Short term impacts related to infrastructure removal could occur; however, removal of all aquaculture equipment would result in less of a long-term impact as compared to the Project. No impact to transportation/traffic would occur.

7.0 Section Cumulative Impacts

Section 15130 of the CEQA Guidelines states that cumulative impacts shall be discussed where they are significant. It further states that this discussion shall reflect the level and severity of the impact and the likelihood of occurrence, but not in as great a level of detail as that necessary for the project alone. Section 15355 of the Guidelines defines cumulative impacts to be "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." Cumulative impacts represent the change caused by the incremental impact of a project when added to other proposed or committed projects in the vicinity.

The CEQA Guidelines (Section 15130[b][1]) state that the information utilized in an analysis of cumulative impacts should come from one of two sources:

1) A list of past, present, and probable future projects producing related cumulative impacts, including, if necessary, those projects outside the control of the agency; or
2) A summary of projections contained in an adopted general plan or related planning document designed to evaluate regional or area-wide conditions.

Potential cumulative impacts for the Project are primarily limited to North Bay, although a minor change to Coast's FLUPSY is proposed in Entrance Bay. Currently, there are four other companies that farm an additional 15 acres of intertidal shellfish in Humboldt Bay and 35 raft structures (Table 7.1). Hog Island Oyster Company (Hog Island) and Taylor Mariculture LLC (Taylor Mariculture) have also recently obtained regulatory approvals to add 21 culture rafts in subtidal areas (15 FLUPSY rafts and 6 nursery rafts). In addition to the Project, there is one other proposal to expand intertidal and subtidal shellfish culture operations in North Bay: the Harbor District's Mariculture Pre-Permitting Project (District Project or Pre-Permitting Project). The Pre-Permitting Project would increase production of Kumamoto oysters, Pacific oysters, and Manila clams. It may also include culture of native macroalgae.

Table 7.1 Existing and Proposed Culture Activities within Humboldt Bay.

Existing / Approved	**Intertidal Area (acres)**	**No. of Subtidal rafts**
Coast	299 acres*	35 rafts
Others	15 acres	56 rafts
Sub-Total	314 acres	91 rafts
Proposed	**Intertidal Area (acres)**	**No. Subtidal rafts**
Coast	622 acres	8 FLUPSY bins
Pre-Permitting Project	266 acres	3.1 acres**
Sub-Total	888 acres	3.1 acres
TOTAL EXISTING & PROPOSED	**1,202 acres**	**91 rafts and 3.1 acres of additional subtidal culture**

* Coast has an approximately 299 acres of intertidal shellfish culture in the Bay, with another 1 acre occupied by subtidal rafts. Coast will discontinue culture on 5.5 of its existing intertidal acres going forward.

** Based on the maximum allowable surface area for subtidal rafts under the Pre-Permitting Project EIR.

The cumulative amount of potential human presence would also increase with the various shellfish aquaculture projects. As discussed in Section 4.0, above, a maximum of 18 additional boat trips/week are expected throughout the bay in order to maintain the Project, increasing the number of boat hours necessary to maintain the beds and conduct harvest and planting activities by 74 hours per week. It is likely that the same culture methods used in either the Project or the District Project will require a similar number and frequency of site visits for operation, maintenance, planting, and harvesting, although the District Project allows culturalists flexibility in determining what culture method to pursue, making accurate predictions of boat traffic difficult. However, because the District's Project is smaller in spatial scale to Coast's expansion project, fewer boat trips will likely be needed on a daily and weekly basis.

The following is a description of the potential cumulative effects associated with the Project and proposed mitigation measures to reduce cumulative impacts to less than significant levels, as feasible and appropriate.

7.1 Cumulative Impacts: Cultural and Archeological Resources

The existing and expanded mariculture activities are not expected to impact cultural and archeological resources because such resources are unlikely given the intertidal and subtidal locations of all proposed and existing projects, and there are no identified or known historic, archaeological, or cultural resources in these areas. Similar to the Project, posts and stakes placed in the substrate to secure shellfish culture equipment could potentially disturb previously undiscovered or unknown historic, archaeological or tribal cultural resources. Additionally, such resources could be discovered by culturists when working in intertidal areas.

Expansion of mariculture activities, other than the Project, could have the same potential impacts as the Project. However, other proposed projects (e.g., the Pre-Permitting Project) include mitigation measures and/or best management practices to reduce potential effects to archeological and cultural resources. As such, cumulative impacts are considered less than significant with incorporation of the mitigation identified in Section 6.4.7 (Mitigation Measures CR-1, CR-2 and CR-3).

7.2 Cumulative Impacts: Biological Resources

The following discussion is related to the cumulative impacts to biological resources from the proposed shellfish aquaculture projects in Humboldt Bay. This information largely draws from studies presented above in Section 6.5.

7.2.1 Shellfish Aquaculture and Aquatic Habitats in Humboldt Bay

The cumulative amount of potential spatial overlap with habitat in North Bay from existing culture, the Project, and the Pre-Permitting Project is equivalent to approximately 26.8% of eelgrass in North Bay, 12.6% of near channel habitat in North Bay, and 13.8% of the intertidal habitat in North Bay overall (Figure 7.1; Table 7.2).[1] It is important to understand that overlap with habitat is not a quantification of impact because impacts occur in discrete areas of each culture area.

[1] The Project also includes a minor increase in the size of Coast's FLUPSY in Central Bay, totaling 72 square feet.

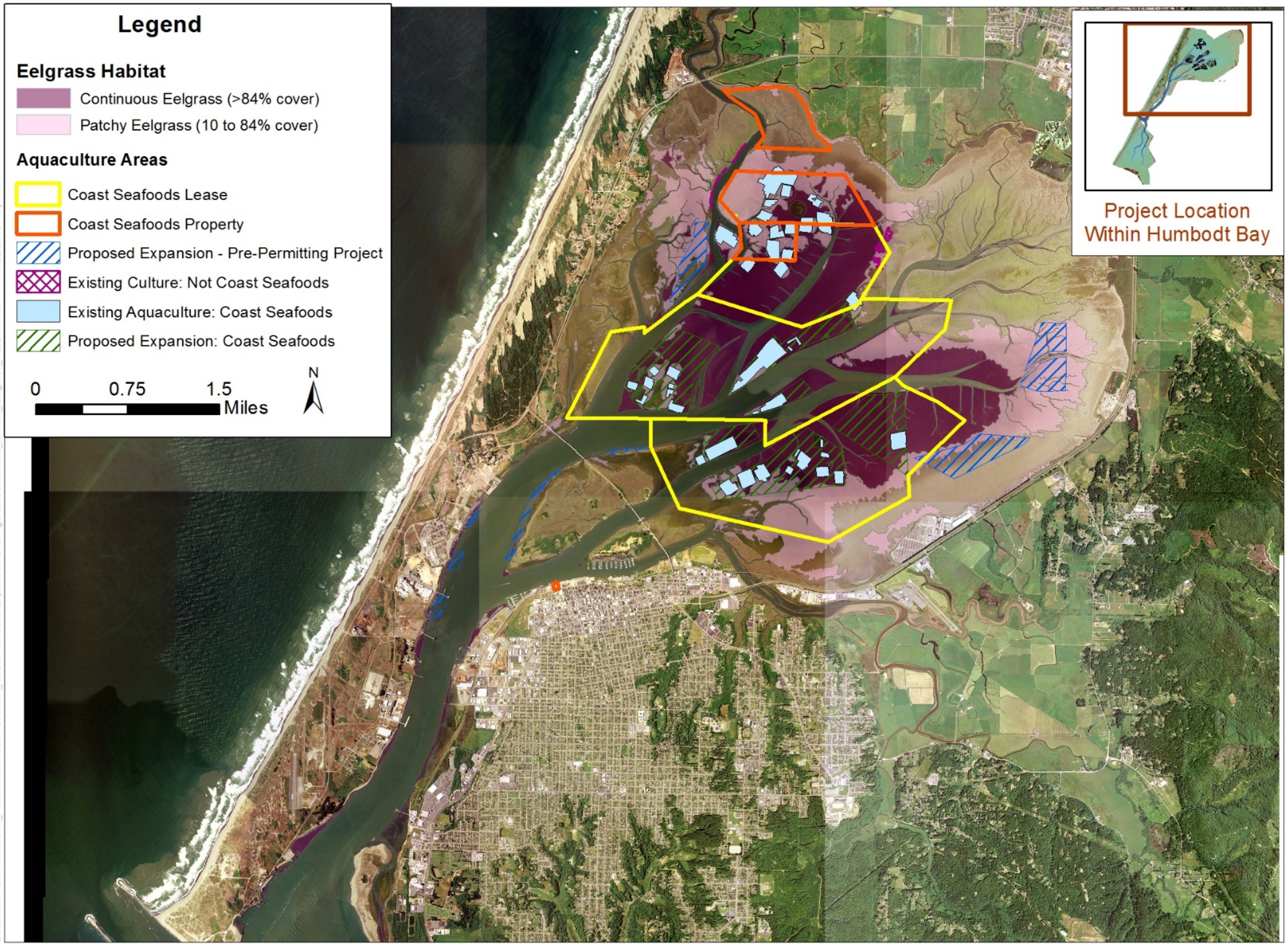

Figure 7.1 Existing and Proposed Shellfish Aquaculture in Humboldt Bay.
Source: GIS layers provided by Wagschal, pers. comm., 2015.

Table 7.2 Spatial Overlap of Existing and Proposed Expansion Projects with Habitats in North Bay.							
Area	**Subtidal Channel Habitat**	**Near Channel Habitat**			**Intertidal Habitat**		
		Non Eelgrass	**Patchy Eelgrass**	**Continuous Eelgrass**	**Non Eelgrass**	**Patchy Eelgrass**	**Continuous Eelgrass**
Existing Culture							
North Bay (acre)	2,109.8	1,736.2	657.3	1,133.7	3,034.5	1,300.8	826.6
Culture Area (acre)	3.5	14.0*	92.9	14.7	8.5	172.5	11.7
Area of Influence (%)	0.2%	0.8%	14.1%	1.3%	0.3%	13.3%	1.4%
All Proposed Expansion Areas							
North Bay (acre)	2,109.8	1,736.2	657.3	1,133.7	3,034.5	1,300.8	826.6
Culture Area (acre)	3.1**	33.7	80.7	209.5	91.4	176.5	289.8
Area of Influence (%)	0.1%	1.9%	12.3%	18.5%	3.0%	13.6%	35.1%

Sources: NOAA 2012; Wagschal, pers. comm., 2015 (GIS layers for Pre-Permitting Project).
*Area calculations include 5.5 acres that will be removed.
**Although intertidal expansion areas for Coast include approximately 6.5 acres of subtidal channel habitat, no culture would be planted in tidal channels, including a 10-ft buffer; therefore, that value was taken out of this calculation and only actual overlap with subtidal channel habitat (e.g., floating culture) was included.

7.2.1.1 Cumulative Impacts of Overwater Structures

While the Project represents a fairly inconsequential amount of additional overwater structure (72 square feet), the Pre-Permitting Project would add more overwater structure to North and Entrance bays (3.1 acres). However, even this acreage represents a small component to overwater structure (<0.1%). As discussed in Section 6.5 above, the literature associated with effects from overwater structure center around the concern that it will increase the amount of ambush predators that would feed on juvenile salmonids and forage fish. The literature cited above (Cardwell and Fresh 1979, Salo et al. 1980, Ratté and Salo 1985) do not show a significant effect to salmonids associated with piers and pilings. A site-specific study was conducted in Humboldt Bay to address the question of increased predation (Kalson and Kramer 2015). That study found seven species of fish under and around floating clam rafts in Humboldt Bay. All seven species were not considered predators on salmonids and longfin smelt. Effects from the cumulative addition of overwater structure would likely be similar, and so are considered less than significant.

7.2.1.2 Cumulative Impacts to Unstructured Intertidal Habitat

The cumulative amount of shellfish aquaculture activities in unstructured habitat would be 125.1 acres (see Table 7.2). Approximately 27% (or 34 acres) of this area overlaps with unstructured habitat that is within 100 meters of a main channel. As discussed in Section 6.5 above, there are certain species (e.g., California halibut and black brant) that tend to avoid structure and prefer open sand- or mudflat habitat and others that are structure-oriented (e.g., fish in the families *Cottidae* and *Embiotocidae*).

However, the majority of species that use the shallow intertidal areas of North Bay are using it as nursery habitat (Pinnix et al. 2005, Schlosser and Eicher 2012). Increased structured habitat, especially adjacent to main channels, can improve conditions for smaller fish species.

One of the main themes in the literature related to changes in intertidal habitats from shellfish aquaculture is the concept of food-web implications, especially in relation to locations where aquaculture is a dominant portion of the estuary (e.g., France). For example, Leguerrier et al. (2004) reported that off-bottom culture in an intertidal mudflat in Marennes-Oléron Bay covering 4,448 acres (or 16% of the bay), and at densities of 200 oysters/m^2, could benefit fish and crabs due to an enhanced food supply. Similarly, Castel et al. (1989) indicated that the presence of oysters on rack-and-bag structures covering 2,471 acres of intertidal habitat augmented meiofauna biomass in the Bay of Arcachon (France). Castel et al. (1989) also reported a reduction in macrofaunal abundance associated with the racks, but indicated that this may have been a product of increased predation, which benefited the slightly larger organisms (e.g., fish and birds) rather than the benthic invertebrates present in the sediment. According to a literature review of off-bottom aquaculture by Forrest et al. (2009), the available information suggests that changes to fish are often viewed as neutral or positive.

Increased diversity and nursery habitat provided by oyster aquaculture is considered by many researchers to be an improved ecological function compared to sand or mudflat habitat. The increase in ecological function provided by the placement of oysters in areas of mud or sandy habitat is also considered an improved condition or passive mitigation, similar to how the transplant or expansion of eelgrass into mud or sandy habitats would be considered an improved condition or serve as mitigation. There are a number of examples in the literature where oyster culture in estuaries, at much higher proportions than is being cumulatively proposed in Humboldt Bay, supports the food-web within that system (e.g. Leguerrier et al. 2004, Dubois et al. 2007, Lin et al. 2009). The amount of unstructured habitat altered is a relatively minor portion of the overall habitat in North Bay. Overall, cumulative impacts to unstructured habitat are considered less than significant.

7.2.1.3 Cumulative Impacts to Eelgrass Habitat

The Project and Pre-Permitting Project are located primarily in eelgrass, although the Project is proposed primarily in continuous eelgrass compared to the Pre-Permitting Project which is primarily in patchy eelgrass. The intertidal footprint of each Project and the proportion of each is provided in Table 7.3. The location of each project is a product of the lease area available for culture operations.

Table 7.3 Overlap with Eelgrass Habitat for the Proposed Intertidal Projects.

Area	Non Eelgrass*	Patchy Eelgrass	Continuous Eelgrass
Project (acre)	15.5	108	492.0
Intertidal Footprint (%)	2.5%	17.5%	79.9%
Pre-Permitting Project (acre)	109.6	149.3	7.3
Intertidal Footprint (%)	41.1%	56.1%	2.7%

Sources: NOAA 2012; Wagschal, pers. comm., 2015 (GIS layers for Pre-permitting Project).
*Acreages given does not include subtidal channel habitat.

The amount of proposed shellfish aquaculture in Humboldt Bay and potential cumulative impacts to eelgrass are similar in scale to those studied in a large-scale project conducted in Willapa Bay, Washington (Dumbauld and McCoy 2015). Willapa Bay is similar to Humboldt Bay in many respects. For example, it has a large tidal exchange, well-mixed water column, is relatively shallow (62% is intertidal out of 88,464 acres total), and has nine small rivers contributing to the total watershed. Most importantly, Willapa Bay has a large eelgrass meadow on 27% to 38% of the intertidal habitat (~15-20,000 acres). Oyster aquaculture occurs on up to 22% (12,340 acres) of the intertidal habitat in Willapa Bay, with a significant overlap occurring with eelgrass habitat.

Dumbauld and McCoy (2015) modeled eelgrass density in Willapa Bay, Washington. A number of parameters were modeled, including: (1) distance to mouth, (2) distance to channel, (3) salinity, (4) elevation, (5) cumulative wave stress, and (6) shellfish aquaculture. The model results indicated that eelgrass density was lower in oyster aquaculture beds, but the impact directly associated with aquaculture represented less than 1.5% of the total predicted eelgrass in Willapa Bay. The authors suggested that, overall, aquaculture resulted in a minor change to eelgrass at the landscape scale because the effect of culture was variable enough at smaller spatial scales so as to eliminate a significant effect at the landscape scale. Further, this minor change may be offset by other important ecological functions provided. According to Forrest et al. (2009), "the acceptability of aquaculture operations or new developments should recognize the full range of effects, since adverse impacts may be compensated to some extent by the nominally 'positive' effects of cultivation."

The Project is providing compensatory mitigation for potential effects to eelgrass regardless of whether there is a change to ecological functions (Conservation Measure BIO-3). The short-term impacts associated with shellfish aquaculture would be outweighed by the long-term net benefits provided by shellfish and the proposed mitigation associated with the Project. If significant impacts to eelgrass are associated with the Pre-Permitting Project, they would require mitigation compliant with USACE regulations. Therefore, potential cumulative impacts to eelgrass will be fully mitigated and net ecological functions of the Humboldt Bay watershed would be improved because of these efforts.

7.2.1.4 Cumulative Impacts to Other Habitat Parameters

Three other habitat concerns are addressed in this EIR: (1) sediment distribution and tidal circulation, (2) water quality, and (3) sediment quality. The largest alteration of sediment distribution and dynamics in Humboldt Bay continues to be the dredging of channels for navigational purposes. Volumes dredged in the main shipping channels average 143,000 cubic yards (cy) per year, with 113,000 cy on average occurring in Eureka Channel (Corps 2012). Historically, oyster harvesting practices (oyster dredging) may have also caused changes in sediment distribution (Barnhart et al. 1992). Oyster dredging is no longer utilized as a method for harvesting oysters in Humboldt Bay.

Sediment Distribution and Tidal Circulation

Intertidal shellfish gear can alter hydrodynamics, reduce flow rates, and change sedimentation associated with the structures. This effect is very similar to that of eelgrass habitat (Gambi et al. 1990, Short and Wyllie-Echeverria 1996, Williams and Heck 2001, Hendriks et al. 2008, Duarte et al. 2013). The majority of intertidal culture proposed in Humboldt Bay is in eelgrass habitat (756.5 acres or 86% of the proposed intertidal culture). Adding culture to eelgrass habitat would not significantly affect hydrodynamics and sedimentation compared to conditions in existing eelgrass beds. This was confirmed by initial sampling performed by Rumrill and Poulton (2004), which showed that sediment deposition associated with cultch-on-longline aquaculture was minor. There is more potential to change sedimentation by adding structure to open sand- and mudflat habitats, which would occur on 125.1 acres (or 14% of the proposed intertidal culture). Based on a study by Forrest and Creese (2006), the mean sedimentation rate increased almost three times that of an adjacent control area under rack-and-bag structures on mudflats. However, the authors reported that even this increased sedimentation rate did not change the overall farm elevation from a normal shore profile. Cumulative impacts are, therefore, considered less than significant.

Water Quality

Filter feeding shellfish may locally reduce turbidity and represent a net removal of nitrogen from Humboldt Bay, as well as transfer nutrients from the water column to the sediments. However, even at the culture densities proposed, the turbidity changes are likely too small to represent a measurable change from natural variation. The net removal of nitrogen is beneficial, as it compensates for anthropogenic additions of nitrogen, but data are not adequate to quantitatively compare anthropogenic nitrogen influx to the amount that is sequestered in shellfish tissue and shell. Shellfish filtration may become more valuable as nutrient input increases within coastal communities (Shumway et al. 2003, Burkholder and Shumway 2011, Kellogg et al. 2013).

Oyster culture has the potential to increase contaminants in the water column associated with the use of work skiffs for accessing culture rafts, oyster beds and associated areas. All companies that would operate in Humboldt Bay would implement a number of Conservation Measures (e.g., HAZ-1 through HAZ-3 for the Project) to minimize the potential for spills and to reduce impacts from spills that do occur. For example, boats would be fueled at the local commercial fuel dock, maintain oil spill absorption pads, and wash decks would be sealed fueling areas isolated prior to fueling so as to prevent any contaminants from entering the water. Overall, even with the increased number of operators proposed in Humboldt Bay, this impact is considered less than significant with the adherence to appropriate Conservation Measures.

Sediment Quality

The final habitat concern for cumulative impacts, sediment quality, can be understood through the literature associated with culture densities that far exceed what is proposed in Humboldt Bay. According to a review of more than 200 studies related to off-bottom culture by Forrest et al. (2009), the authors indicated that "the capacity of the environment to assimilate and disperse farm wastes will mainly depend on water current velocity and wave action (Souchu et al. 2001), as these factors control the size and concentration of the depositional 'footprint'." In general, the culture proposed in Humboldt Bay is of low density relative to the dominant body of literature. Similar to the comparison used in Section 6.5, Mallet et al. (2006) reported that oysters from South St-Simon Bay (New Brunswick) raised at a biomass ranging between 4 and 8 kg/m^2 in an 86.5-acre oyster lease using rack-and-bag and floating bag culture showed no significant differences in sediment chemistry between the culture and control sites. Comparatively, in Humboldt Bay, the cumulative biomass of oysters would be 0.36 kg/m^2 (based on values presented in the Humboldt Bay Mariculture Carrying Capacity Analysis (Carrying Capacity Analysis) (attached as Appendix G) for cultured shellfish biomass in dry tissue weight). In addition, there are many similarities as St-Simon Bay, including characteristics such as a shallow open bay with excellent water exchange. Therefore, similar effects as reported by Mallet et al. (2006) would be expected for the cumulative amount of oysters proposed for Humboldt Bay. Therefore, this impact is considered less than significant.

7.2.2 Shellfish Aquaculture and Benthic Communities

Four potential impacts to benthic communities are discussed in relation to the Project in Section 6.5. The cumulative effects associated with trampling, introduction of NIS and fouling organisms, and establishment of non-native bivalves are not likely to result in significant impacts. Even with an increase in culture area, the intensity and frequency of access to individual locations remains low compared to the thresholds discussed in the literature where impacts were observed (e.g., Eckrich and Holmquist 2000, Rossi et al. 2007). Additionally, the same management and habitat conditions that reduce the potential for introduction of NIS or the establishment of non-native bivalve species will be imposed for all projects. Therefore, these cumulative impacts are considered less than significant.

Although there would be a higher degree of change to species composition consistent with more proposed aquaculture, cumulative impacts would not be significant. As above, the majority of studies related to changes from increased biodeposition and the resulting changes to community structure are related to rack-and-bag culture in France, which consists of culture at densities that far exceed what is proposed in Humboldt Bay. For example, the areal extent of culture in Pertuis Charentais (SW France), which includes Marennes-Oléron Bay, extends over 9,884 acres (Bouchet and Sauriau 2008), which is orders of magnitude greater than what is proposed for the cumulative amount of aquaculture in Humboldt Bay. Even in these estuaries where oyster culture encompasses a large portion of the estuary, there is not a clear indication that effects are negatively affecting the stability of the system (e.g., Leguerrier et al. 2004).

There are, however, examples where estuaries have been overstocked on occasion (e.g., Marennes-Oléron Basin), which resulted in poor growth and high mortality of the oysters. It is in the oyster farmer's (and regulatory body's) interest to ensure that stocking densities within North Bay do not exceed ecological carrying capacity or production carrying capacity. According to the Carrying Capacity Analysis (Appendix G) for the cumulative amount of culture in Humboldt Bay, filtration pressure was shown to range between 5 and 9%, depending on a range of clearance rates, which indicates that the "vast majority of carbon fixed by phytoplankton remains available to non-cultured species." In addition, the phytoplankton turnover rate was calculated to replace itself several times per day. Overall, the analysis concluded that the existing and proposed culture would have some cumulative effect on Humboldt Bay food resources, but there is an abundance of food available and cultured species will not significantly affect the food resources in the bay. This was considered a conservative result, given that the analysis only calculated change to phytoplankton and did not account for other sources of productivity (e.g., detritus, benthic microalgae, biodeposits).

Both the literature and the recent carrying capacity analysis for Humboldt Bay support the conclusion that cumulative impacts to benthic communities are less than significant.

7.2.3 Shellfish Aquaculture and Marine Fish and Wildlife Species

Species do not use types of habitat to the same degree, as discussed above in Section 6.5. The cumulative impacts to individual species or species groups are discussed below.

7.2.3.1 Cumulative Impacts to Dungeness Crab

Juvenile Dungeness crabs primarily use the main channels; use of near channel habitat was documented up to approximately 75 m from the channel margin (Williamson 2006). The cumulative amount of shellfish aquaculture within channels and near channel habitat represents 5.9% of channel and near channel habitat in North Bay. Crabs are typically structure-oriented species, and an increase of structured habitat would likely benefit Dungeness crabs. No other factors (e.g., human disturbance, prey resources, or obstructions to access or migration corridors) are likely to result in a significant effect, even cumulatively.

There are studies of impacts from derelict fishing gear and crab pots that create a risk of capturing and killing a range of marine invertebrates, fish, birds, and marine mammals (e.g., Matsuoka et al. 2005, Gilardi et al. 2010). However, entanglement of Dungeness crabs is considered unlikely due to: (1) oyster longlines and rack-and-bag structures are not designed with the intention of trapping organisms (i.e., much different than fishing gear and crab pots), and (2) longlines and rack-and-bag structures are placed from 1 to 3 ft off the bottom, and crabs would be able to access the area under the lines when the habitat is inundated (or even when the habitat is exposed, depending on predation pressure). According to an analysis of tidal height over the last 20 years (Wagschal, pers. comm., 2015), proposed intertidal aquaculture in Humboldt Bay would remain inundated for an average of 68% to 89% of the year. Note that this calculation does not include the tidal elevations where crabs can access more shallow inundation areas or even exposed areas. Proactive maintenance and correction of line failures would essentially eliminate the potential for entanglement.

Therefore, cumulative impacts to Dungeness crab are considered less than significant.

7.2.3.2 Cumulative Impacts to Pacific Lamprey

Use of Humboldt Bay by Pacific lamprey is unknown, but it is likely that there is some amount of foraging and migration through shallow intertidal areas when Pacific lamprey migrate to and from spawning streams (e.g., predominantly between February and July). Pacific lamprey may also occur in areas occupied by proposed subtidal culture rafts, rafts will occupy only 0.1% of available subtidal habitat in North Bay and will not impact Pacific lamprey in any stage of their life history. Overall, effects to Pacific lamprey are likely similar to those expected for salmonids, given the similarity in life history and use of bays and estuaries. (Please refer to a discussion of cumulative impacts associated with salmonids below.) Human disturbance, habitat degradation or alteration, reduction in prey resources, and obstructions to migration corridors are all considered cumulatively less than significant.

7.2.3.3 Cumulative Impacts to Sturgeon (Green and White Sturgeon)

Sturgeon are a relatively large species (4.5 to 7 ft in length) that likely use Humboldt Bay during non-spawning migrations. Sturgeon move into estuaries up and down the West Coast taking advantage of foraging opportunities in bays and estuaries along the way. During the summer and early fall months, sturgeon will remain in bays for weeks to months at a time. The primary habitats where sturgeon would be located in Humboldt Bay include the main channels and near channel habitats, of which there would be an overlap of 5.9% with shellfish aquaculture based on the cumulative amount of culture proposed (see Table 7.2). However, sturgeon are more likely to use unstructured near channel habitat, of which proposed culture would overlap with 1.9% in Humboldt Bay. As discussed in Section 6.5, sturgeon are likely using the mudflat habitat to the far north (at the north end of Arcata Channel) for foraging, which does not have proposed culture but does have a small amount of existing culture.

Overall, sturgeon would be easy to avoid when they are present in Humboldt Bay. They occur primarily in the main channels, and would access near channel habitat when it is inundated. There would be some increase in boat traffic through the main channels associated with expanded culture areas, however the increase is expected to be minimal compared to existing uses (see above and Section 4.0). As above, proposed intertidal aquaculture structures would be inundated for an average of approximately 68% to 89% of the year (Wagschal, pers. comm., 2015). Sturgeon forage primarily in mudflat habitat and on fish in the channels. Adding structure to mudflat habitat represents a change, but does not mean that sturgeon would be restricted from these areas. Pinnix (pers. comm., 2015) suggested that a 5-ft spacing of oyster longlines would allow sufficient area for these fish to maneuver in the event that they do occur in the shellfish growing areas. Similar spacing is also proposed for rack-and-bag structures, with slightly smaller rows (3 ft) within a group of three racks.

Overall, spatial overlap of proposed culture does not represent a significant portion of the habitat that sturgeon are likely using, there would be a low frequency of activity within the majority of proposed culture areas, and limited indication that structures would represent a problem for migration and access. Therefore, cumulative impacts to sturgeon are considered less than significant.

7.2.3.4 Cumulative Impacts to Salmonids (Coho Salmon, Chinook Salmon, Steelhead, and Coastal Cutthroat Trout)

Salmonids in Humboldt Bay are primarily using either the main channels during their outmigration (e.g., Pinnix et al. 2013) or the tidal portions of Humboldt Bay tributaries (Wallace 2006, Wallace and Allen 2007, Wallace and Allen 2015). This pattern is similar for other salmonids along the West Coast. Simenstad et al. (1982) indicated that most anadromous salmonids that rear for an extended time in freshwater (e.g., coho, spring Chinook, steelhead, sockeye, cutthroat cutthroat) will be oriented toward deeper water when they are present in estuaries. However, the early migrant juveniles of chum, pink, and fall Chinook salmon use the shallower margins of estuaries for a few weeks in the spring before moving into deeper water as they grow larger (Simenstad and Eggars 1981, Simenstad et al. 1982). Information developed by these researchers suggests that coho and other salmonids are not substantially using the locations where oyster longline culture is being proposed, but there may be more overlap with early migrant juveniles. The cumulative amount of habitat overlap within main channels and near channel habitat represents 5.9% of habitat in North Bay that could be used by salmonids.

There is no indication from the existing data that salmonids will be significantly affected by the presence of shellfish aquaculture even if they encounter it during outmigration or rearing. Much of the research suggests that estuaries with aquaculture may enhance habitat for salmonids, or at least represent a neutral effect. For example, Magnusson and Hilborn (2003) assessed the survival of coho and fall Chinook salmon released from West Coast hatcheries with respect to three characteristics: (1) size of the estuary, (2) percentage of the estuary that is in natural condition, and (3) presence of oyster culture in the estuary. While Humboldt Bay was not one of the estuaries assessed, the results suggested that oyster culture was not having an adverse impact on salmon survival in estuaries where there were substantial runs. Willapa Bay, which has a 150+ year history of extensive oyster culture in dense eelgrass beds, had the highest coho salmon survival. Grays Harbor, also an important oyster farming estuary, had the third highest coho survival of the twenty estuaries included in the study. Despite the large number of oyster cultivation operations in Willapa Bay and Grays Harbor (over 25% of the oysters consumed in the U.S. are grown in these estuaries), these Washington estuaries have some of the best released coho salmon survival among the areas examined.

A recent manuscript by Dumbauld et al. (*in review*[2]) identified whether intertidal oyster aquaculture in Willapa Bay effects the distribution and feeding ecology of juvenile salmonids. The study identified no significant differences in the density of juvenile salmonids caught in the four habitat types analyzed (undisturbed open mudflat, seagrass, channel habitats, and oyster aquaculture), and few significant associations with the prey items that the fish consumed. In other words, the majority of salmon that were found over low intertidal habitats were not dependent on structured habitat (e.g., eelgrass or oyster aquaculture) for prey items. Chum salmon, a typically smaller fish during estuarine residency, was the possible exception. This species does not occur in Humboldt Bay. The final conclusion by Dumbauld et al. (*in review*) was that:

> Permanent or 'press' disturbances like diking marshes, dredging and filling shallower estuarine habitats and even hardening shorelines would be expected to have significant impacts for other stocks and life history variants with smaller juveniles that utilize upper intertidal areas (Fresh 2006; Bottom et al. 2009), but our research suggests that short term 'pulse' disturbances like aquaculture which alter the benthic substrate in lower intertidal areas used primarily by larger juvenile salmon outmigrants may pose a less significant threat to maintaining resilience of these fish populations.

Based on the literature discussed above from estuaries that have a much higher amount of oyster aquaculture, and a variety of culture methods, throughout the estuaries, the amount of culture proposed in Humboldt Bay would result in less than significant cumulative impacts to salmonids

7.2.3.5 Cumulative Impacts to Forage Fish (Southern Eulachon, Longfin Smelt, and Pacific Herring)

Forage fish (e.g., fish in the families *Osmeridae* and *Clupeidae*) are an important dietary resource for higher trophic-level fish and marine mammals. Four species of *Osmeridae* (or the smelt family) were collected by Pinnix et al. (2005) in both eelgrass habitat and oyster growing areas, including longfin smelt. Larval smelt was one of the dominant species in the otter trawl sampling in January 2003 to 2006 in a small eelgrass bed near the entrance to Humboldt Bay (Garwood et al. 2013). No eulachon were collected in either survey, and they are not common south of the Mad River, although they are considered infrequent visitors to Humboldt Bay (Gustafson et al. 2010). Pinnix et al. (2005) also collected three species of *Clupeidae* (or the herring family) from oyster growing areas and eelgrass, including Pacific herring. The authors reported that Pacific herring was one of the dominant species during their surveys and the purse seine was especially effective at capturing schooling mid-water fishes such as herring.

[2] Although the information presented was taken from the manuscript, it is also discussed in the WRAC project termination report that supported the manuscript (Dumbauld 2006).

As established from the studies discussed in Section 6.5, above, forage fish are common in the shallow intertidal habitat of Humboldt Bay, especially Pacific herring. There are approximately 888 acres of intertidal shellfish aquaculture proposed in Humboldt Bay and 314 acres of existing intertidal culture, which represents 14% of intertidal habitat North Bay overall. Human disturbance from all projects is considered less than significant, given the low intensity and frequency of access to individual areas, even though the total amount of habitat represents a wide range of areas where forage fish would be found. Similarly, potential impacts to prey resources are considered less than significant, based on the less than significant changes expected to benthic communities.

The only potentially significant overlap with forage fish habitat is that of Pacific herring spawning habitat, especially within the East Bay Management Area. However, as discussed above, herring appear to use approximately 10% of the available habitat to spawn (Mello and Ramsay 2004), and can successfully use aquaculture gear for a spawning substrate (Palsson 1984, Dale, pers. comm., 2015). Mitigation Measure BIO-1 would provide mitigation for spawn that occurs in or near aquaculture plots. Shelton et al. (2014) indicated that spawn survival varies with spawning populations, not by spawning substrate type. While spawning on aquaculture gear can result in increased desiccation, the tradeoff is increased predation at lower elevations where more fish predators are found.

Overall, cumulative impacts to forage fish are considered less than significant.

7.2.3.6 Cumulative Impacts to Groundfish (Rockfish and California Halibut)

The groundfish species assessed in Section 6.5 above (rockfish and California halibut) primarily use channel and near channel habitat in Humboldt Bay, of which proposed aquaculture would overlap with 335 acres or 5.9% of such habitats in North Bay. Similar to other fish species discussed above, there is a potential to disturb groundfish during oyster aquaculture activities. However, the level of disturbance is considered less than significant based on the frequency and duration of activities. When culture areas are accessed in the dry, fish would not be present in the area, and when the area is accessed when the plots are inundated, fish would be able to easily avoid locations where work is being done. Data collected by Pinnix et al. (2005) in North Bay, indicates that fish abundance and diversity (including juvenile rockfish and flatfish species) is higher in oyster culture areas and eelgrass habitat compared to open mudflats. Additionally, as discussed above, there is no indication that prey resources would be negatively affected. Therefore, cumulative impacts to groundfish are considered less than significant.

7.2.3.7 Cumulative Impacts to Marine Mammals (California Sea Lion, Harbor Seal, and Harbor Porpoise)

Marine mammals, especially harbor seals, are primarily located in the main channels and in haul-out areas. Some marine mammals produce and use sound for various biological functions, including social interactions, foraging, orientation, and predator detection. Interference with producing or receiving sounds could have adverse consequences to individuals or populations, including impaired foraging efficiency from masking, altered movement of prey, increased energetic expenditures, and temporary or permanent hearing threshold shifts due to chronic stress from noise (Southall et al. 2007). The increase in boat trips associated with the Project and Pre-Permitting Project are expected to be minimal, and such increases will be small compared to existing boat use of the available channels.

Human disturbance is therefore considered similar to baseline conditions and within the range that marine mammals are accustomed to in Humboldt Bay.

The Pre-Permitting Project sites and Project's expansion areas were selected to avoid established marine mammal haul-out areas. The main overlap with the Project and existing haul-out locations is at Sand Island, where oyster aquaculture has occurred for over 60 years. There are strict Conservation Measures associated with potential disturbance to marine mammals. Conservation Measure BIO-11 includes not conducting activities when a marine mammal is observed hauled out in or near a culture area ready for planting, scheduled maintenance, or harvesting until the mammal has left on its own and without provocation, and Mitigation Measure BIO-2 prohibits aquaculture activities within 100 m of MHHW on Sand Island. Strict adherence to these Measures would ensure that potential cumulative impacts to marine mammals remain less than significant.

7.2.3.8 Cumulative Impacts to Black Brant

The Project's potential impacts on black brant associated with reduction in foraging opportunity, increased human disturbance, and loss of grit sites is assessed in Section 6.5, above. The Pre-Permitting Project also has the potential to result in similar impacts to black brant and thus there is potential for cumulative impacts associated with the District Project and the Project.

The intertidal portion of the Project will occur primarily within areas of continuous eelgrass (492 acres) with much smaller proportions of the Project footprint occurring in patchy eelgrass and other habitats. The bay-wide eelgrass biomass reduction (i.e., the impact to brant foraging) as a result of the Project was estimated to be approximately 3%. This functional loss of eelgrass to brant is not expected to result in significant energetic constraints to brant. The intertidal portion of the District Project will mostly avoid dense eelgrass beds, with most of the footprint of that project occurring in patchy eelgrass (approximately 56%) and a very small proportion (approximately 2.7%) occurring in dense eelgrass. Only dense eelgrass beds were used to estimate bay-wide eelgrass biomass (and thus the estimate is conservative). As such, the patchy eelgrass beds in the District Project's aquaculture footprint are not considered in the biomass estimates even though a portion of the eelgrass will be available for foraging. While the temporal loss of dense eelgrass beds within the District's aquaculture footprint could result in additional loss of foraging totaling a fraction of a percent of the bay-wide eelgrass availability, the reduction is not expected to result in delayed emigration or other energetic effects. Moreover, the District has proposed a buffer around eelgrass plants within its lease areas, such that a reduction in eelgrass availability is unlikely to occur as a result of the District Project. The cumulative effects associated with a reduction in foraging opportunity for brant are thus considered less than significant.

Impacts on black brant associated with human disturbance as a result in increased boat traffic and human presence was also assessed in Section 6.5, above. As assessed using the Stillman et al. (2015) framework, the Project is not expected to result in disturbances approaching thresholds likely to energetically constrain brant (i.e., 10% level of disturbance time). Because the District Project will primarily avoid eelgrass, there is less potential for brant to be disturbed by culturists working on District sites in the (higher-elevation) intertidal areas. However, the proposed projects will result in an increase in boat traffic in the main channels of Humboldt Bay that could result in cumulative effects on brant. While it is not possible to quantify an interaction between repeated boat disturbance and reduction in foraging ability (i.e., at lower tides), conservatively it can be assumed that brant may abandon foraging areas along main boating channels and other areas of repeated disturbance. This is most likely to occur along the largest channels, particularly the main channel north of Indian Island. The northern shore of Indian Island (east of the Samoa Bridge) has been identified as a potential gritting site. Although the Project will avoid this area, the District Project includes a site that occurs in that vicinity (Intertidal 3), thus some gritting areas may be exposed to disturbance as well. As a result, brant may shift some of their distribution within North Bay to avoid repeated disturbance and some portion of individuals may respond by shifting to South Bay, where the majority of the brant distribution formerly occurred.

The ability for brant and other waterbirds to acclimate to some level of disturbance should not be discounted. Currently, brant are distributed roughly equally between the two basins (and eelgrass biomass is also similar in the two basins) despite the current level of aquaculture occurring in North Bay. This suggests that brant have adjusted their behavior (i.e., become acclimated to some levels of disturbance) to some extent to exploit areas of eelgrass abundance, and it is unlikely that brant would completely abandon most foraging sites, particularly those that receive little disturbance, such as longline areas (as opposed to rack-and-bag areas). A shift in brant distribution could result in higher levels of grazing in less disturbed areas. However, the results of eelgrass biomass modelling efforts indicate the reduction in available biomass under proposed Project conditions does not approach significance thresholds (i.e., approximately 3% reduction in foraging potential). Thus it is unlikely that brant will experience a significant reduction in foraging opportunity bay-wide such that their ability to emigrate and breed is threatened. As such the cumulative effects on brant are considered less than significant under CEQA.

7.2.3.9 Cumulative Impacts to Roosting Birds

Many birds roost on structures within Humboldt Bay, including double-crested cormorants, California brown pelicans, Caspian terns, Forster's terns, elegant terns, and several gull species. These birds roost on rafts or other structures, as well as on Sand Island. Noise and other sources of human disturbance can cause them to flush from the area. These disturbances have energetic costs associated with flight while birds search for alternative roost sites. The movement of boats and culturists associated with the projects may result in cumulative effects to roosting birds. However, culturists will primarily use the main channels to access intertidal sites. Birds are unlikely to flush from roosts when boats move through the channels, as roosting birds would be acclimated to regular boat traffic in those areas. It is expected that roosting birds in the bay are generally habituated to human disturbance, given that birds often roost on sites that are near human activity (e.g., docks, piers, etc.), and that individuals that are not habituated to regular human disturbance will roost in more remote areas of the bay. Roost sites in the bay are not a limited resource, as there are numerous unoccupied roost sites in the bay year-round. Therefore, although there is increased potential for cumulative effects associated with disturbance to roosting birds, the impact is considered less than significant under CEQA.

7.2.3.10 Impacts to Nesting Birds

Sand Island occurs in the north-central portion of North Bay. Double-crested cormorants and Caspian terns nest on Sand Island and human disturbance associated with Project operations in the vicinity of the island has the potential to flush nesting Caspian terns and double-crested cormorants. Disturbances could result in the loss of eggs and/or chicks, and potentially nest or colony abandonment. Human disturbance associated with the District's Project also has the potential to impact the Sand Island colony; however, the lease sites associated with the District Project do not occur near Sand Island and boats associated with the District Project are not expected to traverse the north-central part of North Bay, as access to the higher elevation intertidal sites occur via the main channels. Mitigation Measure BIO-2 also requires Coast to maintain a 100-meter buffer around the MHHW line of Sand Island, avoiding the potential for the Project to impact nesting birds. Therefore, cumulative impacts to nesting birds are not expected to occur and are considered less than significant under CEQA.

7.2.3.11 Cumulative Impacts to Birds from Artificial Lighting

Artificial lighting is known to have adverse effects on wildlife, including birds. However, the Project will not result in additional permanent lighting and new lighting will be used infrequently by culturists working at culture areas at night. The District's Project will also involve new lighting but will be limited to boats and culturists, and potentially new floating rafts. New lighting on District Project rafts will include shielded light fixtures to avoid light spillage into adjacent areas. Thus cumulative impacts associated with artificial lighting are considered less than significant under CEQA.

7.2.3.12 Cumulative Impacts to Wigeon and other Waterfowl

As discussed above, boat traffic and the presence of personnel associated with the Project could disturb waterfowl, causing birds to flush from foraging areas and reducing temporal and/or spatial access to food. Human disturbance associated with the Project can result in increased energetic costs as well as a reduction in foraging opportunity. The waterfowl species most likely affected by the Project is American wigeon, which occur in low densities on the bay in winter when they feed on both emergent and floating eelgrass. As discussed in detail in Section 6.5.4 for wigeon and other waterfowl, and in more detail in Section 6.5.4 for black brant (potential impacts to that species are greater than for other waterfowl), the Project is not expected to result in significant impacts to waterfowl foraging opportunities or in human disturbance such that waterfowl are energetically constrained in regards to emigration or breeding. The District Project is also not expected to significantly affect waterfowl foraging primarily because that project largely avoids dense eelgrass areas and mainly occurs in higher-elevation unvegetated mudflats. While there is potential for both projects to result in cumulative effects on waterfowl through increased disturbance, this impact is not expected to be significant given that waterfowl in the bay are already somewhat habituated to the current level of human disturbance from boat traffic and other activities. Moreover, the highest densities of wigeon in the bay coincide with winter waterfowl hunting, indicating that winter habitat use is not strongly influenced by disturbance. As such, cumulative foraging and disturbance-related impacts to American wigeon and other waterfowl are considered less than significant under CEQA.

7.2.3.13 Cumulative Impacts to Migratory Shorebirds

The Project's potential impacts on shorebirds associated with reduction in foraging opportunity and increased human disturbance are assessed in detail in Section 6.5. The District Project also has the potential to result in impacts to shorebirds and thus there is potential for cumulative impacts associated with both projects.

Humboldt Bay is an important estuary for migrating and wintering shorebirds in the Pacific Flyway. Although Project-related impacts to shorebird foraging may occur, the effects are expected to be less than significant under CEQA based on existing evidence of shorebird use of aquaculture sites; specifically, the low tidal elevation of the Project site generally does not support substantial shorebird use. The District Project has greater potential to affect shorebirds, as it occurs in higher-elevation mudflats that represent more typical foraging habitat for shorebirds (i.e., they are inundated less frequently). However, as more fully described in the Pre-Permitting Project Draft EIR, foraging-related impacts to shorebirds as a result of the District Project are expected to be less than significant. Further, given that the two projects differ in elevation type and habitat type, they are unlikely to affect foraging resources to the same extent and thus cumulative impacts to shorebird foraging from both projects are expected to be less than significant.

Increased human disturbance from both the Project and District Project may result in a reduction in foraging opportunity and increased energetic costs for shorebirds. However, shorebirds are unlikely to be flushed by boats moving through channels to or from aquaculture sites, as shorebirds occur on exposed flats and boats move through subtidal areas. For instance, during a reconnaissance site visit associated with brant surveys, shorebirds were observed foraging under longlines in close proximity to the passing boat and they did not typically flush or alter behavior as the boat passed by. As such, the greatest impact to shorebirds related to human disturbance likely occurs when culturists directly access aquaculture sites, which may be at low tides when shorebirds can be present. In some cases, there will be higher levels of disturbance, such as rack-and-bag culture sites that experience almost daily activities, while sites with cultch-on-longlines will experience infrequent levels of disturbance (i.e., once/month for inspections, other than harvest and planting). Therefore, shorebirds may avoid areas that receive frequent disturbance, but they are unlikely to be regularly disturbed in areas with cultch-on-longline, which represents the majority of the proposed culture associated with the Project. Thus, even though there will be effects associated with both aquaculture projects, cumulative impacts to shorebirds are expected to be less than significant under CEQA.

7.3 Cumulative Impacts: Aesthetics and Visual Resources

Existing and other proposed mariculture in Humboldt Bay (including the Pre-Permitting Project) have similar impacts on aesthetic and visual resources as the Project. In combination with other proposed shellfish aquaculture development, the proposed Project would result in a substantial expansion of shellfish culture equipment in North Bay over baseline conditions. However, the findings made for the Project's impacts on aesthetics and visual resources apply similarly when considering cumulative impacts. Particularly, the culture equipment is low profile, produces minimal glare, is often submerged, and the use is consistent with the character of North Bay. In addition, the District Project will utilize shaded lights to reduce light spread and glare. As with the existing culture equipment (Figures 6.6.4-6.6.7), the proposed culture equipment has limited visibility from most public vantage points. This cumulative impact is considered less than significant.

7.4 Cumulative Impacts: Air Quality

Existing and other proposed mariculture in the bay (including the Pre-Permitting Project) will have similar air quality impacts as the Project. However, because other projects are also expected to comply with adopted air quality plans and AQMD regulations, this cumulative impact is considered less than significant with incorporation of the mitigation identified in Section 6.7.7 (Mitigation Measure AQ-1).

7.5 Cumulative Impacts: Greenhouse Gas Emissions

Existing and other proposed mariculture in the bay (including the Pre-Permitting Project) will have similar GHG emission impacts as the Project. However, the level of GHG emissions resulting from shellfish culture (i.e., boat use and storage, processing/cleaning, and transportation of shellfish) in Humboldt Bay is considered minor, particularly relative to the amount of food that will be produced and other activities in the region (the existing setting). Therefore, this cumulative impact is considered less than significant.

7.6 Cumulative Impacts: Hydrology and Water Quality

Existing and other proposed mariculture in the bay (including the Pre-Permitting Project) will have similar effects on hydrology and water quality as the Project. However, the findings made for the Project's impacts on hydrology and water quality apply similarly when considering cumulative impacts, particularly because other projects are expected to take similar precautions (i.e., best management practices and mitigation measures) not to impact water quality. Additionally, the assessment of the Project's effects on the abundance of suspended organic matter and potential competition for this food source between cultured shellfish and other filter feeders (Impact BIO-9; Appendix G) is a cumulative analysis and the impact is found to be less than significant. Therefore, this cumulative impact is considered less than significant.

7.7 Cumulative Impacts: Hazards and Hazardous Materials

Existing and other proposed mariculture in the bay (including the Pre-Permitting Project) will have similar effects regarding hazards and hazardous materials as the Project and the effect is cumulative. However, the findings made for the Project's impacts regarding hazards and hazardous materials apply similarly when considering cumulative impacts, particularly because other projects are expected to take similar precautions to minimize the potential for oil or other spills in the bay (i.e., Conservation Measures HAZ-1, HAZ-2 and HAZ-3) so as not to cause impacts related to hazards and hazardous materials. In addition, the Project and District Project are expected to employ similar mitigation measures to minimize potential impacts related to marine debris (Mitigation Measures HAZ-1 through HAZ-5). Therefore, this cumulative impact is considered less than significant.

7.8 Cumulative Impacts: Recreation

Existing and other proposed mariculture in the bay (including the Pre-Permitting Project) will have similar effects to recreation as the Project. While the Project and Pre-Permitting Project would both result in increased employment, it is expected that employees would be hired from the local community. The projects are not anticipated to generate a significant increase in population or recreational uses that would result in an increased demand for recreational facilities. The findings made for the Project's impacts on recreational users of Humboldt Bay apply similarly when considering cumulative impacts, particularly because potential impacts would only occur during certain tide heights and would be limited to areas outside of navigation channels. In addition, the Project employs Conservation Measures REC-1 and REC-2 to minimize potential impacts to recreation as far as feasible. Therefore, the cumulative effect on recreation is considered less than significant.

7.9 Cumulative Impacts: Noise

Existing and other proposed mariculture in the bay (including the Pre-Permitting Project) will have similar noise-related effects as the Project. However, the findings made for the Project's noise-related impacts apply similarly when considering cumulative impacts, because noise generating activities from mariculture are consistent with the types of noise commonly experienced on Humboldt Bay and are generally not near sensitive receptors. Therefore, this cumulative impact is considered less than significant.

7.10 Cumulative Impacts: Transportation/Traffic

Existing and other proposed culture in the bay (including the Pre-Permitting Project) will have similar effects to transportation/traffic as the Project. The findings made for the Project's impacts on transportation/traffic apply similarly when considering cumulative impacts, particularly because the projects would not substantially increase the local population, this impact would occur only during certain tide heights, the culture areas would be marked, and potential impacts would be limited to areas outside of navigation channels. The cumulative effect on transportation/traffic is considered less than significant.

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