Draft Environmental Impact Report for the Humboldt Bay Mariculture Intertidal Pre-Permitting Project

SCH #2017032068

Humboldt Bay Harbor, Recreation and Conservation District
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Introduction

A Draft Environmental Impact Report (EIR) for the Humboldt Bay Mariculture Intertidal Pre-Permitting Project and Yeung Oyster Farm (SCH# 2017032068) was circulated from August 19 – October 5, 2020. In response to the comments received, the Humboldt Bay Harbor, Recreation and Conservation District (District) has substantially modified the project by removing proposed shellfish culture from northeastern Humboldt Bay. As such, the proposed project size has been reduced from approximately 136 acres to 45 acres. Due to this substantial project change, the Harbor District is recirculating the Draft EIR for comments. The revised project and potential environmental effects are described below.

- Pursuant to State CEQA Guidelines Section 15088.5(a), a lead agency must recirculate a DEIR when significant new information is added to the EIR after public notice is given of the availability of the draft EIR for public review. In this case, the proposed project size has been substantially reduced from approximately 136 acres to 45 acres. The DEIR is being recirculated in its entirety.
- Consistent with CEQA Guidelines Section 15088.5(f)(1), the Harbor District advises reviewers that while previous comments will remain part of the administrative record, they do not require a written response in the Final EIR. New comments must be submitted on this Recirculated DEIR for response and consideration in the Final EIR.

Executive Summary

This EIR assesses the potential environmental effects of implementing the Humboldt Bay Mariculture Intertidal Pre-Permitting Project ("Project"). The Project would increase production of Kumamoto oysters (*Crassostrea sikamea*) and Pacific oysters (*C. gigas*) in Humboldt Bay, California. Under the Project, approximately 44.9 acres (ac) of culture would be established in intertidal areas using methods that suspend cultured shellfish off the bay bottom.

The regulatory structure of the Project is unique for Humboldt Bay, where permits are typically obtained and held by private shellfish growers. Specifically, under the Project, the District would obtain and hold the permits and lease the pre-permitted areas to private shellfish growers ("Lessees").

Table S-1. Summary of the Project's Impacts, Mitigation Measures and Impact Levels of Significance

Impact	Significance Without Mitigation	Mitigation Measure(s)	Significance With Mitigation
Cultural and Archeological Resources			
CR-1: Placement of equipment.	PS	**CR-1**: Protocols for inadvertent discovery of any cultural or archeological resource. **CR-2**: Protocols for inadvertent discovery of Native American remains and grave goods. **CR-3.** Training for Lessees operating at Site 2.	LS
Biological Resources			
BIO-1: Effects of intertidal culture on shorebird species as a result of loss of foraging habitat and alteration of food sources.	LS	None needed	N/A
BIO-2: Effects of intertidal culture on black brant (*Branta bernicla nigricans*) as a result of loss of foraging habitat and alteration of food sources.	LS	None needed	N/A
BIO-3: Potential impact to marine mammals from the potential loss of foraging habitat and restrictions to movement due to placement of aquaculture equipment in intertidal areas.	LS	None needed	N/A
BIO-4: Effects of human disturbance (e.g., boat movement, presence of culture workers) on marine mammals and other wildlife.	PS	**BIO-1**: Educational meetings.	LS
BIO-5: Effects of artificial lighting on wildlife.	PS	**BIO-2:** Shielding of light fixtures.	LS
BIO-6: Effects to green sturgeon (*Acipenser medirostris*) as a result of potential reduction in prey.	LS	None needed	N/A

Impact	Significance Without Mitigation	Mitigation Measure(s)	Significance With Mitigation
BIO-7: Effects on abundance of suspended organic matter and related effects to other native species.	LS	None needed	N/A
BIO-8: Effects to green sturgeon as a result of habitat loss or degradation.	LS	None needed	N/A
BIO-9: Effects to green sturgeon due to entanglement.	NI	None needed	N/A
BIO-10: Effects on wetland functions.	LS	None needed	N/A
BIO-11: Effects on eelgrass (*Zostera marina*).	PS	**BIO-3:** Eelgrass avoidance by boats. **BIO-4:** Eelgrass avoidance of culture equipment. **BIO-5**: Deposition of shells.	LS
BIO-12: Potential effect to eelgrass by constraining its expansion into higher elevation areas as a result of sea level rise.	LS	None needed	N/A
BIO-13: Potential impacts on Pacific herring (*Clupea pallasii*) spawning sites.	PS	**BIO-3; BIO-4; BIO-5** **BIO-6**: Spawning herring avoidance.	LS
BIO-14: Potential for cultured shellfish to naturalize or establish self-sustaining populations outside of cultivation and the effects of this naturalization on native marine species and communities.	LS	None needed	N/A
BIO-15: Effect on benthic habitat and communities from the shellfish culture equipment and cultured shellfish, including initial equipment installation activities, anchoring, posts, and material staging.	LS	None needed	N/A
BIO-16: Potential impacts to submerged aquatic vegetation and benthic habitat resulting from bottom scour, support vessel operations, motor contact, and trampling by workers.	LS	None needed	N/A
BIO-17: Potential biological effects of additional shellfish culture structures due to potential changes in light transmission through water column, water flow, and sediment transport.	LS	None needed	N/A
BIO-18: Impact on the distribution and dispersal of non-native invertebrate fouling species.	PS	**BIO-7**: Bio-fouling organism removal.	LS

Impact	Significance Without Mitigation	Mitigation Measure(s)	Significance With Mitigation
BIO-19: Conflicts with local policies, particularly those described in the Humboldt Bay Management Plan which is a guidance document for the District and the LCPs of the County of Humboldt, City of Eureka and City of Arcata.	NI	None needed	N/A
Aesthetic and Visual Resources			
AV-1: Effect on scenic vistas and visual character from the presence of mariculture workers and vessels.	LS	None needed	N/A
AV-2: Effect on scenic vistas and visual character from the presence of shellfish culture equipment.	LS	None needed	N/A
AV-3: Effects of glare and artificial lighting.	PS	**BIO-2:** Shielding of light fixtures.	LS
Air Quality			
AQ-1: Contribution to PM_{10} levels.	PS	**AQ-1**: Compliance with air quality regulations.	LS
Greenhouse Gas (GHG) Emissions			
GGE-1: Generation of GHGs.	LS	None needed	N/A
GGE-2: Conflict with an applicable plan, policy or regulation adopted for reducing GHG emissions.	NI	None needed	N/A
Energy			
EN-1: Potential for wasteful, inefficient, or unnecessary consumption of energy resources.	NI	None needed	N/A
EN-2: Potential for conflict with or obstruction of a state or local plan for renewable energy or energy efficiency.	NI	None needed	N/A
Hydrology and Water Quality			
WQ-1: Petroleum spills.	PS	**WQ-1**: Minimize fuel and petroleum spill risks.	LS
WQ-2: Pollutant/contaminant remobilization.	LS	None needed	N/A
WQ-3: Alteration of circulation patterns.	LS	None needed	N/A
WQ-4: Changes to the abundance of suspended organic matter.	LS	None needed	N/A
Land Use			

Impact	Significance Without Mitigation	Mitigation Measure(s)	Significance With Mitigation
LU-1: Effects on coastal dependent industrial uses.	LS	None needed	N/A
LU-2: Conflict with land use plans or policies.	NI	None needed	N/A

NI=No Impact, LS=Less than Significant, PS=Potentially Significant, N/A=Not Applicable

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Appendices

Section 1.0 Introduction/Project Structure/Use of the Environmental Impact Report

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The regulatory structure of the Project is unique for Humboldt Bay, where permits are typically obtained and held by private shellfish growers. Specifically, under the Project, the District would obtain and hold the permits and lease the pre-permitted areas to private shellfish growers ("Lessees").

1.1 Intended Use of this EIR

The Humboldt Bay Harbor Recreation and Conservation District (District) is the California Environmental Quality Act (CEQA) Lead Agency for the Project. This Draft Environmental Impact Report (EIR) 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. Under the Project, the District will be leasing Project sites to Lessees. Relevant Project conditions described in this EIR (e.g., mitigation measures and thresholds) as well as any other conditions contained in other Project approvals will be required of the Lessees as part of their lease conditions. Table 1.1-1 shows the agencies expected to use this EIR in their decision-making processes and the related environmental laws, approvals, permits and/or consultations.

Table 1.1-1. Agencies expected to use this EIR 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)	Clean Water Act (CWA) Section 404, Rivers and Harbors Act Section 10	Individual Permit
	National Environmental Policy Act	Environmental Assessment
North Coast Regional Water Quality Control Board	CWA Section 401	Section 401 Water Quality Certification
Humboldt Bay Harbor, Recreation and Conservation District	State of California Harbor and Navigation Code	Humboldt Bay Harbor District Permit
California Coastal Commission	CA Coastal Act	Coastal Development Permit
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 California Coastal Commission and Humboldt Bay Harbor District
City of Eureka	Eureka Municipal Code	Potential Use Permit (sites 2&3)

Section 2.0 Project Description

2.1 Project Goals and Objectives

The overall Project goal and purpose is to allow for an expansion of commercial mariculture activities in Humboldt Bay, to create jobs and improve the local economy, while also increasing local and sustainable seafood production. The Project is guided by the following objectives that will aid decision makers in their review of the Project and associated environmental impacts:

- To create additional job opportunities and sustainable economic development for Humboldt Bay and local jurisdictions.
- To increase a source of local sustainable seafood and reduce Humboldt County and California's reliance on imported seafood.
- To allow flexible farming methods that can adapt to specific grower operational and management needs, environmental conditions, and site conditions.
- To locate oyster farms in areas that optimize growing conditions and minimize environmental impacts.

2.2 Project Sites

The Project consists of three sites where culture of Kumamoto oysters (*Crassostrea sikamea*) and/or Pacific oysters (*C. gigas*) could occur. The sites were identified based on the following criteria (further information regarding site selection is provided in Appendix D):

1. Good potential for successful mariculture based on input from local aquaculturists and assessment of appropriate tidal elevations.
2. Minimize environmental effects:
    a. Avoid marine mammal haul-out areas.
    b. Avoid eelgrass (*Zostera marina*) beds by locating sites at higher elevations where eelgrass is absent or sparse.
3. Avoid existing tideland leases.
4. Avoid northeastern Humboldt Bay where public opposition to shellfish culture has been documented.

The proposed sites are shown in Figures 2.2-1, 2.2-2, 2.8-1, 2.8-2 and 2.8-3. Spatial coordinates for each site are provided in Appendix A.

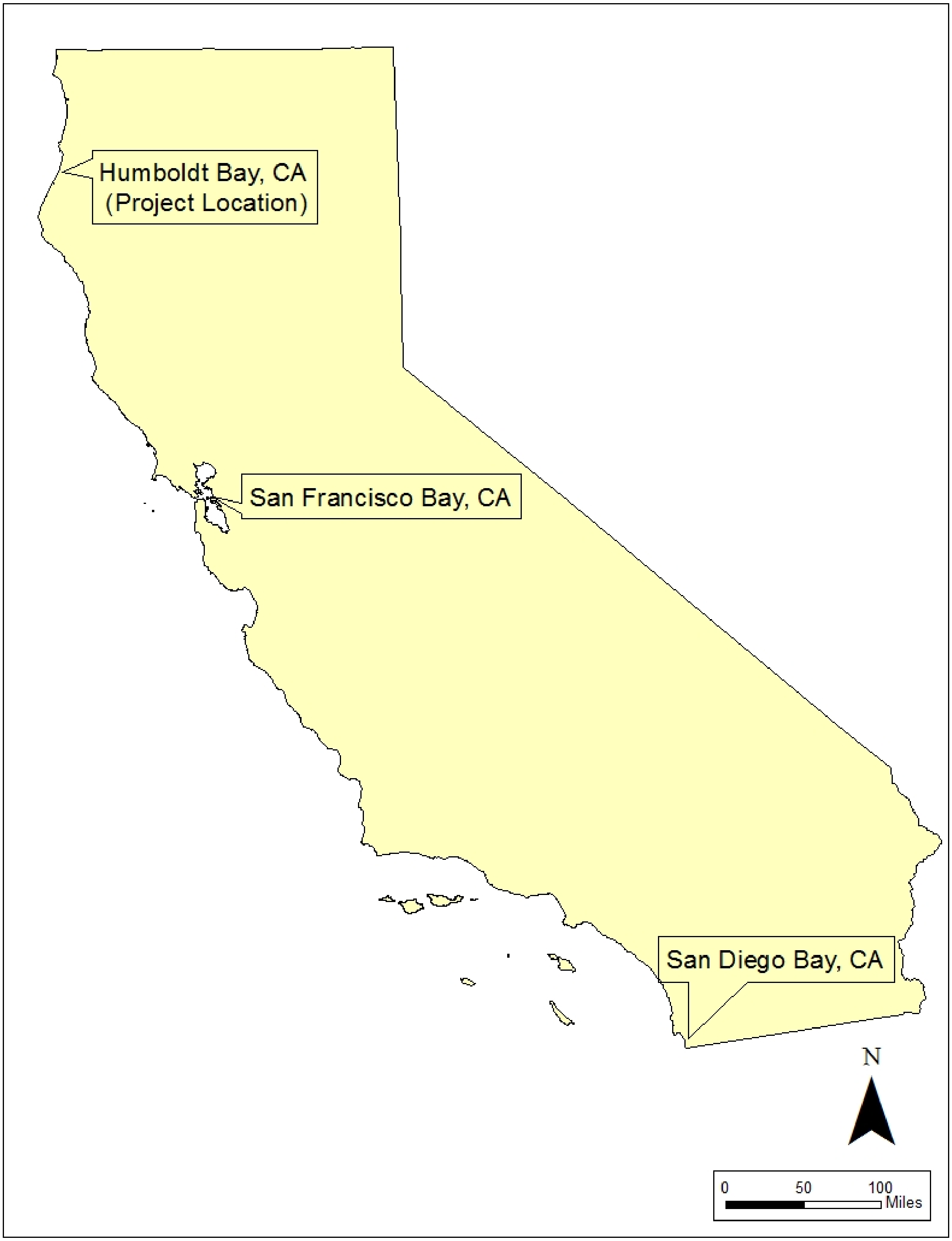

Figure 2.2-1. The Project is located in Humboldt Bay, California

Figure 2.2-2. Proposed Culture Sites

2.3 Project Description

The Project is an economic development project of the Humboldt Bay Harbor, Recreation and Conservation District (Harbor District or District), primarily funded by the District and Humboldt County Headwaters Fund. Expanded mariculture activities through the Project will create jobs and improve the local economy, while also increasing local and sustainable seafood production.

As part of the Project, the District will obtain all the necessary regulatory approvals to allow mariculture activities at specific sites in Humboldt Bay, California. Once this EIR is finalized and all other regulatory approvals are gained, the District will grant leases to private shellfish growers ("Lessees") for discrete portions of the Project's pre-permitted sites. For all sites leased through the Project, the Harbor District will issue a standardized tideland lease for mariculture (hereafter 'Lease'). Leases will be the mechanism by which the District ensures that all activities occurring under the Project are fully compliant with this Environmental Impact Report (EIR) and all other regulatory terms and conditions for the pre-permitted sites. The Leases will:

1. Include a map and legal description of the leased area, and allow the Lessee to conduct specific mariculture activities within that area;
2. Incorporate the full suite of regulatory requirements that each Lessee must comply with in order to operate under this EIR and other regulatory approvals;
3. Describe the mechanisms by which the District will oversee culture activities to ensure that operations are consistent with all regulatory requirements including regular reporting by Lessees to the Harbor District; and
4. Describe the process by which the Harbor District will address failures to meet lease requirements, including cancelling leases and requiring the removal of all cultured organisms and related equipment if lease conditions are not met.

As described below, there are three general shellfish culture methods that will be allowable at the leased sites. Mariculture activities under the Project must not exceed specific thresholds related to (1) the surface area and volume occupied by culture activities, (2) the amount of culture equipment in contact with the bay bottom (benthic footprint), (3) farm worker activities, and (4) biomass of cultured animals. Other terms and conditions to be followed will be identified during the Project's environmental analysis and regulatory approval process.

Prospective Lessees will be required to provide a site specific description of their proposed activities (a "culture description") to the Harbor District for approval. Additionally, if a Lessee plans to alter their culture operations (for example, but not limited to, the culture footprint, equipment type, or number of animals) the Lessee must submit a revised culture description to the Harbor District for approval. Culture descriptions must clearly demonstrate that (1) the general methods proposed are consistent with those in the standardized Lease and this EIR, and (2) the thresholds established in this EIR will not be exceeded by the culture activities. These determinations are at the discretion of the District in consultation with other permitting agencies. The following steps will be taken to ensure compliance with lease requirements.

Step 1. The culture descriptions provided by prospective Lessees will be reviewed by Harbor District staff to ensure that they are consistent with Lease requirements (and therefore with this EIR and other associated regulatory requirements).

Step 2. Before, during and immediately after installation of culture equipment, Harbor District staff will visit the culture sites to assess the proposed culture layouts and further ensure consistency with Lease requirements. Staff from all permitting agencies, agencies commenting on this EIR, and any other interested agency will be invited to attend the site visits to provide input.

Step 3. If it is determined that the proposed activity is consistent with Lease requirements, and any other Harbor District requirements, then the District will enter into a Lease with the Lessee, and the Lessee may implement their culture activities as proposed. When a lessee proposes a new culture method or an adaptation of the general culture methods, staff from all permitting agencies, agencies commenting on this EIR, and any other interested agency will be invited to provide input regarding the appropriateness of the method.

Step 4. Harbor District staff will visit the culture sites during and immediately after each site is "planted" and at least annually thereafter to ensure compliance with all Lease requirements. A standard inspection report will be developed and utilized to document these visits.

Step 5. Each Lessee will provide an annual report to the Harbor District. This report will describe the culture site's current status of operations, production, culture methods and relationship to the thresholds described below and all other lease requirements. The reports will include an assessment of the originally proposed culture operations versus existing ("as built") conditions (including a description of location, methods, equipment and any other pertinent information). The reports will also document the state of operations and upkeep on the site, including the presence of discarded, broken or abandoned tools, gear, or equipment. Reports will also include representative site photographs. As requested, the Harbor District will provide copies of the annual reports to staff from all permitting agencies, agencies commenting on this EIR, and any other interested agency.

In the event that culture activities are at any point found to be out of compliance with Lease requirements, the Harbor District will require immediate action to achieve compliance with the Lease. The District will reserve the right to revoke the Lease and require the removal of all cultured organisms and related equipment for any failure to comply with lease terms, regardless of the type or magnitude of the non-compliance action.

In the event that a culture site is to be abandoned, all culture equipment, including broken equipment as well as cultured organisms (attached and dislodged) will be removed. To help enforce cleanup of equipment that has become dislodged, it will be required that all culture equipment be labeled with the equipment owner's name, unless this cannot be reasonably done (e.g., it would not be reasonable to label a screw). Surveys for debris (including dislodged shells) will be required within all abandoned culture areas and within 100 feet of every abandoned culture area and all debris must be removed. An exception will be made for shells that are completely buried. The District (or a District contractor) will conduct a post clean up survey to ensure that cleanup was consistent with the requirements of this EIR, with further cleanup and post clean up surveys implemented as necessary. To ensure there is funding for this to occur, prior to finalization of a lease, potential Lessees will be required to provide financial assurances for removal. Financial assurances can be provided in the form of performance bonds, letters of credit, or other financial instruments. The estimated cost of cleanup will be developed by the lessee and approved by the District. The District will assume the ultimate responsibility for cleanup if financial assurances are not adequate or if the lessee is not otherwise fulfilling their obligation for the cleanup.

2.4 Culture Methods

The continued success of mariculture in Humboldt Bay will require adaptation of culture methods as new technologies are developed. New methods can result in higher production, improved product quality, and reduced environmental effects. To allow for adaptation of culture methods, the following process was used to develop the Project description:

1. A generic Project layout was developed based on the following culture methods. These methods represent the general types of culture that would occur under the Project.
    a. Rack-and-Bag,
    b. Cultch-on-Longline, and
    c. Basket-on-Longline.
2. The following culture characteristics were assessed. These culture characteristics are related to specific environmental effects of mariculture (Table 2.4-1).
    a. Levels of activity by farm workers,
    b. Water surface area occupied by culture equipment and cultured organisms,
    c. Volume of culture equipment and cultured organisms,
    d. Area of culture equipment in contact with bay bottom (benthic footprint), and
    e. Maximum biomass of shellfish soft tissue that could be present at any given time.
3. Based on the culture characteristics of each method, thresholds were established for the Project. Under the Project, culture can occur within each site as long as it:
    a. Does not exceed these culture characteristic thresholds,
    b. Follows other terms and conditions established by the Project's regulatory approvals including the EIR, and
    c. Does not result in any environmental effects that were not considered under the Project.

If there are environmental effects that were not considered under the Project, then additional regulatory approvals may be required.

Table 2.4-1. Culture Characteristics and Related Potential Environmental Effects

Culture Characteristics	Potential Environmental Effect
Levels of activity by farm workers	Environmental effects by farm workers (e.g., trampling, wildlife disturbance)
Water surface area occupied by culture equipment and cultured organisms	Increased shading and overwater cover
Volume of culture equipment under the water line	Effects on currents and sedimentation
Benthic footprint	Reduction in habitat for benthic organisms
Biomass of cultured shellfish	Reduced particulate organic matter as a result of consumption by cultured shellfish

2.5 Example Culture Methods

The Project is designed to allow for some flexibility in culture methods. The following culture methods were used to evaluate the potential environmental effects of mariculture and to establish thresholds for certain mariculture characteristics.

2.5.1 Shellfish Culture Rack-and-Bag Method

This description was adapted from Coast Seafoods Company (CSC) (2007). Rack-and-bag culture is used for growing Kumamoto oysters and Pacific oysters. The oysters are grown as "singles", meaning they are not attached to any structure such as shells or to each-other (they are "loose" in the bags). Rack-and-bag culture uses polyethylene mesh bags and rebar frames. Each rebar frame is 3 feet (ft) x 12 ft and supports 3–6 bags attached to the frame via industrial rubber bands (see Appendix B). Each bag is initially seeded with oysters and placed in intertidal areas. It takes 1–2 years for the seed to grow into oysters of market size, depending on tidal height and primary productivity, and then the bags of oysters are harvested by hand (lifted from the racks into a skiff), processed and brought to market.

2.5.2 Shellfish Culture Cultch-on-Longline Method

This description was adapted from CSC (2007). Cultch-on-longline culture is used for growing Kumamoto oysters and Pacific oysters. Prior to planting in the bay, oyster seed is attached to shells, which are attached to longlines. Planting is accomplished by placing seeded longlines 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 one ft above the bay bottom (see Appendix B).

Longline beds are harvested when they have oysters of a harvestable size and market conditions are right. It usually takes 1.5–3 years for oysters to reach a harvestable size. One of two methods is used to harvest longlines. The first, hand picking, involves placing around 20 bushel tubs on the bed at high tide using an oyster scow. The tubs are then filled at low tide by hand. The picking crew cuts the longline into manageable single clusters and places them in the picking tub. A floating ball is attached to each tub, and at high tide an oyster scow is used to pull the tub out of the water. The oysters are dumped on the deck of the scow, and the tub is placed back on the bed to be refilled.

The second method of harvest, the longline harvester, involves positioning a scow over the longline bed at high tide. Individual lines are then pulled onto the floating scow either by hand or by means of a hydraulically operated roller. If the lines are pulled by hand then the lines need to be cut into individual clusters, usually at the plant. If the lines are pulled mechanically they run through a breaker that strips the clusters from the line. The longline harvester does not come in contact with the bottom while harvesting longlines.

2.5.3 Shellfish Culture Basket-on-Longline Method

Basket-on-longline culture is used to grow Kumamoto oysters and Pacific oysters as singles. This method utilizes baskets that hang off a monofilament line suspended off the bottom using 2 inches (in) schedule 80 PVC pipe. The monofilament line is 5 mm in diameter and protected by a 3/8 in polyethylene sleeve that the monofilament is slid inside (see Appendix B). The baskets are approximately 24 in x 10 in x 6 in and are held on the line with plastic clips. A float, which is approximately 2.5 in diameter and 5.5 in long, is often attached to the baskets so that the baskets float up during high tides. Once the oysters reach a harvestable size, in approximately 1.5–2 years, the baskets are removed from the water, and the oysters are accessed through end caps on the baskets.

2.6 Determination of Culture Characteristics

The following processes and assumptions were used to develop an understanding of mariculture characteristics, upon which thresholds for mariculture operations were based.

2.6.1 Environmental Effects by Farmworkers

Farmworkers may have environmental effects when they are working at the culture sites, for example by trampling vegetation or disturbing wildlife. Mr. Greg Dale (retired CSC operations manager) and Mr. Ted Kuiper (retired shellfish culturist) were interviewed to determine the type and number of visits for each method.

2.6.2 Surface Area

Cultured organisms and associated equipment can affect eelgrass and other habitat features by increasing shade over these features. Overwater structure can also provide habitat for organisms, including plants, birds, fish and invertebrates. The water surface area per acre (ac) occupied by culture equipment and cultured organisms was calculated based on the following assumptions (also see Appendix B):

For rack-and-bag culture:

- Racks are 12 ft x 3 ft and are elevated by six 5/8 in rebar posts
- Racks are set in groups of 9, with a distance of 3 ft between subgroups of three racks
- Each group of nine racks is 10 ft apart from each other group of nine racks

For cultch-on-longline culture:

- Area is based on measurements of sampled cultch-on-longlines in 2012
- Lines are in groups of 5, with a distance of 2.5 ft between each line
- Each group of five lines is separated by 5 ft within a given row
- Rows are 10 ft apart
- Lines are a maximum of 100 ft, but areas where a 100 ft line won't fit are filled by partial lines
- Lines are elevated by 2 in PVC posts every 2.5 ft

For basket-on-longline culture:

- Baskets are 24 in x 10 in
- Basket floats are 2.5 in diameter and 5.5 in long
- Lines are in groups of 3, with a distance of 3 ft between each line
- Each group of three lines is separated by 20 ft on all sides
- Lines are a maximum of 100 ft, but areas where a 100 ft line won't fit are filled by partial lines
- Lines are elevated with 2 in PVC posts every four baskets and line ends are anchored with 1.5 in x 2 in wide galvanized fence posts

2.6.3 Volume

Cultured organisms and associated equipment can alter water currents and sedimentation rates. The overall volume of cultured organisms and associated equipment is a reasonable metric for assessing effects on currents and sedimentation. The volume of each culture method per acre was assessed based on the following assumptions (also see Appendix B).

For rack-and-bag culture:

- Rack dimensions are 12 ft x 3 ft x 0.7 ft
- Racks are set in groups of 9, with a distance of 3 ft between subgroups of three racks
- Each group of nine racks is 10 ft apart from each other group of nine racks

For cultch-on-longline culture:

- Volume of individual lines and associated shellfish is based on measurements taken in 2012
- Lines are in groups of 5, with a distance of 2.5 ft between each line
- Each group of five lines is separated by 5 ft within a given row
- Rows are 10 ft apart
- Lines are a maximum of 100 ft, but areas where a 100 ft line won't fit are filled by partial lines

For basket-on-longline culture:

- Basket dimensions are 24 in x 10 in x 6 in
- Floats are 2.5 in diameter and 5.5 in long
- Lines are in groups of 3, with a distance of 3 ft between each line
- Each group of three lines is separated by 20 ft
- Lines are a maximum of 100 ft, but areas where a 100 ft line won't fit are filled by partial lines

2.6.4 Benthic Footprint

The area of culture equipment in contact with the bay bottom was calculated based on the following:

For rack-and-bag culture:

- Racks are 12 ft x 3 ft and are elevated by six 5/8-inch diameter rebar posts
- Racks are set in groups of 9, with a distance of 3 ft between subgroups of three racks
- Each group of nine racks is 10 ft apart from each other group of nine racks

For cultch-on-longline culture:

- Lines are elevated by 2 in PVC posts every 2.5 ft
- Lines are in groups of 5, with a distance of 2.5 ft between each line
- Each group of five lines is separated by 5 ft within a given row
- Rows are 10 ft apart

For basket-on-longline culture:

- Each line holds 40 baskets
- Lines are in groups of 3, with a distance of 3 ft between each line
- Each group of three lines is separated by 20 ft
- Lines are a maximum of 100 ft, but areas where a 100 ft line won't fit are filled by partial lines
- Lines are elevated with 2 in PVC posts every four baskets and line ends are anchored with 1.5 in x 2 in wide galvanized fence posts

2.6.5 Biomass of Cultured Shellfish

Phytoplankton consumption by cultured shellfish is proportional to the number of shellfish cultured. The shellfish biomass calculations are based on the following:

For rack-and-bag culture:

- Each Rack-and-Bag unit contains six bags per rack, with 2 liters (L) of seed added per bag and periodic subsequent division of that stock into more bags
- Racks are set in groups of 9, with a distance of 3 ft between subgroups of three racks
- Each group of nine racks is 10 ft apart from each other group of nine racks

For cultch-on-longline culture:

- Each 100 ft longline contains 40–100 dozen oysters
- Lines are in groups of 5, with a distance of 2.5 ft between each line
- Each group of five lines is separated by 5 ft within a given row
- Rows are 10 ft apart

For basket-on-longline culture:

- Each basket is planted with 2 L of seed with periodic subsequent division of that stock into more baskets. Each line holds 40 baskets
- Lines are in groups of 3, with a distance of 3 ft between each line
- Each group of three lines is separated by 20 ft
- Lines are a maximum of 100 ft, but areas where a 100 ft line won't fit are filled by partial lines

2.7 Results and Thresholds

Based on the information described above, culture characteristics are depicted in Tables 2.7-1 and 2.7-2.

Table 2.7-1. Type and Number of Visits by Farmworkers to Different Types of Intertidal Mariculture Operations

Method	Type of Visit	# Visits per Year	Note
Rack-and-Bag	Place racks	0.2	Once every 5 years
	Inspections	104	Range of 1–3 times per week, assumed average of twice per week
	Flip bags	26	Bags flipped on average every two weeks
	Grade oysters	6.4	Every 6–8 weeks in summer (Feb to Oct) and every 8–12 weeks in winter (Nov to Jan)
	Plant and harvest	0.5	Plant and harvest once per 2 years
Cultch-on-Longline	Staking lines	0.2	Once every 5 years
	Monthly inspection	12	
	Plant and Harvest	1	Plant and harvest once every two years
Basket-on-Longline	Stake lines	0.2	Once every 5 years
	Grade oysters	6.4	Every 6–8 weeks in summer (Feb to Oct) and every 8–12 weeks in winter (Nov to Jan)
	Plant and harvest	1	Plant and harvest once per 2 years

- "Shaded cells" depict the maximum values for each culture characteristic. These values represent the maximum level of effort that generally occurs for the various mariculture methods.

* The information provided is for individual culture units (i.e., a single bag, longline, or basket). A group of units would generally be visited more frequently.

Table 2.7-2. Culture Characteristics of Example Intertidal Culture Methods

Method	Water Surface Area (ft^2) in Culture per Acre	Volume (ft^3) of Shellfish Culture Equipment and Cultured Organisms per Acre	Benthic Footprint (ft^2) per Acre	Biomass (kg) of Shellfish Dry Weight per Acre (6% of Live Weight)
Rack-and-Bag	13,068 (30%)	8,736	4.36	253
Cultch-on-Longline	4,792 (11%)	1,947	118.07	97
Basket-on-Longline	3,484 (8%)	1,623	11.80	207

- "Shaded cells" represent the maximum values for each culture characteristic. Under the Project, these maximum values are the culture characteristic thresholds that cannot be exceeded by shellfish culture operations.

2.8 Site Specific Thresholds

Farmworker activity at the sites must not exceed the general activity levels described for rack-and-bag culture (Table 2.7-1). Additionally, the thresholds identified in Table 2.7-2 cannot be exceeded. Site specific thresholds were determined by scaling the thresholds to the size of each site (i.e., multiplying each site's area suitable for culture by the relevant threshold values) (Table 2.8-1).

Table 2.8-1. Site Specific Culture Characteristic Thresholds

Site	Acres	Allowed Surface Area (ft^2) of Water that Can be in Mariculture Production	Allowed Volume (ft^3) of Mariculture Equipment and Cultured Organisms	Allowed Benthic Footprint (ft^2)	Allowed Biomass of Shellfish (Dry Weight, kg)
1	29	381,586	255,091	3,448	7,388
2	4	50,965	34,070	460	987
3	12	154,202	103,085	1,393	2,985
Total	**45**	586,753	392,246	5,301	11,360

Figure 2.8-1. Site 1 is approximately 29.2 acres.

Figure 2.8-2. Site 2 is approximately 3.9 acres.

Figure 2.8-3. Site 3 is approximately 11.9 acres.

2.9 References

[CSC] Coast Seafoods Company. 2007. Coast Seafoods Application for Continued Mariculture Operations in Humboldt Bay, California. Draft Mitigated Negative Declaration. Prepared for Humboldt Bay Harbor, Recreation and Conservation District.

Section 3.0 Project Alternatives

The Project as described above is the preferred project or "Project". Three alternatives were considered to the Project. Alternative 1 would involve reduced culture footprints within each site. Alternative 2 would only allow for the use of one of the proposed culture methods (basket-on-longline) and Alternative 3 is the scenario of not implementing the Project.

3.1 Alternative 1. Reduced Footprint

Under this alternative, the area allowed for culture within each project site would be decreased by 25%. Resulting culture thresholds would be as shown in Table 3.1-1. In general, a decreased footprint may reduce environmental effects but also reduce the level of economic development created by the Project.

Table 3.1-1. Site Specific Culture Characteristic Thresholds under Alternative 1

Site	Acres	Allowed Surface Area (ft^2) of Water that Can be in Mariculture Production	Allowed Volume (ft^3) of Mariculture Equipment and Cultured Organisms	Allowed Benthic Footprint (ft^2)	Allowed Biomass of Shellfish (Dry Weight, kg)
1	22	286,189	191,318	2,586	5,541
2	3	38,224	25,553	345	740
3	9	115,652	77,314	1,045	2,239
Total	34	440,065	294,185	3,976	8,520

3.2 Alternative 2. Basket-on-Longline Method Only

The basket-on-longline method is being increasingly used in Humboldt Bay and elsewhere. Shellfish farmers are likely to use this method under the Project. Alternative 2 would only allow this method, as it is described in Appendix B. This alternative would reduce the allowed flexibility in methods that the Project is trying to achieve, but would increase certainty regarding environmental effects and potentially reduce some of the environmental effects. Culture characteristics of Alternative 2 are shown in Table 3.2-1.

Table 3.2-1. Site Specific Culture Characteristic under Alternative 2

Site	Acres	Allowed Surface Area (ft^2) of Water that Can be in Mariculture Production	Allowed Volume (ft^3) of Mariculture Equipment and Cultured Organisms	Allowed Benthic Footprint (ft^2)	Allowed Biomass of Shellfish (Dry Weight, kg)
1	29	101,733	47,392	345	6,044
2	4	13,588	6,330	46	807
3	12	41,111	19,151	139	2,443
Total	45	156,432	72,873	530	9,294

3.3 Alternative 3. No Project

Alternative 3 is the No Project Alternative, which is the scenario of not implementing the Project. Under this scenario, it is expected that existing shellfish culture would continue and may expand in Humboldt Bay through permitting efforts by private entities. However, the rate of expansion may be slower and the final area of culture may be less. Additionally, planning for locations and types of culture would not happen in the comprehensive manner that is happening through the Project (i.e., different culture activities and locations would be proposed separately by individual private culturists).

Section 4.0 Environmental Setting and Effects of the Alternatives

The environmental setting described in this section reflects physical conditions as they occurred at the time the Notice of Preparation (NOP) was published (February, 2019) with some updates. Further information regarding the environmental setting is provided within each effect's analysis section below.

4.1 Humboldt Bay

Humboldt Bay is approximately 14 miles (mi) (22.5 kilometers [km]) long and its width varies from 0.5 mi (0.8 km) in Entrance Bay to 4.3 mi (6.9 km) across the widest part of the North Bay. At high tide, Humboldt Bay occupies an area of 24.1 mi^2 (62.4 km^2), which is reduced to 10.8 mi^2 (27.97 km^2) at low tide (Proctor et al. 1980). At low tide, extensive intertidal mudflats are exposed, comprising about 2/3 of the Humboldt Bay area (Gast and Skeesick 1964; Proctor et al. 1980). The entrance and shipping channel depths are maintained at 38 to 48 ft (11.6 to 14.6 m) by periodic dredging (HBHRCD 2007).

As California's 2nd 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, recreational 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 significant at scales ranging from local fisheries, including oyster production, to regional migration stopovers by shorebird and waterfowl. The Humboldt Bay area hosts over 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 important in the life cycles of commercially and recreationally important fish species including shellfish, crustaceans and finfish. Humboldt Bay has a successful oyster culture industry, producing about 70% of the oysters grown in California. Portions of the diked former tidelands around Humboldt Bay, particularly in the Arcata Bottoms, are utilized for agriculture, primarily livestock grazing for dairy and beef production. The largest urban concentrations are in Arcata (population approximately 16,651) and Eureka (population approximately 25,866).

During the late-19th and early-20th centuries, diking and filling reduced Humboldt Bay salt marshes from an estimated 9,000 ac to only 900 ac today. Humboldt Bay habitat has been further disturbed by discharges of agricultural and urban runoff, industrial and recreational activities, excessive sedimentation from the bay's watershed and other sources, colonization by invasive *Spartina*, and other stressors (HBHRCD 2007; Sutula et al. 2008).

4.1.1 References

Gast, J. A, and D. G. Skeesick. 1964. The circulation, water quality, and sedimentation of Humboldt Bay. Special Report, Humboldt State College, Department of Oceanography. Issue 2.

[HBHRCD] Humboldt Bay Harbor, Recreation and Conservation District. 2007. Humboldt Bay Management Plan. Final.

Proctor, C. M., J. C. Garcia, D. V. Galvin, G. C. Lewis, and L. C. Loehr. 1980. An Ecological Characterization of the Pacific Northwest Coastal Region. U.S. Fish and Wildlfie Service. FWS/OBS-79/11 through 79/15.

Sutula, M., J. N. Collins, A. Wiskind, C. Roberts, C. Solek, S. Pearce, R. Clark, A. E. Fetscher, C. Grosso, K. O'Connor et al. 2008. Status of Perennial Estuarine Wetlands in the State of California. Surface Water Ambient Monitoring Program State Water Resources Control Board. SCCWRP #571.

4.2 Effects Not Analyzed in EIR

Section 15060(d) of the CEQA guidelines requires that that the lead agency "focus the Draft EIR on the significant effects of the Project and indicate briefly its reasons for not determining that other effects would not be significant or potentially significant". Section 15128 of the CEQA Guidelines states that "An EIR shall contain a statement briefly indicating the reasons that various possible significant effects of a project were determined not to be significant and were therefore not discussed in detail in the EIR." This section describes the environmental impacts found not to be significant.

4.2.1 Agriculture Resources

The Project would have a beneficial effect on agricultural resources by increasing the footprint of shellfish culture in Humboldt Bay. There would be no negative impacts on agricultural resources, and the proposed land use is consistent with existing zoning, including zones designated by the City of Eureka Municipal Code (Section 156.065) and County of Humboldt Code (Section 313-5.4). The use is also consistent with policies pertaining to this part of the bay that are described in the Humboldt Bay Management Plan (HBMP) (Section 2.3.2 of HBHRCD 2007). Hence, no impact to agricultural resources is expected.

4.2.2 Geology and Soils

4.2.2.1 Risks to People and Structures

There are numerous fault lines near the Project area, as well as the intersection of three tectonic plates. As such, the area is highly susceptible to seismic activity. However, the Project would not add any fixed structures to the landscape that would be susceptible to seismic damage, nor would it put existing structures at greater risk. The Project area is level and lacks structures that could become unstable and injure culturists. The soil could be subject to liquefaction, which would pose a minor risk to culturists; however, the risk is considered very low, given that (1) liquefaction of the type that would be a risk to culturists is uncommon, and there is no historical evidence of liquefaction in Humboldt Bay; (2) culturists would be at the Project sites only temporarily, and no people would inhabit the Project sites; and (3) culturists would be near boats and safety equipment, including personal floatation devices. Hence, impacts related to seismic risks are expected to be less than significant.

4.2.2.2 Erosion

Through a study of sedimentation at shellfish culture sites in Humboldt Bay similar to the Project sites and equipment (Rumrill and Poulton 2004) found that "fine sediments were deposited and eroded in an inconsistent manner." However, based on the study results, there appears to be a net increase in sediment accumulation, not a loss. A minor amount of net sediment deposition, rather than erosion, is expected when shellfish culture equipment is placed in tidelands. Hence, no impact is expected.

4.2.2.3 Instability

The Project would not involve the construction of any permanent structures and is not expected to affect the potential for onsite or offsite landslides, lateral spreading, subsidence, liquefaction, or collapse. Hence, no impact is expected.

4.2.2.4 Expansive Soils

There may be expansive soils in the Project area; however, the Project would not add enclosed or habitable structures (buildings) to the landscape; therefore, there would be no substantial risk to life or property from Project development. Hence, no impact is expected.

4.2.3 Wastewater Disposal

The Project does not involve the development of new waste water disposal systems. Culturists would use existing facilities (restrooms), likely in underutilized industrial areas. Hence, no impact is expected.

4.2.4 Hazards and Hazardous Materials

4.2.4.1 Transport, Use, Release, or Emission of Hazardous Materials

The only hazardous materials that would be associated with the Project are fuel and lubricants for boats, including for internal combustion engines on small boats. Use of these materials is common in Humboldt Bay and does not represent a significant hazard to the environment or people. A requirement of the District's leases to Lessees would be that Project personnel would follow all current and standard safety and cleanup protocols for fueling and lubricating engines. No impact is expected.

4.2.4.2 Known Hazardous Sites

The Project area is not known to be on any list of hazardous materials sites compiled pursuant to Government Code Section 65962.5. Because the Project sites are intertidal, it is unlikely that they supported historical uses that would have resulted in contamination. There are contaminated sites located on the margins of the bay, but hazardous materials are not expected to reach the Project sites at concentrations that would have any impact on the Project's culturists. Hence, no impact is expected.

4.2.5 Aircraft/Airport Related Safety

The only nearby airport is Murray Field, which is a public airport approximately 0.8 mi from the nearest Project boundary. Airplanes landing and departing from this airport are not expected to be a hazard for the Project's culturists. Hence, no impact is expected.

4.2.6 Emergency Responses and Fire Hazards

The Project would not have any effect on an adopted emergency response plan or emergency evacuation plan, because it would not impede emergency response or evacuation routes or procedures. Also, because the Project area is in intertidal (aquatic) areas, there is no risk of wildfires. Hence, no impacts are expected.

4.2.7 Mineral Resources

The Project would expand mariculture operations in Humboldt Bay. It does not involve the extraction or deposition of any material that may result in the depletion of mineral resources. It would have no other effects on mineral resources. Hence, no impact is expected.

4.2.8 Noise

The Project would involve expanding mariculture operations on Humboldt Bay. Its primary noise effect would be caused by the addition of approximately 10 small watercraft with internal combustion engines. These would generate noise similar to that generated by other small watercraft on the bay. The Project boats could not be heard from sensitive receptors. Because the Project's noise generation would be typical of what already occurs in Humboldt Bay, noise impacts would be less than significant.

4.2.9 Population/Housing

The Project would involve expanding mariculture operations on Humboldt Bay. It may create approximately 16 new jobs. Some of these jobs may be filled by people already living in the area and some may be filled by people from out of the area. However, it is expected that there is sufficient housing and other required infrastructure available to support this negligible potential population increase. Hence, no impacts are anticipated.

4.2.10 Public Services

The Project may create approximately 16 new jobs. Some of these jobs may be filled by people already living in the area and some may be filled by people from out of the area. However, there are ample public services available in the region to support this negligible potential population increase. Hence, no impacts are anticipated.

4.2.11 Recreation

Approximately 16 people would be employed by the Project, some would be from the region and others may move to the region for employment through the Project; however, the small increase in population caused by the Project is negligible. The project would not increase the use of existing parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated. Also, the Project does not include recreation facilities or require construction or expansion of recreational facilities. There would not be an environmental impact resulting from recreation associated with the project.

4.2.12 Transportation/Traffic

4.2.12.1 Traffic Levels, Patterns and Hazards

The Project would not substantially increase the local population. Approximately 16 culturists may be employed through the Project. Some of these culturists likely will be from the region and some may relocate to the region for employment because of the Project. The culturists are expected to utilize existing parking areas and other facilities; including underutilized industrial areas on the Samoa Peninsula. They are also expected to utilize existing bay access points. No impact is expected.

4.2.12.2 Alternative Transportation

The Project's mariculture equipment could interfere with the movement of watercraft (e.g., boats, kayaks) in intertidal areas. This interference would occur only when the tides are high enough for watercraft to move through the intertidal areas, but so low that that the vessels can't move readily over the equipment. Empty space among the equipment would allow smaller watercraft (e.g., kayaks) to move about, but in some cases only in two directions (e.g., parallel to rows of equipment). Watercraft movement in subtidal areas, including in the primary navigation channels for watercraft, would not be affected. Because this impact would occur only during certain tide heights and is limited to areas outside of navigation channels (i.e., in intertidal areas where boating activity is limited), the impact is considered less than significant.

4.2.13 Utilities/Service Systems

Project employees would use existing restrooms, likely within underutilized industrial areas. The Project would generate waste that would go to a landfill. This waste may include rope from cultch-on-longline culture operations and other disposable materials. Regional landfills would have the capacity to accept this relatively small amount of waste. The Project would maintain compliance with federal, state, and local statutes and regulations related to solid waste. Hence, no impacts are expected.

4.2.14 Wildfire Hazard

The proposed project occurs in tidal and subtidal areas of Humboldt Bay. Due to the presence of water at the project sites, the project does not pose a risk of creating wildfires. No impact is expected.

4.2.15 References

[HBHRCD] Humboldt Bay Harbor, Recreation and Conservation District. 2006. Humboldt Bay Management Plan-Draft Environmental Impact Report. Humboldt Bay Harbor, Recreation and Conservation District, Eureka. California. SCH # 2005082040.

Rumrill, S. S., and V. K. Poulton. 2004. Ecological Role and Potential Impacts of Molluscan Shellfish Culture in the Estuarine Environment of Humboldt Bay, CA. Annual Report, Western Regional Aquaculture Center. Oregon Department of State Lands, South Slough National Estuarine Research Reserve, and Estuarine and Coastal Science Laboratory.

4.3 Overview of Effects Analyses

Potential effects are assessed based on the following categories:

- Tribal, Cultural and Archeological Resources
- Biological Resources
- Aesthetics and Visual Resources
- Air Quality
- Greenhouse Gas (GHG) Emissions
- Energy
- Hydrology and water quality
- Land Use

The general terms used in this EIR to describe the level of significance of impacts are as follows:

- No Impact
- Less than significant without mitigation
- Less than significant with mitigation
- Significant

4.4 Effects to Tribal, Cultural and Archeological Resources

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

- Planwest Partners and the Cultural Resources Facility, Center for Indian Community Development, Humboldt State University 2008. Humboldt Bay Historic and Cultural Resource Characterization and Roundtable. October 2008.

- Humboldt County Department of Community Services Development 2008. Humboldt County General Plan November 20, 2008. Chapter 10, Section 10.6 Cultural Resources.

- Humboldt Bay Harbor, Recreation and Conservation District 2006. Humboldt Bay Management Plan Draft EIR. April 2006.

- ESA 2008. Marina Center Mixed Use Development Project Draft Environmental Impact Report. November 2008.

4.4.1 Environmental Setting

Humboldt Bay is the ancestral heartland of the Wiyot, 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.

4.4.2 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 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" including archaeological and Native American sites.
- 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.

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, Section 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.

4.4.2.1 ASSEMBLY BILL 52

AB 52, enacted in 2014, amends sections of CEQA relating to Native Americans. AB 52 establishes a new category of cultural resources, named tribal cultural resources (TCRs), and states that a project that may cause a substantial adverse change in the significance of a TCR may have a significant effect on the environment. Section 21074 was added to the Public Resources Code to define TCRs, as follows:
(a) "TCRs" are either of the following:

1. Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either of the following:
    a. Included or determined to be eligible for inclusion in the California Register of Historical Resources.
    b. Included in a local register of historical resources as defined in subdivision (k) of Section 5020.1.
    c. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Section 5024.1. In applying the criteria set forth in subdivision (c) of Section 5024.1 for the purposes of this paragraph, the lead agency shall consider the significance of the resource to a California Native American tribe.
    d. A cultural landscape that meets the criteria of subdivision (a) is a TCR to the extent that the landscape is geographically defined in terms of the size and scope of the landscape.
    e. A historical resource described in Section 21084.1, a unique archaeological resource as defined in subdivision (g) of Section 21083.2, or a "non-unique archaeological resource" as defined in subdivision (h) of Section 21083.2 may also be a tribal cultural resource if it conforms with the criteria of subdivision (a).
2. AB 52 requires the lead agency to begin consultation with any tribe that is traditionally or culturally affiliated with the geographic area. In addition, AB 52 includes the following time limits for certain responses regarding consultation:
    a. Within 14 days of determining that an application for a project is complete or a decision by a public agency to undertake a project, the lead agency shall provide formal notification to the designated contact of, or a tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice.
    b. After provision of the formal notification by the public agency, the California Native American tribe has 30 days to request consultation.
    c. The lead agency must begin consultation process within 30 days of receiving a California Native American tribe's request for consultation.

Assembly Bill (AB) 52 (Chapter 532, Statutes of 2014) establishes a formal consultation process for California Native American tribes as part of CEQA and equates significant impacts on tribal cultural resources with significant environmental impacts (new PRC Section 21084.2).

4.4.2.2 Native American Consultation

California Senate Bill 18 requires local governments to consult with tribes prior to making certain planning decisions and to provide notice to tribes at certain key points in the planning process. The intent of SB 18 is to provide California Native American tribes an opportunity to participate in local land use decisions at an early planning stage, for the purpose of protecting, or mitigating impacts to, cultural places. In accordance with the requirements of Senate Bill 18 and AB 52, Humboldt Bay Harbor District past staff Adam Wagschal has contacted representatives from three Native American entities with possible interest in requesting consultation. These included:

- Ted Hernandez – Wiyot Tribe
- Janet Eidsness and Daniel Holsapple – Blue Lake Rancheria
- Erika Cooper & Melanie McCavour – Bear River Band of the Rohnerville Rancheria

District staff has been in consultation with these tribes since 2015. The Wiyot Tribe has provided input regarding mitigation measures. Consultation is ongoing.

4.4.3 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 it will:

1. Cause a substantial adverse change in the significance of a historical resource as defined in CEQA §15064.5.
2. Cause a substantial adverse change in the significance of an archaeological resource pursuant to CEQA §15064.5.
3. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.
4. 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 (California Native American Heritage Commission [NAHC] undated). 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.

Criteria for eligibility include resources that are (California State Parks [CSP] 2010):

- "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)."

4.4.4 Effects Analyses of the Project

Protection of archeological 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. Posts or stakes placed in the substrate to secure shellfish culture equipment could potentially disturb cultural or archeological resources. MITIGATIONs CR-1 and CR-2 provide protocols for actions that will occur if resources are discovered. Site 2 has a relatively high potential for the presence of cultural resources due to its close proximity to Tuluwat Island where there are past and ongoing cultural uses by the Wiyot Tribe. MITIGATION CR-3 would provide further assurances for protection of resources at Site 2. This mitigation measure was developed in coordination with the Wiyot Tribe. With these mitigation measures this potential impact is less than significant.

MITIGATION CR-1: Protocols for inadvertent discovery of any cultural or archeological resource. The following protocol shall be implemented if a cultural or archeological resource is discovered.

1. The party who made the discovery shall be responsible for immediately contacting by telephone the District.
2. Ground-disturbing activities shall be immediately stopped at the find locality 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.
3. 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.
4. The discovery locale shall be secured (e.g., 24-hour surveillance) as directed by the District if considered prudent to avoid further disturbances.
5. Upon learning about a discovery, the District shall be responsible for immediately contacting by telephone the contacts listed below to initiate the consultation process for its treatment and disposition:

a. Tribal Historic Preservation Officers (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 also be notified immediately.

7. Ground-disturbing Project work at the find locality shall be suspended temporarily while the District, THPOs, a consulting archaeologist, and other applicable parties consult about appropriate treatment and disposition of the find. Ideally, a treatment plan may be decided within three working days of discovery notification and the field phase of a treatment plan may be accomplished within five days after its approval, however, circumstances may require longer periods for data recovery. Where a project can be modified to avoid disturbing the find, this may be the preferred option.

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 shall be responsible for coordinating any requests by or contacts to the media about a discovery.

9. Ground-disturbing work at a discovery locale may not be resumed until authorized in writing by the District.

10. Final disposition of all collected archaeological materials shall be documented in a data recovery report and its disposition decided in consultation with Tribal representatives.

11. For the Pre-Permitting Project sites, these protocols shall be requirements contained within District leases to Lessees.

MITIGATION CR-2. Protocols for inadvertent discovery of Native American remains and grave goods. In the event of a discovery of Native American remains or grave goods, the following protocol would be followed, in addition to the protocol described under MITIGATION CR-1.

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. The preference of the Wiyot area tribes is to leave ancestral burials and remains in situ, and that no photographs or analyses be made.

2. 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 at (916) 653-4082.

3. The NAHC is responsible for identifying and immediately notifying the most likely descendant (MLD) of the deceased Native American.

4. Within 48 hours of their notification by the NAHC, the MLD may recommend 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 District rejects the recommendation of the MLD and mediation between the parties by NAHC fails to provide measures acceptable to the District, the District shall cause the re-burial of the human remains and associated grave offerings with appropriate dignity at an appropriate nearby location not subject to further subsurface disturbance.
6. These protocols shall be requirements contained within District leases to Lessees.

MITIGATION CR-3. Training for Lessees operating at Site 2. Site 2 has the greatest possibility for inadvertent discovery of archeological and historic resources. Hence, prior to initiating culture at this site, Pre-Permitting Project Lessees will meet with the Wiyot Tribe THPO in order to gain an understanding of the resources that may be disturbed and practical steps for minimizing disturbance.

4.4.5 Assessment of Alternatives

The Project alternatives are discussed below. Table 4.4-1 shows the level of significance for each impact under each alternative.

4.4.5.1 Alternative 1. Reduced Footprint

The reduced project footprint described for Alternative 1 would result in less soil disturbance (benthic impacts) and less potential impacts to cultural and archeological resources as the Project. The same mitigation measures as proposed for the Project would be required to reduce impacts to less than significant.

4.4.5.2 Alternative 2. Basket-on-Longline Method Only

Alternative 2 would result in less soil disturbance and less potential impacts to cultural and archeological resources. The same mitigation measures as proposed for the Project would be required to reduce impacts to less than significant.

4.4.5.3 Alternative 3. No Project

Under the no project alternative there would not be any new potential impacts to cultural and archeological resources. Existing shellfish culture in Humboldt Bay and related potential impacts would likely continue.

Table 4.4-1. Levels of significance of the Project and alternatives for cultural impacts.

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
CR-1: Placement of equipment	LSM	LSM	LSM	NI

NI=No Impact, LS=Less than Significant without Mitigation, LSM=Less than Significant with Mitigation, PS=Potentially Significant

4.4.6 References

[CSP] California State Parks. 2010. California Register. California State Parks, Office of Historic Preservation. [online]. Accessed 13 January 2015. http://ohp.parks.ca.gov/?page_id=21238.

[NAHC] California Native American Heritage Commission. Undated. Determining the Significance of Impacts to Archeological and Historical Resource: California Environmental Quality Act. [online]. Accessed 13 January 2015. http://www.nahc.ca.gov/Article_5.html.

4.5 Effects to Biological Resources

4.5.1 Environmental Setting

The Project will occur in and potentially affect intertidal habitats in Arcata Bay. Table 4.5-1 and Figure 4.5-1 presents the types and areas of intertidal habitats in Arcata Bay and the overlapping areas of existing shellfish culture and shellfish culture proposed by the Project. The Project proposes intertidal culture within 45 ac, which is approximately 0.57% of the 7,918 ac of intertidal habitat in Arcata Bay. Table 4.5-2 shows the area of eelgrass within the Project sites as mapped in 2017 (SHN 2017).

Table 4.5-1. Acres of Intertidal Habitats in Arcata Bay and the Overlapping Areas of Existing Shellfish Culture and Proposed Project Shellfish Culture

Habitat[1]	Existing Culture	Proposed Project Sites			Total Existing and Proposed Culture	Total Habitat in North Bay	Habitat in Existing or Proposed Culture
		1	2	3			
Unconsolidated Sediment	2.20	19.69	3.88	8.72	34.50	2,760.96	1.2%
Macroalgae	0.43	0.00	0.00	3.06	3.49	1,104.02	0.3%
Discontiuous Eelgrass (11-84% Cover)	249.01	9.45	0.00	0.00	258.45	1,959.23	13.2%
Continuous Eelgrass (85-100% Cover)	26.99	0.06	0.00	0.00	27.04	1,961.48	1.4%
Unclassified	14.74	0.00	0.00	0.00	14.74	132.55	11.1%
Total	278.63	29.19	3.88	11.79	338.22	7,918.24	4.3%

[1] Habitat types are based on mapping conducted by NOAA Coastal Services in 2009 with corrections made
Note – Hog Island Oyster Company is pursuing permits for an approximately 39-acre oyster farm in northwest Humboldt Bay. At the time of writing this DEIR, Hog Island Oyster Company's project was in a permitting phase. This area is not included in the table.

Table 4.5-2. Acres of Eelgrass within each Project Site as Mapped in 2017 (SHN 2017).

Site	Acres with Eelgrass	Acres without Eelgrass	Percent of Site with Eelgrass	Total Area
1	0.015641	29.184359	0.054%	29.2
2	0.000049	3.899951	0.001%	3.90
3	0.000296	11.799704	0.003%	11.8
Total	0.015986	44.884014	0.036%	44.9

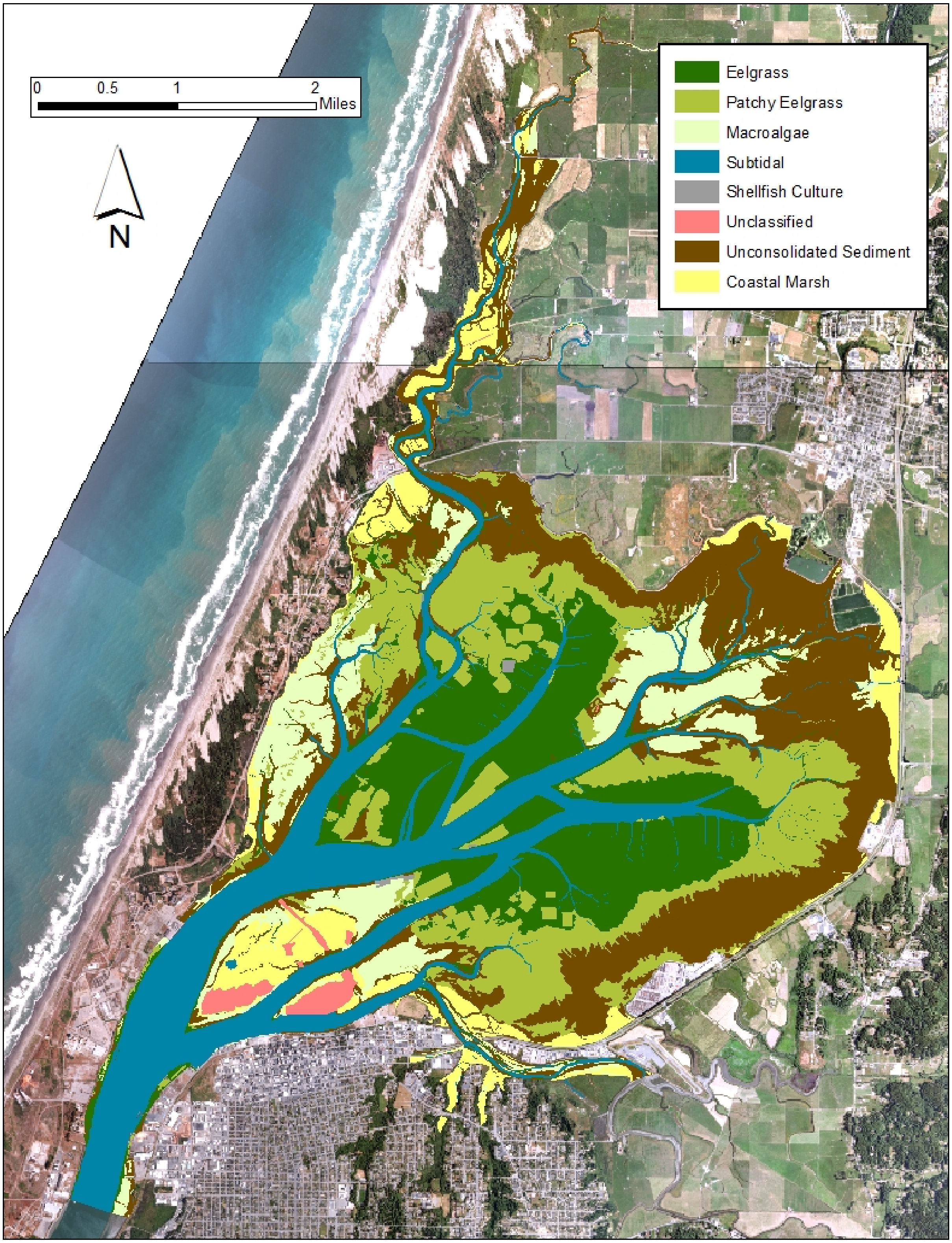

Figure 4.5-1. Arcata Bay and Arcata Bay Habitats as Defined by this EIR (Habitats were Mapped by NOAA Coastal Services in 2009).

4.5.1.1 Subtidal Community

Subtidal habitats occur adjacent to Project sites, in bay channels. The subtidal community in Humboldt Bay is comprised of plant and animal species that are always inundated by water. Due to the numerous aquatic species that occur in the bay and estuaries, "functionally related" species groups have been defined (HBHRCD 2006). Special status fish in this community include tidewater goby (*Eucyclogobius newberryi)*, coastal cutthroat trout (*Oncorhynchus clarkii clarkia)*, coho salmon (*O. kisutch),* steelhead (*O. mykiss)*, Chinook salmon (*O. tshawytscha)*, longfin smelt (*Spirinchus thaleichthys)*, green sturgeon (*Acipenser medirostris*) and eulachon (*Thaleichthys pacificus).* Commercially and recreationally important species that utilize 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 utilize subtidal areas.

4.5.1.2 Intertidal Community

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 (*Polysiphonia*), rockweed (*Fucus* spp.) and sea lettuce (*Ulva* spp.). During high tides, fish, including special status fish species described in this EIR, 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. These species are discussed throughout this EIR.

4.5.2 Special Status Species Potentially Affected

This EIR focuses on plant and animal species that:

- Are likely to occur within or adjacent to the Project sites and potentially be effected by the Project, and
- Are listed under the Endangered Species Act (ESA) or California Endangered Species Act (CESA), or
- Are listed as a Species of Special Concern or Fully Protected Species by the State of California, or
- Are a plant species ranked by the California Native Plant Society as Rank 2 or rarer, or
- Are marine mammals (due to their protection under the Marine Mammal Protection Act [MMPA]).

These species are referred to as "special status species".

No special status plant species have been identified that would potentially be affected by the Project.

4.5.3 Animal Species Potentially Affected

Based on the criteria listed in Section 4.5.2, a literature review, and input from experts, the special status and commercially important animal species determined to be potentially affected by the Project are identified in Table 4.5-3. Brief descriptions of the species requiring detailed analysis in this EIR are provided below. Other species are described where appropriate in the following effects analysis.

Table 4.5-3. Special Status and Commercially Important Animal Species Potentially Affected by the Project

Common Name	Scientific Name	Status
Green sturgeon-southern Distinct Population Segment (DPS)	*Acipenser medirostris*	Federally threatened, State Species of Special Concern
Coho salmon-southern OR/northern CA evolutionary significant unit (ESU)	*Onchorhynchus kisutch*	Federally threatened, State threatened
Northern California steelhead DPS	*Onchorhynchus mykiss*	Federally threatened
California coastal Chinook salmon ESU	*Onchorhynchus tshawytscha*	Federally threatened
Coastal cutthroat trout	*Oncorhynchus clarki clarki*	State species of special concern
Southern eulachon DPS	*Thaleichthys pacificus*	Federally threatened
Longfin smelt	*Spirinchus thaleichthys*	State threatened
Dungeness crab	*Cancer magister*	Commercially important
Pacific herring	*Clupea pallasii*	Commercially important
Rockfish	*Sebastes* spp.	Commercially important
California halibut	*Paralichthys californicus*	Commercially important
Western snowy plover	*Charadrius nivosus nivosus*	Federally threatened
California brown pelican	*Pelecanus occidentalis californicus*	State fully protected species
Marbled Murrelet	*Brachyramphus marmoratus*	Federally threatened, State endangered
California sea lions	*Zalophus californianus*	Protected under the Marine Mammal Protection Act (MMPA)
Harbor seal	*Phoca vitulina*	Protected under the MMPA
Harbor Porpoise	*Phocaena phocaena*	Protected under the MMPA

- This EIR addresses shorebirds and waterfowl collectively, with some discussion of individual species in the effects analysis.

4.5.3.1 Green Sturgeon–Southern DPS

Green sturgeon is a long-lived, slow-growing fish species, which is listed as threatened under the Federal ESA, and as a Species of Special Concern under the California ESA. Mature males range from 4.5–6.5 ft (1.4–2 m) fork length and they do not mature until they are at least 15 years old, while mature females range from 5–7 ft (1.6–2.2 m) fork length and do not mature until they are at least 17 years old (National Marine Fisheries Service [NMFS] 2009). Maximum ages of adult green sturgeon are likely to range from 60–70 years. This species is found along the west coast of Mexico, the United States, and Canada.

The life history of green sturgeon is typical of anadromous fish. They likely spend most of their lives in nearshore oceanic waters, bays (including Humboldt Bay), and estuaries. Spawning occurs in deep pools in "large, turbulent, freshwater river mainstems" (NMFS 2009). Currently, spawning is believed to occur in the Klamath River basin, the Sacramento River, and the South Fork of the Trinity River. Spawning is unlikely to occur in creeks flowing into Humboldt Bay. Green sturgeon adults are regularly observed in channels within Humboldt Bay.

4.5.3.2 Coho and Chinook Salmon, Steelhead Trout and Coastal Cutthroat Trout (Salmonids)

Humboldt Bay supports three salmonid species that are listed as threatened under the Federal ESA: coho salmon, Southern Oregon/Northern Coastal California (SO/NCC) evolutionary significant unit (ESU), the Northern California steelhead trout Distinct Population Segment (DPS), and the California coastal Chinook salmon ESU. The coho salmon SO/NCC ESU is also listed as threatened under CESA. Additionally, Humboldt Bay supports coastal cutthroat trout (*O. clarki clarki*), a California Department of Fish and Wildlife (CDFW) species of special concern.

Salmonid life history is characterized by periods of pelagic conditions, adult upstream migration, spawning and egg development, fry and juvenile development, smolt outmigration, and estuary rearing. Channels within marsh habitats may be of particular importance to subyearling salmonids (*Oncorhynchus spp.*) because of the high insect and invertebrate prey resources and potential refuge from predators (Bottom et al. 2005). Wallace (2006) found significant use of the tidal portions of Freshwater Creek, Elk River, and Salmon Creek (Humboldt Bay tributaries) by juvenile Chinook salmon, coho salmon and steelhead trout. Pinnix et al. (2013) found that in Humboldt Bay, juvenile coho salmon primarily utilize deep channels, channel margins and floating eelgrass mats.

4.5.3.3 Southern Eulachon DPS

The Pacific eulachon is a small anadromous fish from the eastern Pacific Ocean (NMFS 2011). In March 2010, NMFS listed the Southern DPS as threatened under the ESA; the DPS includes populations in Washington, Oregon, and California. Critical habitat was designated in October 2011; in California, critical habitat includes the Mad River (NMFS 2011).

Eulachon spend 3–5 years at sea before returning to freshwater to spawn, from late winter to mid-spring. Eggs are fertilized in the water column, where they then sink and adhere to the river bottom of coarse sand and gravel. Most adults die after spawning. Eggs hatch in 20–40 days, and larvae are carried downstream and "are dispersed by estuarine and ocean currents shortly after hatching" (NMFS 2011).

Eulachon have been documented in Humboldt Bay and nearby coastal rivers such as Redwood Creek and the Mad River. In 1996, the Yurok tribe supported a eulachon sampling effort on the Klamath River of over 110 surveying hours, from early February to early May. No eulachon were observed. Considering the low abundance for over 20 years, CDFW considers the fish to be "nearly extirpated from California" (California Department of Fish and Game [CDFG] 2010).

4.5.3.4 Longfin Smelt

Longfin smelt are estuarine fish listed as threatened under the CESA. Longfin smelt are known to occur in Humboldt Bay, but little is known regarding their distribution, abundance or life history there. It 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.

4.5.3.5 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 (U.S. Fish and Wildlife Service [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 in ocean-fronting beaches (Brindock and Colwell 2011) although small numbers of plovers have been documented nesting in gravel bars of the Eel River (Colwell et al. 2011). Nonbreeding western snowy plovers occasionally occur on the interior of Humboldt Bay (Colwell 1994), but they are expected to occur mainly in the southern portion of the bay on sandier substrates rather than on softer substrates associated with mudflats in the northern portion of the bay. Snowy plovers are expected to occur in the Project area rarely as occasional foragers.

4.5.3.6 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 2011). Breeding occurs in mature, coastal coniferous forest with nests built in tall trees. In California, breeding occurs primarily in Del Norte and Humboldt counties. The loss of old-growth forest is a primary reason for this species' decline (USFWS 1992). In California, marbled murrelets nest in redwoods that are older than 200 years (Nelson 1997). They are also vulnerable to oil spills along the coast. Marbled murrelets can occur in Humboldt Bay as foragers and are expected to primarily occur in the entrance portion of the bay.

4.5.3.7 California Sea Lion

California sea lions (*Zalophus californianus*) are restricted to middle latitudes of the eastern North Pacific. There are three recognized management stocks: (1) the U.S. stock from Canada to Mexico, (2) the western Baja California stock, and (3) the 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 individuals occur in Humboldt Bay.

4.5.3.8 Harbor Seal

Harbor seals (*Phoca vitulina*) are widely distributed throughout the northern Atlantic and Pacific Oceans along coastal waters, river mouths, and bays (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 to the open ocean, and harbor seals can dive to depths of almost 500 meters (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.

4.5.3.9 Harbor Porpoise

Harbor porpoises (*Phocaena phocaena*) are distributed throughout the coastal waters of the North Atlantic and 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 SO/NCC stock that extends from Point Arena 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.

4.5.4 Plans Protecting Biological Resources

In the vicinity of the Project area, numerous riparian habitats and other sensitive natural communities have been identified by city governments, CDFW, and 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. http://www.fws.gov/humboldtbay/
- The Arcata Marsh and Wildlife Sanctuary, owned and managed by the City of Arcata. http://www.cityofarcata.org/departments/environmental-services/water-wastewater/wildlife-sanctuary

- CDFW Wildlife Areas (WA), at the following locations http://www.dfg.ca.gov/lands/wa/region1/index.html: 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 (CGP), Habitat Conservation Plans (HCPs), and recovery plans for listed species.

Local Coastal Plans and other relevant documents include:

- City of Arcata Certified Local Coastal Program (LCP), http://www.cityofarcata.org/departments/building-planning/regulations/certified-local-coastal-program
- Humboldt Bay Area Plan of the Humboldt County LCP, April 1995, http://co.humboldt.ca.us/planning/local_coastal_plans/hbap/hbap.pdf
- Eel River Area Plan of the Humboldt County LCP, May 1995, http://co.humboldt.ca.us/planning/local_coastal_plans/erap/erap.pdf
- Local Coastal Plan Issue Identification Report, September 2003, http://co.humboldt.ca.us/planning/local_coastal_plans/pdf/issueidentificationreport/issue.pdf
- Humboldt Bay National Wildlife Refuge Comprehensive Conservation Plan 2009, http://www.fws.gov/humboldtbay/ccp.html
- HBMP 2007, www.humboldtbay.org

The 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 CGP Biological Resources section 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 area, HCPs and candidate conservation agreement and assurances plans have been written, but none geographically overlap the Project area.

The HBMP (HBHRDC 2007) which is incorporated by reference to this EIR provides guidance to the District regarding management of the bay. Preferred uses in Arcata Bay identified by the plan include (1) continued or heightened protection of Arcata 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.

4.5.4.1 Clean Water Act Section 404 Wetlands

Under Section 404 of the Clean Water Act (CWA), wetlands are "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas" (USEPA 2011). USACE defines three characteristics of wetlands: hydrology, hydrophytic plants, and hydric soils. An area must exhibit all three characteristics to be considered a "jurisdictional wetland." Some areas may perform the functions of wetlands, yet not be delineated as jurisdictional wetlands if they do not exhibit all three wetland characteristics. All of the Project sites are likely to be considered jurisdictional wetlands.

4.5.4.2 California Coastal Act

The Project area is within the California Coastal Commission's area of retained permitting jurisdiction and the Project will require a Coastal Development Permit. The California Coastal Act (CalCA) contains policies to protect marine resources, coastal waters, estuaries, wetlands, water quality, and environmentally sensitive habitat areas.

4.5.5 Definition of Significance and Baseline Conditions

Baseline conditions are those that have been documented at the time that the NOP was published. These conditions are described above as the present conditions of biological resources within and in the vicinity of the Management Area.

The CEQA Guidelines provide direction in evaluating Project impacts and determining which impacts will be significant (Remy et al. 1999). CEQA defines "significant effect on the environment" 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), a project's effects on biotic resources are deemed significant where the 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"
- "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 listed in Appendix G may or may not be significant, depending on the level of the impact. For biological resources, these impacts include whether the Project would:

1. 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.
2. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by CDFW or USFWS.

3. Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.
4. Have a substantial adverse effect on coastal wetlands as defined by the CalCA.
5. 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.
6. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.
7. Conflict with the provisions of an adopted HCP, Natural Community Conservation Planning (NCCP), or other approved local, regional, or state HCP.

4.5.6 Effects Analyses of the Project

This section evaluates possible impacts that would potentially affect biological resources as related to the thresholds described above.

IMPACT BIO-1: Effects of intertidal culture on shorebird species as a result of loss of foraging habitat and alteration of food sources. Humboldt Bay is an important estuary for migrating and wintering shorebirds in the Pacific flyway, and the bay has been designated as an International site in the Western Hemisphere Shorebird Reserve Network. During bay-wide surveys, as many as 32 shorebird species and over 80,000 individuals have been recorded during spring migration (as observed in April 1991) although shorebird counts conducted during the 1990's reflected a decline relative to historic estimates (Colwell 1994). A 2018 survey effort found that the bay and surrounding habitats may be used by >500,000 shorebirds of ~26 species during spring migration alone; most observations were of Western Sandpipers (*Calidris mauri*) (Colwell and Feucht, 2018).

In Humboldt Bay, a suite of non-breeding shorebird species use intertidal mudflat areas for foraging, although their habitat use is differential based on species' morphology, water depth (and thus tidal cycles), and substrate type. In general, shorebirds are very flexible and opportunistic in their diets, 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; 1977; 1979). These birds often concentrate at the edge of the receding tideline, where worms, crustaceans, and bivalves occur close to the surface. Thus, the hydrologic regimes and ecosystem processes that maintain abundant invertebrate populations are more important than the specific invertebrate taxa available. Near the waterline, shorebird microhabitat use typically depends on each species' leg length, as well as the size and shape of their bills. For example, the very shortest-billed semipalmated plovers (*Charadrius semipalmatus*) and black-bellied plovers (*Pluvialis squatarola*) often feed on recently exposed mud, small sandpipers (*Calidris* spp.) 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, 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 forage in exposed areas as well).

Shorebirds in Humboldt Bay also exploit other habitats, particularly agricultural fields, when intertidal mudflats are inundated (Colwell and Dodd 1997; Long and Ralph 2001). Shorebird use of pastures is correlated with 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). In addition to bill shape and leg length, sediment type can dictate where shorebird species forage. 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).

Aquaculture practices in intertidal areas may have the potential to reduce the amount of available foraging habitat for shorebirds through habitat modification (Colwell 1994) and a study on wintering shorebirds conducted in Tomales Bay suggests that some shorebird species can avoid aquaculture areas (Kelly et al. 1996), although those observed effects are likely related to bottom-culture techniques that are no longer used in Humboldt Bay. Foraging resources for shorebirds are altered in two primary ways by shellfish culture: (1) cultured animals and associated bio-fouling organisms can be a food source to birds (Caldow et al. 2007; Forrest et al. 2009), and (2) habitats, and thus food resources, below culture operations can be altered (Trianni 1996; Quintino et al. 2012). Under the Project, intertidal aquaculture would be permitted to occur on a total of 45 acres in Arcata Bay. Shorebirds may use this area when exposed during lower tides.

The placement of cultch-on-longline, basket-on-longline or rack-and-bag infrastructure within intertidal habitats in Arcata Bay could preclude shorebirds from entering all or portions of aquaculture sites, as some species may be wary of objects placed on mudflats. Human disturbance may also preclude shorebirds from using intertidal sites, at least temporarily, as some practices (i.e., rack-and-bag) require approximately two visits per week for maintenance. Some birds may avoid aquaculture beds entirely, or avoid walking or foraging only under longlines (particularly if holding baskets) or rack-and-bags. In such cases birds may utilize rows between aquaculture beds. Alternatively, shorebirds may be attracted to aquaculture areas due to an increase in foraging resources associated with cultured oysters or other organisms that grow on the infrastructure. The presence of shells and disturbance of substrate from site access during maintenance and harvest also increases substrate heterogeneity which may attract or deter shorebird species, depending on foraging techniques used.

Due to variation in foraging technique, sensitivity to structures in intertidal habitats, and social structure (e.g., flocking vs. territorial behavior), it is likely shorebird species will be differentially affected by the Project. The relative importance of Humboldt Bay for migration or for extended non-breeding periods (i.e., as a resource for foraging) differs between shorebird species due to variation in migration strategies. For instance, small sandpipers arrive in Humboldt Bay in large flocks and can be observed numbering in the thousands (Colwell 1994, Colwell and Feucht, 2018), although their residency time in the estuary is short. A study on radio-marked western sandpipers found that the mean length of stay in Humboldt Bay was 3.3 days (Warnock and Bishop 1998), indicating this species uses multiple short flights and stopovers during migration. Contrary to this strategy, long-billed curlews spend long "wintering" periods (i.e., June through March) in Humboldt Bay and establish non-breeding low-tide territories and use agricultural fields, particularly during winter rain periods (Colwell and Dodd 1997). Thus, territorial birds that reside in the bay longer are likely to be more affected by the Project than birds that reside in the bay for short durations and with little fidelity to specific foraging sites.

To date, one study has been conducted in Humboldt Bay comparing low-tide shorebird use of cultch-on-longline plots to adjacent tidal flats not used for aquaculture (Connolly and Colwell 2005). The results indicate greater bird species diversity 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. 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 was potentially related to increased foraging opportunity or an increase of prey density or diversity. One species (black-bellied plover) was more abundant 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. For instance, prey may be less available to black-bellied plovers, due to higher concentrations of shorebirds attracted to the longlines, or prey may be less detectable due to visual obstructions in longline plots.

There are some limitations associated with the Connolly and Colwell (2005) study in terms of its applicability for impact assessment for the Project. First, the study plots were associated with cultch-on-longline beds, but not basket-on-longline or rack-and-bag infrastructure that may be implemented under the Project. Those two aquaculture practices could have the potential to deter shorebirds from using aquaculture beds, more so than cultch-on-longline, as suspended baskets are more likely to obscure visibility and predator detection for shorebirds. Because it is unknown which technique, or combination of techniques, aquaculture operators will utilize, it must be recognized that all methods may be used and shorebirds may respond differently (possibly demonstrating partial or complete avoidance) compared to the cultch-on-longline technique. Also, the spatial scale of the Connolly and Colwell (2005) study may have been inadequate to appropriately assess aquaculture practices on long-billed curlews, as many individuals of this species will occupy non-breeding territories in Humboldt Bay and the study plots were established irrespective of curlew territories. 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 if few territories overlap with study plots (Connolly and Colwell 2005).

Based on the results of the previous study of aquaculture use by shorebirds in Humboldt Bay, some species (and possibly most species) may be unaffected by the Project or could benefit from increased prey abundance under aquaculture beds, while others may tend to avoid aquaculture beds. However, as noted above, no studies have been conducted in regards to shorebird response to the basket-on-longline or rack-and-bag methods, and thus it is possible that some species that would forage under cultch-and-longline may avoid those areas partially or completely. For some species, complete avoidance of aquaculture areas may not result in adverse effects such as increased competition for food and reduced body condition, as many species (e.g., western sandpipers) demonstrate plasticity in selecting stopover sites, thus allowing them to opportunistically exploit food resources when available and facilitating predator avoidance. 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 are able to forage in various locations throughout the bay, demonstrating low site fidelity, foraging habitat is likely not limited during their brief stopovers. Although up to 45 ac of intertidal mudflats could be used for aquaculture under the Project, species exhibiting brief stopovers are unlikely to be affected by loss of habitat if those areas are avoided or utilized.

Other species, long-billed curlews in particular, may be disproportionally affected, as they are large, territorial birds that rely on intertidal foraging areas for extended periods during the non-breeding season. For instance, they are known to occupy territories within proposed intertidal aquaculture areas, particularly Site 3, where approximately 10 curlews maintain foraging territories along the west end of Tuluwat Island. It is unknown how long-billed curlews will respond to aquaculture beds, particularly if rack-and-bag or basket-on-longline methods are used, but it is possible that curlews may be displaced from those areas. Although curlews are known to use pastures as alternative habitats during wet periods, 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 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 could be periodically displaced as much as twice per week by the presence of humans. Large birds, like curlews, experience higher energetic costs when forced to fly than smaller birds, like small sandpipers. Because of this potential habitat loss or degradation, it is possible that the carrying capacity of the bay will be reduced for curlews, such that as many as 10 individuals will no longer be supported as a result of the Project. The wintering population of curlews in Humboldt Bay has been estimated to be approximately 200–300 individuals (Leeman and Colwell 2005), thus the Project could possibly affect up to 5% of the bay-wide population through habitat modification. In the context of their population size, the long-billed curlew range-wide population has been estimated to be 161,181 individuals (Jones et al. 2008).

The potential loss of foraging habitat for curlews would not result in habitat or population-level impacts that are sufficient to meet CEQA criteria for a significant impact. As described above, curlews (due to their territoriality) are more likely to be affected by the Project than other shorebirds, particularly small sandpipers that utilize the bay in large numbers but for short durations. Therefore, the Project is expected to have a less than significant impact on foraging habitat for shorebirds and this impact is considered less than significant without mitigation.

IMPACT BIO-2: Effects of intertidal culture on black brant (*Branta bernicla nigricans*) as a result of loss of foraging habitat and alteration of food sources. Humboldt Bay is an important spring staging site for black brant in the Pacific flyway. Brant rely exclusively on eelgrass during the non-breeding season and their distributions are strongly correlated with the distribution of eelgrass (Moore et al. 2004). Humboldt Bay is one of the most important spring staging areas in the Pacific flyway and represents the most important spring staging site in California (Moore et al. 2004), with most (approximately 60%) of the population having been estimated using Humboldt Bay (Moore et al. 2004). The southern portion of Humboldt Bay (i.e., South Bay) contains the majority of the eelgrass beds within Humboldt Bay, and that region supports the majority (81%, as determined by surveys between 1931 and 2001) of the brant using the bay during spring migration (Moore et al. 2004). Therefore the distribution of brant in the bay appears to be proportional with eelgrass distribution (Moore et al. 2004). Although a reduction in brant use of Humboldt Bay has been attributed to poor eelgrass quality in the past during specific years, hunting pressure and disturbance has likely had a greater effect on brant use (and declines in abundance) in the bay than the overall quality of eelgrass (Moore and Black 2006).

The Project will expand aquaculture operations in 45 ac of intertidal habitats. Aquaculture will occur in areas without eelgrass, which represents low-quality habitat for brant. Areas between aquaculture equipment with eelgrass (or where eelgrass may grow in the future) will be available for foraging brant, but the extent this species will continue to forage in areas with culture and associated human disturbance is unknown. Because they are a hunted species, brant are likely more sensitive to human disturbance than other species, including shorebirds. Although human disturbance is expected to be minimal in most aquaculture areas (e.g., approximately one visit per month for cultch-on-longline and two visits per week for rack-and-bag), brant may avoid areas where aquaculture occurs or use them less. For instance, brant may continue to use culture areas comparably to existing conditions or avoid aquaculture beds because structures impede their ability to take off and land in those areas. Brant may also infrequently use the areas between the narrow rows, possibly walking between them and foraging, but they are likely unable to take off or land in narrow spaces between rows of aquaculture equipment. Brant are less likely to use beds with basket-on-longline culture compared to cultch-on-longline, as brant will likely be more wary to forage between those larger structures.

The proposed aquaculture areas avoid eelgrass. The potential loss of habitat represents a small proportion of foraging habitat available in Arcata Bay and a very small proportion of foraging habitat in the greater Humboldt Bay. Although eelgrass habitat in Arcata Bay represents important spring stopover habitat for the species, the potential loss of a very small proportion of available habitat will not result in a significant impact per the criteria described above for CEQA, and thus the impact is considered less than significant without mitigation.

IMPACT BIO-3: Potential impact to marine mammals from the potential loss of foraging habitat and restrictions to movement due to placement of aquaculture equipment in intertidal areas. Harbor seals breed along the Humboldt County coast and inhabit the region throughout the year (Sullivan 1980). Harbor seals will utilize Humboldt Bay as a pupping and haul-out area; other haul-out sites are located in Trinidad Bay and the mouths of the Mad and Eel Rivers. California sea lions do not breed along the Humboldt County coast; however non-breeding or migrating individuals can occur in Humboldt Bay. Harbor porpoises (*Phocoena phocoena*) 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.

When in Humboldt Bay, marine mammals may occasionally move through general areas of Arcata Bay where aquaculture expansion is proposed. These species are expected to move through, and forage in, the relatively deep channels that occur between shallow intertidal areas rather than the shallower areas where intertidal aquaculture beds will be located. If moving through intertidal areas during high tides, structures are not expected to restrict movements of marine mammals, as these species would readily navigate the culture equipment and move through spaces between equipment. Harbor seals could haul-out on mudflats near intertidal aquaculture beds. However, the placement of off-bottom aquaculture infrastructure will not limit the species' ability to haul-out in Arcata Bay, as the Project area represents a small proportion of the potential areas that can be used for haul-outs. Therefore, impacts to movement and foraging by marine mammals are considered less than significant and this impact is considered less than significant without mitigation.

IMPACT BIO-4: Effects of human disturbance (e.g., boat movement, presence of culture workers) on marine mammals and other wildlife. Aquaculturists will routinely visit leased areas for installation, inspections, planting and harvesting, product grading, and other activities related to aquaculture practices. The number of visits to each site will depend on the types of aquaculture operations that are occurring. In intertidal areas for instance, rack-and-bag methods are labor-intensive and require inspections an average of twice per week. Other methods are less intensive; cultch-on-longline requires only monthly inspections and basket-on-longline requires only six or seven visits per year. For all these activities, noise will be generated from small vessels, movement and maintenance of equipment, and communication among aquaculture workers. Noise from aquaculture practices will be similar to what occurs from other users of the bay including recreational users (e.g., hunters, fishermen, and paddle and motor boaters) and commercial users (e.g., shippers and commercial fishermen).

Shorebirds and wading birds (i.e., herons and egrets [Ardeidae]) frequently forage in intertidal areas during low tide and may occur within or adjacent to intertidal aquaculture areas. During higher tides, diving ducks and piscivorous birds, like western grebes (*Aechmophorus occidentalis*) and double-crested cormorants (*Phalacrocorax auritus*), will forage in channels near culture sites. Marine mammals may also occur in channels near aquaculture sites and harbor seals may occasionally haul-out on mudflats.

Human disturbance associated with visits to aquaculture sites has the potential to flush waterbirds that may be foraging or roosting within or near aquaculture areas. Such disturbance in close proximity to foraging or roosting birds can cause them to flush from the area. It is expected that many birds will become habituated to human disturbance and only flush to nearby sites (and quickly return after the activity is complete) whereas other individuals may flush greater distances if they are more wary of humans or noise. These disturbances have energetic costs associated with flight while birds search for alternative roosts or foraging sites, with larger birds experiencing higher energetic costs. Disturbance could also result in a reduction in foraging efficiency in nearby foraging areas (or alternative sites), increased movement, or altered activity patterns that reduce energy reserves and increase predation risk. An increase in energetic output to acquire foraging resources could ultimately result in lowered reproductive success for some individuals.

Human disturbance could cause marine mammals to flush from their loafing sites on mudflats. As described above for avian species, flushing of marine mammals may increase energetic demands on individuals if they are disturbed from resting areas and forced to relocate. However, haul-out sites and other loafing areas are not limited in Arcata Bay and sensitive species will likely utilize alternative sites that receive infrequent human disturbance. Also, MITIGATION BIO-1 below will require aquaculture farmers to implement an education program that will inform workers of procedures to avoid flushing marine mammals when using boats in Arcata Bay. These include speed restrictions and other marine mammal avoidance techniques. Impacts associated with human disturbance are considered less than significant with implementation of MITIGATION BIO-1.

MITIGATION BIO-1: Educational meetings. Farmers will hold annual educational meetings with their personnel (which will be described in annual reports) where the following procedures relating to marine mammals will be described. These meetings will describe that when marine mammals are encountered, personnel shall:

- Reduce speed and remain at least 100 yards from the animal(s), whether it is on land or in the water.
- Provide a safe path of travel for marine mammals that avoids encirclement or entrapment of the animal(s) between the vessel and the shore.
- If approached closely by a marine mammal while underway, the operator shall reduce speed, place the vessel in neutral and wait until the animal is observed clear of the vessel before making way.
- Avoid sudden direction or speed changes when near marine mammals.
- Never approach, touch, or feed a marine mammal.

During these meetings, farmers will also be directed to properly stow any gear and remove any trash or debris from the bay (including on raft structures) so as to avoid potential entanglement of fish or marine mammal species that may be on or near culture equipment.

IMPACT BIO-5: Effects of artificial lighting on wildlife. The adverse effects of artificial night lighting on terrestrial, aquatic, and marine sources such as birds, mammals and plants are well documented (Rich and Longcore 2006). Some of these effects include altered migration patterns and reproductive and development rates, changes in foraging behavior and predator-prey interactions, altered natural community assemblages and phototaxis (attraction and movement towards light). For instance, when birds fly into lighted areas at night, they may lose their visual cues to the horizon and the lights then become the reference, resulting in disorientation (Herbert 1970). Also, there is evidence that floodlights on structures, such as buildings and bridges, will attract and kill migrant birds, especially on misty and cloudy nights during fall and spring (Overing 1938; Lord 1951; Baldwin 1965; Herndon 1973; Jackson et al. 1974). Fish are known to be attracted to lights as well and increased lighting can alter behavior and increase prey risk. For example, salmonid fry have been observed slowing or stopping out-migration, and thus subjected to increased predation when exposed to bright lights from the shoreline (Tabor et al. 2004). However, no installation of additional lighting associated with the Project will occur. Additionally, an increase in lighting from boat traffic (i.e., from navigation lights) is expected to be insignificant. To reduce the potential for substantial light pollution to occur, MITIGATION BIO-2 will be implemented. With this mitigation, the impact is less than significant.

MITIGATION BIO-2: Shielding of light fixtures. Only lighting fixtures that are fully shielded and designed to minimize off site glare and avoid on water light spillage will be utilized at night.

IMPACT BIO-6: Effects to green sturgeon as a result of potential reduction in prey. Tributaries to Humboldt Bay do not provide spawning habitat for green sturgeon. However, adult green sturgeon are known to temporarily reside in deeper channels in the bay (Lindley et al. 2011). Beamis and Kynard (1997) suggested that green sturgeon move into the estuaries of non-natal rivers to feed; this is likely true for Humboldt Bay. Likely food sources for green sturgeon are small fishes and benthic invertebrates associated with silty/sandy substrates and benthic fauna (NMFS 2009). There are two potential processes by which the proposed mariculture operations could reduce these prey resources: by displacing prey and by causing ecosystem changes that result in reduced prey populations or availability. This first potential effect is discussed below. The second is assessed in IMPACT BIO-7, "Effects on the abundance of suspended organic matter and related effects to other native species."

The proposed intertidal mariculture areas are only temporarily inundated with tidal waters. Small fish that may be prey for green sturgeon likely forage in these areas. However, there is ample space for prey fish species to forage among the mariculture equipment and cultured shellfish. Additionally, cultured shellfish and mariculture equipment can benefit small fish by providing habitat and food resources (see review by Dumbauld et al. 2009). Hence, the Project's proposed shellfish culture is not expected to negatively affect small fish. Additionally, benthic invertebrates have been shown to occur at higher densities in intertidal areas with cultured shellfish than in intertidal areas without cultured shellfish (see review by Dumbauld et al. 2009). Based on available information, there is no reason to conclude that culture would reduce prey resources for green sturgeon.

Based on the above, the Project is not expected to have a significant effect on green sturgeon as a result of prey reduction and no mitigation measures are recommended. Hence, this impact is considered less than significant without mitigation.

IMPACT BIO-7: Effects on the abundance of suspended organic matter and related effects to other native species. Cultured shellfish consume natural food sources that are suspended in the water column including phytoplankton and other organic matter and there is potential competition for this food source between cultured shellfish and other filter feeders. This potential impact is analyzed in Appendix B. Notably, the analysis is based on a substantially higher amount of new shellfish culture than the combination of what currently exists and what is proposed for the Project. The analysis was conducted at a time when there was a substantially larger area of shellfish culture being proposed. The effects of the Project would be less than what was considered in the analysis.

Based on the analysis (Appendix B), while the clearance efficiency calculations indicate that shellfish filtration could exceed the bay's flushing rate if the most conservative flushing rate estimate is used, this does not evaluate the impact on phytoplankton within the bay. The filtration pressure and regulation ratio analyses, which take into account the impact on available phytoplankton, indicate that Humboldt Bay is highly productive and this productivity can withstand substantial cultivated shellfish density without affecting food resources available to other organisms in the bay. The results of the study indicate that increased culture would have some cumulative effect on bay conditions, but that food resources are likely abundant enough that native species would not be significantly affected. Therefore, this potential impact is considered less than significant without mitigation.

IMPACT BIO-8: Effects to green sturgeon as a result of habitat loss or degradation. As described under IMPACT BIO-6 (Effects to green sturgeon as a result of potential reduction in prey), green sturgeon likely utilize Humboldt Bay for feeding and the Project is unlikely to have a negative effect on prey resources for green sturgeon. Green sturgeon habitat would also be affected by placement of culture equipment, which can displace green sturgeon habitat. Current shellfish culture equipment in Humboldt Bay covers approximately 0.76 ac of the bottom (the "benthic footprint") with post, anchors, etc. Structures in the bay not related to shellfish culture (e.g., docks and piles) have not been inventoried well and it is difficult to estimate the benthic footprint of these structures. However, these structures can be characterized as "scattered" along the shoreline and don't appear to occupy a substantial proportion of benthic habitat in the bay. The Project would allow for up to 0.12 ac of additional benthic footprint, including posts associated with intertidal culture operations. Hence, the total benthic footprint of existing and Project shellfish culture equipment would be less than 0.9 ac (which is in addition to the unknown benthic footprint created by non-culture related structures). This represents less than 0.011% of the 7,918 ac of Arcata Bay intertidal habitats. Hence, substantial area for feeding by green sturgeon would remain unaltered. Space between shellfish culture equipment would remain available for use by sturgeon because culture areas are permeable (sturgeon can freely move within the culture areas).

Based on the above, the Project is not expected to have a significant effect on green sturgeon as a result of habitat loss or degradation and this impact is considered less than significant without mitigation.

IMPACT BIO-9: Effects to green sturgeon as a result of entanglement. As an anadromous species, sturgeon swim among diverse structures in rivers, embayments, and the ocean. They have the sensory ability to detect structures and the swimming ability to avoid them. It is expected that green sturgeon would not collide or become entangled with mariculture equipment or cultured shellfish. Shellfish culture has occurred for decades in West Coast embayments where sturgeon occur, and there is no known record (anecdotal or otherwise) of a sturgeon ever becoming entangled in mariculture equipment. No impact is expected.

IMPACT BIO-10: Effects on wetland functions. Wetlands, including in Humboldt Bay, provide numerous functions such as primary production, flood protection, nutrient removal/transformation, wildlife habitat, and recreational opportunities. These functions are assessed separately throughout this EIR. The addition of shellfish culture activities to a wetland does not preclude the functions of that wetland. In areas with shellfish culture; plants grow, flood protection functions continue, nutrients are removed and transformed and recreational activities can persist. As such, the Project is not expected to have a significant effect on wetland functions and this impact is considered less than significant without mitigation.

IMPACT BIO-11: Effects on eelgrass. Humboldt Bay contains approximately 45% of California's eelgrass habitat (Gilkerson 2008) and eelgrass is one of the most abundant habitats in Arcata Bay, densely covering approximately 1,898 ac of Arcata Bay's 9,587 ac of intertidal habitats. According to Schlosser and Eicher (2012) "Past records suggest that eelgrass distribution in Humboldt Bay has retained the same general footprint over the last 150 years, with some year-to-year fluctuations" and "The year-to-year fluctuations noted by numerous investigators occur primarily at the upper margins of continuous eelgrass beds-i.e., in some years, eelgrass extends higher in the intertidal zone than in other years." Based on data reported in Schlosser and Eicher (2012), mapped eelgrass in North Bay (Arcata Bay) has ranged from a minimum of 840 ac in 1959 to a maximum of 3,577 ac in 2009. However, comparing mapped eelgrass between years may not be very 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. In Humboldt Bay, eelgrass has critical ecological functions and is important to numerous fish and wildlife species including species listed under the state and federal ESAs. The ecological functions of eelgrass in Humboldt Bay are described well in the HBMP EIR (HBHRCD 2006) which is incorporated by reference to this EIR.

Areas in Humboldt Bay that support eelgrass are considered special aquatic sites under the 404(b)(1) guidelines of the CWA (40 CFR 230.43). Under the Magnuson-Stevens Fishery Conservation and Management Act, eelgrass is designated as Essential Fish Habitat for federally-managed fish species within the Pacific Coast Groundfish and Pacific Coast Salmon Fisheries Management Plans. Also, under the Magnuson-Stevens Fishery Conservation and Management Act eelgrass is considered a Habitat Area of Particular Concern. In 2014, NMFS released a California eelgrass mitigation policy which contains recommendations for managing eelgrass in California (NMFS 2014).

The Project is designed to avoid impacts to eelgrass to the maximum extent possible. The Project sites were identified with specific consideration towards their ability to support shellfish culture without impacting eelgrass. Although eelgrass does occur within some of the sites, it will be largely avoided with implementation of MITIGATION BIO-3, BIO-4 and BIO-5.

MITIGATION BIO-3: **Eelgrass avoidance by boats.** Boat traffic will be routed around eelgrass beds to minimize the potential for damage to eelgrass from propellers and hulls. Site descriptions will be prepared for each culture site and will describe boat routes that shellfish farm workers will use to avoid eelgrass.

MITIGATION BIO-4: Eelgrass avoidance of culture equipment. Prior to placement of shellfish culture equipment, eelgrass will be mapped and a 30 foot buffer will be placed around eelgrass plants. Shellfish culture will not occur within these areas. Aquaculture equipment will only be placed during the months of July and August, when eelgrass is at its maximum extent to ensure avoidance of eelgrass habitat.

MITIGATION BIO-5: **Deposition of shells.** Shellfish farm operators will not intentionally deposit shells or any other material on the bay floor. Natural deposition of shells and other materials will be minimized to the maximum extent feasible.

With incorporation of these mitigation measures, it is expected that most potential impacts to eelgrass will be avoided. However, there may still be some impacts. Eelgrass may be trampled by farm workers or accidently come into contact with boat hulls and/or propellers. Additionally, the presence of culture equipment and cultured animals may have some effect on circulation patterns and sedimentation, which could have a negative or positive affect on eelgrass distribution. Overall, Project impacts may result in some minor decrease in the density and/or distribution of eelgrass plants. However, with the mitigation measures described above, a substantial adverse effect to eelgrass is not expected. Hence, this impact is considered less than significant with mitigation.

IMPACT BIO-12: Potential effect to eelgrass by constraining its expansion into higher elevation areas as a result of sea level rise. The co-occurrence of eelgrass and off-bottom shellfish culture in Humboldt Bay is well documented (Rumrill and Poulton 2004). However, eelgrass can be less dense when it co-occurs with cultured shellfish (Rumrill and Poulton 2004). The Project's objective is to avoid impacts to eelgrass. However, if eelgrass moves into areas where culture occurs, due to sea level rise or other factors, then the eelgrass and shellfish culture will be expected and allowed to co-exist. Eelgrass density may be reduced due to shading, trampling or other activities. However, it is expected that eelgrass will persist within these culture areas as it has in other culture areas. Based on the above, this impact is considered less than significant without mitigation.

IMPACT BIO-13: Potential impacts on Pacific herring spawning sites. Pacific herring spawn on eelgrass in Humboldt Bay and can spawn on shellfish culture equipment. Maintenance of shellfish culture equipment has the potential to disturb spawning herring and herring eggs. Additionally, there has not been research regarding survival rates of eggs deposited on shellfish culture equipment versus eelgrass or other structure.

The project sites were designed to avoid eelgrass. Furthermore, with implementation of MITIGATION BIO-3, BIO-4 and BIO-5, the Project is not expected to significantly reduce eelgrass available for spawning herring. Additionally, with MITIGATION BIO-6, it is expected that herring will be able to successfully reproduce with eggs deposited on shellfish culture equipment; though the reproductive success rate is unknown. This impact is less than significant with mitigation.

MITIGATION BIO-6: Spawning herring avoidance. During the herring spawning season (December, January and February) shellfish farmers will visually inspect shellfish culture equipment to be worked on prior to harvesting, planting or maintenance to determine if herring have spawned. If herring spawning has occurred then the harvesting, planting or maintenance will be postponed for two weeks on the beds where spawning occurred in order to allow for successful reproduction.

IMPACT BIO-14: Potential for cultured shellfish to naturalize or establish self-sustaining populations outside of cultivation and the effects of this naturalization on native marine species and communities. Successful spawning of Pacific oysters south of Wilapay Bay, WA is believed to be rare (Carlton 1992). This is likely also true for Kumamoto oysters, as neither species has become established in Humboldt Bay outside of culture areas. These species have been cultured in Humboldt Bay for decades without evidence of propagation in the bay to the detriment of other species or habitats. The impact is less than significant.

IMPACT BIO-15: Effect on benthic habitat and communities from the shellfish culture equipment and cultured shellfish, including initial equipment installation activities, posts and material staging. Shellfish culture will affect benthic habitat. Hosack et al. (2006) found that structured habitats (both eelgrass and oyster aquaculture) supported more diverse and dense populations of epibenthic and benthic invertebrates. Additionally, equipment will displace benthic habitat used by animals, including polychaetes, crustaceans and mollusks. Benthic habitat that will be displaced by Project equipment is also used for foraging by bird and fish species. Current shellfish culture equipment in Humboldt Bay covers approximately 0.76 ac of the bottom (the "benthic footprint") with post, anchors, etc. Structures in the bay not related to shellfish culture (e.g., docks and piles) have not been inventoried well and it is difficult to estimate the benthic footprint of these structures. However, these structures can be characterized as "scattered" along the shoreline and don't appear to occupy a substantial proportion of benthic area in the bay. The Project would allow for approximately 0.12 ac of additional benthic footprint. The total benthic footprint of existing and Project shellfish culture equipment would be less than 0.9 ac (which is in addition to the unknown benthic footprint created by non-culture related structures). This represents less than 0.011% of the 7,918 ac of Arcata Bay intertidal habitat. Particularly due to the relatively small spatial extent of this benthic footprint, this impact is considered less than significant without mitigation.

IMPACT BIO-16: Potential impacts to submerged aquatic vegetation and benthic habitat resulting from bottom scour and outboard motor contact associated with support vessel operations and trampling by workers. Table 2.7-1 depicts the number of visits per year expected for each potential culture method. It is expected that there will be some impacts to submerged aquatic vegetation and benthic habitat resulting from bottom scour and outboard contact associated with work vessels and trampling by workers. However, effects are expected to be temporary (i.e., vegetation and benthic habitats are expected to recover after disturbance) and the spatial extent of the impact is expected to be small relative to the area of submerged aquatic vegetation and benthic habitats in Arcata Bay. It is difficult to estimate the area that will be affected, but is reasonable to assume that it will be less than 0.2 ac per year. With consideration towards the 7,918 ac of intertidal habitat in Arcata Bay, this impact is considered less than significant without mitigation.

IMPACT BIO-17: Potential biological effects of the addition of shellfish culture structures due to potential changes in light transmission through the water column, water flow and sediment transport. To some extent, culture equipment will reduce light transmission through the water column. This could potentially affect primary productivity in the water column as well as benthic productivity. With MITIGATION BIO-3–5 the effects to eelgrass are expected to be discountable. Additionally, water clarity in Humboldt Bay is naturally very low. Measurements by Barnhart et al. (1992) showed that in several areas the maximum depth to which 1% of surface illumination penetrates is less than an average four ft. Culture equipment could also reduce water flow rates and result in changes to sedimentation patterns; sediment may seasonally accumulate and erode. This is not expected to have any significant ecological effects and sea level rise may compensate for any net elevation increases by increasing the depth of water in the bay. Existing and proposed Project intertidal culture consists of up to 338 ac of Arcata Bay's 7,918 ac of intertidal habitat. Hog Island Oyster Company is proposing an additional 39 ac intertidal farm. This is a considerable proportion of Arcata Bay. However, as described above, the effects are not expected to be detrimental, consisting of some reduction in light transmission, and potential sediment erosion and accumulation. This is not expected to result in a substantial effect to the ecological value of the bay or biological resources and hence this impact is less than significant without mitigation.

IMPACT BIO-18: Impact on the distribution and dispersal of non-native invertebrate fouling species. Hard substrate will be added by the Project in the form of shellfish shells, ropes/lines, baskets, posts and stakes. This substrate will attract both non-native and native fouling organisms. During a study by Boyle et al. (2006) of fouling organism composition and succession at Woodley Island, Humboldt Bay, 34% of all species identified were non-native. It is expected that fouling organisms of shellfish and shellfish culture equipment will also be both native and non-native. This effect is considered neutral as it benefits both natives and non-natives in a similar composition as at other hard substrate. However, there is the potential for activities that involve removal of fouling organisms to further disperse non-native fouling organisms. Certain species such as colonial sea squirts in the genus *Didemnum* may disperse with currents, reproduce, and further spread their distribution. The extent that this may actually occur is unknown and warrants research. However, as a precautionary approach, MITIGATION BIO-7 will substantially reduce opportunities for dispersal and with this mitigation measure the impact is less than significant.

MITIGATION BIO-7: Bio-fouling organism removal. All bio-fouling organism removal operations shall be carried out onshore or on a vessel. All bio-fouling organisms removed during these cleaning operations shall be disposed of at an appropriate upland facility.

IMPACT BIO-19: Conflicts with local policies, particularly those described in the Humboldt Bay Management Plan which is a guidance document for the District and the LCPs of the County of Humboldt, City of Eureka and City of Arcata. The Project is consistent with these policies. Additionally, the Project has many design components that limit its effect on ecological resources, consistent with Local Coastal Plans. Funding for the Project was approved by the County Board of Supervisors and District Commissioners, indicating their support for the Project. There is no impact.

4.5.7 Assessment of Alternatives

The alternatives are discussed below. Table 4.5-4 compares impacts under each alternative.

4.5.7.1 Alternative 1. Reduced Footprint

With implementation of Alternative 1, maintenance needs would be reduced and therefore there would be less potential impacts associated with boats (e.g., prop scour) and people (e.g., trampling) at the sites. Additionally, there would be less surface area and volume of culture equipment, less benthic footprint and lower biomass of cultured shellfish. As such, the types of biological impacts would be the same but the magnitude would be reduced. The same mitigation measures as proposed for the Project would be required to reduce impacts to less than significant. Specific differences in culture characteristics are shown in Tables 3.1-1 and 3.2-1.

4.5.7.2 Alternative 2. Basket-on-Longline Method Only

With implementation of Alternative 2, maintenance needs would be reduced and therefore there would be less potential impacts associated with boats (e.g., prop scour) and people (e.g., trampling) at the sites. Additionally, there would be less surface area and volume of culture equipment, less benthic footprint and lower biomass of cultured shellfish. As such, the types of biological impacts would be the same but the magnitude would be reduced. The same mitigation measures as proposed for the Project would be required to reduce impacts to less than significant. Specific differences in culture characteristics are shown in Tables 3.1-1 and 3.2-1.

4.5.7.3 Alternative 3. No Project

Under the no project alternative there would not be any new potential impacts to biological resources. Existing shellfish culture in Humboldt Bay and related potential impacts would likely continue.

Table 4.5-4. Levels of significance of the Project and alternatives for biological resources.

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
BIO-1: Effects of intertidal culture on shorebird species as a result of loss of foraging habitat and alteration of food sources.	LS	LS	LS	NI
BIO-2: Effects of intertidal culture on black brant (*Branta bernicla nigricans*) as a result of loss of foraging habitat and alteration of food sources.	LS	LS	LS	NI
BIO-3: Potential impact to marine mammals from the potential loss of foraging habitat and restrictions to movement due to placement of aquaculture equipment in intertidal areas.	LS	LS	LS	NI
BIO-4: Effects of human disturbance (e.g., boat movement, presence of culture	LSM	LSM	LSM	NI

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
workers) on marine mammals and other wildlife.				
BIO-5: Effects of artificial lighting on wildlife.	LSM	LSM	LSM	NI
BIO-6: Effects to green sturgeon as a result of potential reduction in prey.	LS	LS	LS	NI
BIO-7: Effects on the abundance of suspended organic matter and related effects to other native species.	LS	LS	LS	NI
BIO-8: Effects to green sturgeon as a result of habitat loss or degradation.	LS	LS	LS	NI
BIO-9: Effects to green sturgeon as a result of entanglement.	NI	NI	NI	NI
BIO-10: Effects on wetland functions.	LS	LS	LS	NI
BIO-11: Effects on eelgrass.	LSM	LSM	LSM	NI
BIO-12: Potential effect to eelgrass by constraining its expansion into higher elevation areas as a result of sea level rise.	LS	LS	LS	NI
BIO-13: Potential impacts on Pacific herring spawning sites.	LSM	LSM	LSM	NI
BIO-14: Potential for cultured shellfish to naturalize or establish self-sustaining populations outside of cultivation and the effects of this naturalization on native marine species and communities.	LS	LS	LS	NI
BIO-15: Effect on benthic habitat and communities from the shellfish culture equipment and cultured shellfish, including initial equipment installation activities, posts and material staging.	LS	LS	LS	NI
BIO-16: Potential impacts to submerged aquatic vegetation and benthic habitat resulting	LS	LS	LS	NI

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
from bottom scour and outboard motor contact associated with support vessel operations and trampling by workers.				
BIO-17: Potential biological effects of the addition of shellfish culture structures due to potential changes in light transmission through the water column, water flow and sediment transport.	LS	LS	LS	NI
BIO-18: Impact on the distribution and dispersal of non-native invertebrate fouling species.	LSM	LSM	LSM	NI
BIO-19: Conflicts with local policies, particularly those described in the Humboldt Bay Management Plan which is a guidance document for the District and the LCPs of the County of Humboldt, City of Eureka and City of Arcata.	NI	NI	NI	NI

NI=No Impact, LS=Less than Significant without Mitigation, LSM=Less than Significant with Mitigation, PS=Potentially Significant

4.5.8 References

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4.6 Effects to 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 CalCA, and on policies within the Humboldt County General Plan (CGP) and its supporting documents.

4.6.1 Summary of Present and Possible Future Conditions

Present visual resource conditions are described in numerous documents including:

- The Humboldt CGP, Chapter 10, Section 10.7 Scenic Resources (Humboldt County Planning and Building Department [HCPBD] Adopted October 23, 2017)
- Local Coastal Plan Issue Identification Report, September 2003 (HCPBD 2003).
- The CGP, Volume II, Humboldt Bay Area Plan of the Humboldt County LCP (Certified 1982, County of Humboldt 2014 edition)
- The CGP, Volume II, Eel River Area Plan of the Humboldt County LCP (Certified April 1982, County of Humboldt 2014 edition)

As stated in Appendix D of the Humboldt County General Plan EIR (Natural Resources and Hazards Report, revised April 20, 2017) scenic resources include "coastline views, mountains, hills, ridgelines, inland water features, forests, agricultural features, idyllic rural communities", and combinations of these features. These resources are contained within properties such as Humboldt County parks, state parks, open space and wildlife refuge areas, private farmlands and ranches, and private and federal forest. Specific to the Project, scenic resources of interest are coastline views and inland water features.

The Humboldt Bay shoreline is irregular and topographically flat with saltmarsh and mudflats that support both native and non-native vegetation. The many streams and sloughs that empty into Humboldt Bay provide a land/water interface that is generally visually appealing. 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. Recreational activities that occur in the immediate area include fishing, hunting, boating, kayaking, birding, and hiking.

The future conditions of visual resources are largely dependent on the scenic resources goals and policies defined in the Humboldt CGP (HCPBD 2017), as informed by the Local Coastal Plans of the Humboldt Bay Area. The Humboldt CGP recognizes scenic area types that are characteristic of Humboldt County. Relevant to the Project are these types:

- Open space and agricultural lands
- Scenic roads (several state highways are eligible for official designation, including Highway 101 for its entire route in Humboldt County)
- Coastal scenic and coastal view areas
- Community separators

Policies and goals in the Humboldt CGP (HCPBD 2017) that will affect and determine future protection of scenic area types include:

SR-G1. Conservation of Scenic Resources. Protect high-value scenic forest, agriculture, river, and coastal areas that contribute to the enjoyment of Humboldt County's beauty and abundant natural resources.

SR-G2. Support for a Designated Scenic Highway System. A system of scenic highways that increase the enjoyment of, and opportunities for, recreational and cultural pursuits and tourism in the County without detracting from allowed uses.

SR-P1. Working Landscapes. Recognize the scenic value of resource production lands.

SR-P2. Development in Mapped Scenic Areas. In mapped scenic areas, new discretionary and ministerial development shall be consistent with and subordinate to natural contours, hilltops, tree lines, bluffs and rock outcroppings. Visible disturbance and interruption of natural features shall be minimized to the extent feasible.

SR-P3. Scenic Highway Protection. Protect the scenic quality of designated Scenic Highways for the enjoyment of natural and scenic resources, coastal views, landmarks, or points of historic and cultural interest.

Visual effects from the Project will include changes in visual character to the Project area due to:

- The presence of mariculture workers and vessels, and

- The addition of the shellfish culture equipment and cultured shellfish to intertidal locations in Humboldt Bay.

4.6.2 Definition of Significance and Baseline Conditions

Baseline conditions are those conditions existing at the time the NOP was circulated. 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 CGP and its supporting documents.

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

- Has a substantial adverse effect on a scenic vista,
- Substantially damages scenic resources, including trees, rock outcroppings, and historical buildings within a state scenic highway,
- Substantially degrades the existing visual character or quality of the site or surroundings, or
- Creates a new source of substantial light or glare.

The Humboldt Bay Area Plan includes additional criteria to determine significance. 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.

4.6.3 Effects Analyses of the Project

Potentially significant Project effects and related mitigation measures are described below.

IMPACT AV-1: Effect on scenic vistas and visual character from the presence of mariculture workers and vessels.

Human presence and vessel traffic at the Project sites primarily consists of recreational users, for example, boaters, fishermen and hunters. The presence of mariculture workers and increased vessel traffic will have temporary effects on the scenic vistas at these sites. Table 2.7-1 shows the estimated recurrence of visits by shellfish culturists to Project sites. Project sites are located as close as 0.15 miles from transportation corridors including Highway 255; due to the distance from shore, the appearance of workers at these intertidal sites would be overwhelmed by the extensive saltmarsh, mudflat, and water between observers and subjects, rendering the workers and vessels difficult to see. Sites 2 and 3 are near the east end of the westernmost span of the Samoa Bridge (Highway 255), and visible to passing traffic, pedestrians and bicyclists. However, there is also a major navigation channel, with frequent 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 these uses are consistent with what already occurs and is expected in Humboldt Bay. Hence, the impact is less than significant without mitigation.

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

The project sites do not currently have shellfish culture equipment in place. The shellfish culture equipment to be placed will be similar in scale and materials as the existing equipment in the bay. Mariculture equipment has a low profile; elevated above the substrate by 1–3 ft. Furthermore, culture equipment is placed at lower intertidal elevations making the equipment visible only during low tides. Project sites are located as close as 0.15 mi from Highway 255; due to the distance from shore, the view of shellfish culture equipment at the sites would be a very small portion of the extensive saltmarsh and mudflat features in the bay thereby rendering them difficult to see from typical vantage points, with minimal visual effect (Figures 4.6-1 through 4.6-5). Sites 2 and 3 are located on the north and east sides of Tuluwat Island near the westernmost span of the Samoa Bridge (Highway 255). Shellfish culture equipment would be easily observed at this site.

Figure 4.6-1. Location and direction of photo shown in Figure 4.6-2, of Site 1.

Figure 4.6-2. View of Site 1 from the location and direction shown in Figure 4.6-1.

Figure 4.6-3. Location and Direction of Photos Shown in Figures 4.6-4 and 4.6-5 of Sites 2 and 3.

Figure 4.6-4. View of Site 2 from the Location and Direction Depicted in Figure 4.6-3.

Figure 4.6-5. View of Site 3 from the Location and Direction Depicted in Figure 4.6-3.

The addition of shellfish culture equipment will alter the visual characteristics of the Project sites and will add to the visual effect of the existing shellfish culture equipment in Arcata Bay. This impact is considered less than significant without mitigation due to the low profile of the proposed shellfish culture equipment; the historical presence of shellfish culture in Arcata Bay and because these uses are consistent with what already occurs and is expected in Humboldt Bay.

IMPACT AV-3: Effects of glare and artificial lighting. The equipment proposed for placement will not be constructed of materials which produce substantial amounts of glare. Increased artificial lighting will result from the use of workers using flashlights or headlamps and by navigation lights on vessels. Such lighting would be transient and is considered a less than significant impact.

With the implementation of MITIGATION BIO-2, which will reduce off site glare of lighting, the visual effect is considered less than significant.

MITIGATION BIO-2: Shielding of light fixtures. Only lighting fixtures that are fully shielded and designed to minimize off site glare and avoid on water light spillage will be utilized at night.

4.6.4 Assessment of Alternatives

Project alternatives are discussed below. Table 4.6-1 compares the potential impacts of the alternatives.

4.6.4.1 Alternative 1. Reduced Footprint

With implementation of Alternative 1, maintenance needs would be reduced and therefore there would be less visual impacts associated with staff and boats visiting the sites. Additionally, there would be less surface area and volume of culture equipment, further reducing visual impacts. As such, the types of impacts would be the same but the magnitude would be reduced. The same mitigation measures as proposed for the Project would be required to reduce impacts to less than significant.

4.6.4.2 Alternative 2. Basket-on-Longline Method Only

With implementation of Alternative 2, maintenance needs would be reduced and therefore there would be less potential impacts associated with staff and boats visiting the sites. As such, the types of impacts would be the same but the magnitude would be reduced. The same mitigation measures as proposed for the Project would be required to reduce impacts to less than significant.

4.6.4.3 Alternative 3. No Project

Under the no project alternative there would not be any new potential impacts to aesthetic and visual resources. Existing shellfish culture in Humboldt Bay and related potential impacts would likely continue.

Table 4.6-1. Levels of Significance of the Project and Alternatives for Potential Aesthetic and Visual Resource Impacts

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
AV-1: Effect on scenic vistas and visual character from the presence of mariculture workers and vessels.	LS	LS	LS	NI
AV-2: Effect on scenic vistas and visual character from the presence of shellfish culture equipment.	LS	LS	LS	NI
AV-3: Effects of glare and artificial lighting.	LSM	LSM	LSM	NI

NI=No Impact, LS=Less than Significant without Mitigation, LSM=Less than Significant with Mitigation, PS=Potentially Significant

4.7 Effects to 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.

4.7.1 Background and Setting

The Project is located in the North Coast Air Basin (NCAB). Air quality regulation in the NCAB is the responsibility of the North Coast Unified Air Quality Management District (AQMD) pursuant to the Federal Clean Air Act (42 USC § 7401 *et seq*.) and the comparable state law (Health and Safety Code § 39000 *et seq*.). 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 "nonattainment" for that standard. The NCAB is in attainment status for all federal standards for criteria pollutants and in attainment status for all state standards except for suspended particulate matter smaller than 10 micrometers (PM_{10}) (Table 4.7-1).

Table 4.7-1. Air Quality Status in the North Coast Air Basin

Pollutant	Federal Standard Status	State Standard Status
Carbon Monoxide	Attainment	Attainment
Hydrogen Sulfide	(No Federal Standard)	Attainment
Lead	Attainment	Attainment
Nitrogen Dioxide	Attainment	Attainment
Ozone	Attainment	Attainment
Particulate (PM_{10})	Attainment	***Non-Attainment***
Sulfates	(No Federal Standard)	Attainment
Sulfur Dioxide	Attainment	Attainment
Vinyl Chloride	(No Federal Standard)	Attainment

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. 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. AQMD has adopted "Regulation 1," which stipulates requirements for ainir quality management within the NCAB.

4.7.2 Definition of Significance and Baseline Conditions

The thresholds of significance for potential air quality impacts are based on the extent that the Project will (a) directly interfere with the attainment of long-term air quality objectives identified by AQMD; (b) contribute pollutants that would violate an existing air quality standard, or contribute to a non-attainment of air quality objectives in the NCAB; (c) produce pollutants that would contribute as part of a cumulative effect to non-attainment for any priority pollutant; (d) produce pollutant loading near identified sensitive receptors that would cause locally significant air quality impacts; or (e) release odors that would affect a number of receptors.

4.7.3 Effects Analysis of the Project

The Project would create a small amount of emission from up to approximately 5 small boats that are expected to be used for Project operations. It would not create any substantial pollution concentrations or objectionable odors. Additionally, there are no sensitive receptors or a substantial number of people in the vicinity of the Project sites.

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 up to 5 small boats being used in the bay. The vessel engines would contribute to a minor net increase in emissions of particulate matter. Given the small size and limited quantity of vessels, their contribution to PM_{10} levels in Humboldt Bay is likely negligible, even without mitigation.

Moreover, the District lacks direct jurisdiction over air quality, and thus lacks direct authority to require mitigation for potential air quality impacts. However, AQMD regulates vessel engine emissions pursuant to several air quality plans. CEQA addresses circumstances such as this through reliance by lead agencies on the regulatory oversight of responsible agencies carrying out statewide policy. Specifically, State CEQA Guidelines Section 15064(h) establishes a procedure that allows lead agencies, including the District, to rely on the environmental standards promulgated by other regulatory agencies, such as AQMD, with respect to pollutant regulation. AQMD has adopted several air quality management plan elements, including a "PM_{10} Attainment Plan." MITIGATION AQ-1 would require compliance with AQMD regulations and with this mitigation measure this impact is considered less than significant.

MITIGATION AQ-1: Compliance with air quality regulations. Culturists shall consult with AQMD with respect to the requirements of adopted AQMD regulatory plans and shall comply with the requirements of all adopted air quality plans, including plans covering particulate emissions, and shall implement all actions required by AQMD. This mitigation measure will be incorporated into the District's lease requirements for Lessees.

4.7.4 Assessment of Alternatives

Alternatives are discussed below. Potential impacts of the project and alternatives are presented in Table 4.7-2.

4.7.4.1 Alternative 1. Reduced Footprint

With implementation of Alternative 1, maintenance needs would be reduced and therefore there would be less impacts to air quality. As such, the types of impacts would be the same but the magnitude would be reduced. The same mitigation measure as proposed for the Project would be required to reduce impacts to less than significant.

4.7.4.2 Alternative 2. Basket-on-Longline Method Only

With implementation of Alternative 2, maintenance needs would be reduced and therefore there would be less impacts to air quality. As such, the types of impacts would be the same but the magnitude would be reduced. The same mitigation measure as proposed for the Project would be required to reduce impacts to less than significant.

4.7.4.3 Alternative 3. No Project

Under the no Project alternative, there would be no impact on air quality, but existing uses and related impacts to air quality in the bay would continue.

Table 4.7-2. Levels of Significance of the Project and Alternatives for Potential Air Quality Impacts

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
AQ-1: Contribution to PM_{10} levels	LSM	LSM	LSM	NI

NI=No Impact, LS=Less than Significant without Mitigation, LSM=Less than Significant with Mitigation, PS=Potentially Significant

4.8 GHG Emissions

4.8.1 Setting

4.8.1.1 State

California has adopted statewide legislation to address various aspects of climate change and GHG emissions. Much of this legislation establishes a broad framework for the State's long-term GHG reduction and climate change adaptation program. The governor has also issued several executive orders (EOs) related to the State's evolving climate change policy. Of particular importance are Assembly Bill (AB) 32 and Senate Bill (SB) 32, which outline the State's GHG reduction goals of achieving 1990 emissions levels by 2020 and a level 40 percent below 1990 emissions levels by 2030. In the absence of federal regulations, control of GHGs is generally regulated at the state level. It is typically approached by setting emission reduction targets for existing sources of GHGs, setting policies to promote renewable energy and increase energy efficiency, and developing statewide action plans.

4.8.1.2 Humboldt County

Humboldt County's *General Plan* was adopted in 2017. The General Plan's Air Quality Element contains additional policies related to air quality that are relevant to the GHG emissions issues associated with the Project. These policies are as follows:

- Goal AQ-G4 GHGs: Successful mitigation of GHGs associated with the General Plan to levels of non-significance as established by the Global Warming Solutions Act and subsequent implementation of legislation and regulations.
- Policy AQ-9P County CAP: Through public input and review, develop and implement a multi-jurisdictional CAP to achieve reductions in greenhouse gas emissions consistent with the state Global Warming Solutions Act and subsequent implementing legislation and regulations
- Policy AQ-P11 Review of Projects for GHG Emission Reductions: The County shall evaluate the GHG emissions of new large scale residential, commercial and industrial projects for compliance with state regulations and require feasible mitigation measures to minimize GHG emissions.
- Standard AQ-S2 Evaluate GHG Impacts: During environmental review of large scale residential, commercial and industrial projects, include an assessment of the project's GHG emissions and require feasible mitigation consistent with best practices documented by the California Air Pollution

Control Officers Association in their 2008 white paper "CEQA & Climate Change" or successor documents.

- Implementation Measure AQ-IM3 County-wide CAP: Develop and implement a CAP that effectively mitigates the carbon emissions attributable to the General Plan, consistent with the requirements of the state Global Warming Solutions Act and subsequent implementing legislation and regulations.
- Implementation Measure AQ-IM5 GHG Emissions: Update the General Plan and Land Use Ordinances, as appropriate, to reflect the adopted countywide CAP and the new state laws and regulations for GHG emissions when they become available.

4.8.1.3 City of Eureka

The City of Eureka's *2040 General Plan* was adopted in October 2018 and establishes a roadmap for long-term physical, social, and economic future for the city. It includes goals, policies, and programs to direct land use and development decisions, manage resources, deliver public services, and provide infrastructure. The General Plan's Air Quality Element contains goals, policies, and programs related to GHG emissions. These policies are as follows:

- Goal AQ-1.1 Regional Coordination: Cooperate with the North Coast Unified Air Quality Management District, Redwood Coast Energy Authority, and other agencies to develop a consistent and effective approach to air quality planning and management, as well as to reduce GHG emissions and air quality impacts in the region.

- Goal AQ-1.2 GHG Reduction: Continue to work with Redwood Coast Energy Authority to implement appropriate measures to reduce regional greenhouse gas emissions in Eureka, such as incentivizing the use of alternative energy sources, and periodically update the City's GHG inventory and reduction plan, consistent with State reduction targets and regulations.

- Goal AQ-1.14 Education and Outreach: Provide educational opportunities and assist in engaging with the public regarding air quality, its health impacts, and potential actions that people can take to improve air quality and minimize GHG emissions.

- Implementation AQ-1: Prepare a CAP that provides the framework for the City to reduce greenhouse gas emissions to meet the State targets identified for 2040 through City operations, and existing and future development. GHG emission reductions related to land use, mobility, energy, and solid waste will be addressed in the CAP.

4.8.2 Definitions of Significance and Baseline Conditions

Baseline conditions are those at the time the NOP was published. Definitions of significance are available from the CEQA checklist, based on whether the Project would:

1. Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment?

2. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHGs?

4.8.3 Effects Analyses of the Project

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

IMPACT GGE-1: Generation of GHGs. The Project would involve the use of approximately 5 small vessels in Humboldt Bay which would generate GHGs. The Project would also indirectly result in a negligible increase in processing/cleaning, transportation (primarily trucking) and storage of the product (shellfish). Storage is expected to primarily occur at underutilized industrial sites along the Samoa Peninsula in Humboldt Bay. The amount of GHGs generated by these activities is considered low, particularly relative to the amount of food that will be produced and other activities in the region (the existing setting). The effect is considered less than significant without mitigation.

IMPACT GGE-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 AB32 and SB97 and no impact is expected.

4.8.4 Alternatives

Alternatives are described below. Table 4.8-1 compares the impacts of the Project and alternatives.

4.8.4.1 Alternative 1. Reduced Footprint

With implementation of Alternative 1, culture maintenance needs would be reduced and therefore there would be less GHG emissions. As such, the types of impacts would be the same but the magnitude would be reduced.

4.8.4.2 Alternative 2. Basket-on-Longline Method Only

With implementation of Alternative 2, culture maintenance needs would be reduced and therefore there would be less GHG emissions. As such, the types of impacts would be the same but the magnitude would be reduced. The same mitigation measure as proposed for the Project would be required to reduce impacts to less than significant.

4.8.4.3 Alternative 3. No Project

Under the no Project alternative, there would be no new GHG emissions, but existing uses and related impacts would continue.

Table 4.8-1. Levels of Significance of the Project and Alternatives for Potential GHG Emission Impacts

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
GGE-1: Generation of GHGs.	LS	LS	LS	NI
GGE-2: Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHGs.	NI	NI	NI	NI

NI=No Impact, LS=Less than Significant without Mitigation, LSM=Less than Significant with Mitigation, PS=Potentially Significant

4.9 Energy

This section discusses the energy use associated with construction and operation of the Project. This section also describes the applicable regulatory framework and the existing state of energy resources in the Project area.

4.9.1 State and Regional Energy Resources and Use

California has a diverse portfolio of energy resources that produced 2,535.7 trillion British thermal units (BTUs)[1] in 2017, approximately 44 percent of which was in the form of biofuels and other renewable energy (US EIA 2020a).[2] Overall, California's crude oil production has declined during the past 30 years, but the state remains one of the top producers of crude oil in the nation, accounting for about 5 percent of total U.S. production in 2017 (US EIA 2018). California is among the top states in the nation in electricity generation from renewable resources. In 2017, the state was the leader in total utility-scale electricity generation from renewable resources, including hydroelectric power. California typically leads the nation in generation from solar, geothermal, and biomass energy. In 2017, the state was also the nation's second-largest producer of electricity from conventional hydroelectric power and the fifth-largest producer from wind energy (US EIA 2018).

According to the U.S. Energy Information Administration (2018), California consumed approximately 7,881.3 trillion BTUs of energy in 2017. Per capita energy consumption (i.e., total energy consumption divided by the population) in California is among the lowest in the country, with each state resident responsible for 200 million BTUs in 2017, which ranked 48th among all states (US EIA 2020b). Natural gas accounted for the greatest share of energy consumption (28 percent), followed by motor gasoline (22 percent), distillate and jet fuel (16 percent), interstate electricity (8 percent), renewable energy (16 percent), and the remainder from a variety of other sources (US EIA 2020c). The transportation sector consumed the highest quantity of energy (40 percent),

[1]One BTU is the amount of energy required to heat 1 pound of water by 1°F at sea level. BTU is a standard unit of energy used in the United States and is on the English system of units (foot-pound-second system).
[2]Note, 2017 data are the most recent available at the U.S. Energy Information Administration website.

followed by the industrial (23 percent), commercial (19 percent), and residential (18 percent) sectors (US EIA 2020d).

Gasoline is the most used transportation fuel in California, with 97 percent of all gasoline being consumed by light-duty cars, pickup trucks, and sport utility vehicles. In 2015, 15.1 billion gallons of gasoline were sold, according to the State Board of Equalization (California Energy Commission 2019a). Diesel fuel is the second largest transportation fuel used in California, representing 17 percent of total fuel sales behind gasoline. According to the state Board of Equalization, in 2015 4.2 billion gallons of diesel, including off-road diesel, was sold (California Energy Commission 2019b).

As discussed in the 2017 Integrated Energy Policy Report, California Energy Commission (CEC) staff projects that petroleum-based fuels will continue to represent the largest shares of transportation fuel demand through at least 2030. However, CEC staff projects that demand for gasoline is expected to wane over time, primarily due to increases in fuel efficiency and electrification. Based on a middle-case scenario, gasoline consumption in the state is predicted to fall from just under the current 15 billion gallons in 2016 to just over 12 billion gallons in 2030. During the same period, demand for jet fuel and diesel fuel is projected to remain constant at approximately 4 billion gallons of gasoline-equivalent for each fuel type (California Energy Commission 2018:212–213).

In Humboldt County, gasoline and diesel consumption for light-duty vehicles in Humboldt County in 2010 was about 76 million gallons (Humboldt County 2017).

4.9.2 Federal Regulatory Setting

4.9.2.1 Energy Policy Act (2005)

The Energy Policy Act of 2005, intended to establish a comprehensive, long-term energy policy, is implemented by the U.S. Department of Energy. The Energy Policy Act addresses energy production in the United States, including oil, gas coal, and alternative forms of energy and energy efficiency and tax incentives. Energy efficiency and tax incentive programs include credits for the construction of new energy-efficient homes, production or purchase of energy-efficient appliances, and loan guarantee for entities that develop or use innovative technologies that avoid the production of greenhouse gases (GHGs).

4.9.2.2 Update to Corporate Average Fuel Economy Standards (2009)

The Corporate Average Fuel Economy (CAFE) standards incorporate stricter fuel economy standards promulgated by the State of California into one uniform standard. Additionally, automakers are required to cut GHG emissions in new vehicles by roughly 25 percent by 2016. The federal Environmental Protection Agency (EPA), the National Highway Traffic Safety Administration (NHTSA), and the California Air Resources Board (CARB) issued joint Final Rules for CAFE standards and GHG emissions regulations for 2017 to 2025 model year passenger vehicles, which require an industry-wide average of 54.5 miles per gallon (mpg) in 2025.

4.9.3 State Regulatory Setting

4.9.3.1 Assembly Bill 2076, Reducing Dependence on Petroleum (2000)

The CEC and CARB are directed by Assembly Bill (AB) 2076 (passed in 2000) to develop and adopt recommendations for reducing dependence on petroleum. A performance-based goal is to reduce petroleum demand to 15 percent less than 2003 demand by 2020.

4.9.3.2 Assembly Bill 1493, Pavley Rules (2002, amendments 2009)/Advanced Clean Cars (2011)

Known as Pavley I, AB 1493 provided the nation's first GHG standards for automobiles. AB 1493 required CARB to adopt vehicle standards that will lower GHG emissions from new light-duty autos to the maximum extent feasible beginning in 2009. Additional strengthening of the Pavley standards (referred to previously as Pavley II and now referred to as the Advanced Clean Cars [ACC] measure) was adopted for vehicle model years 2017–2025 in 2012. Together, the two standards are expected to increase average fuel economy to roughly 54.5 mpg in 2025. The increase in fuel economy will help lower the demand for fossil fuels.

4.9.3.3 Executive Order S-01-07, Low Carbon Fuel Standard (2007)

Executive Order (EO) S-01-07 mandated (1) that a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020 and (2) that a low carbon fuel standard for transportation fuels be established in California. The EO initiated a research and regulatory process at CARB. CARB has since adopted and implemented the Low Carbon Fuel Standard, which requires a progressive reduction in the carbon intensity of fuels over time.

4.9.4 Local Regulatory Setting

4.9.4.1 Humboldt County Bay Area Plan

The Energy Element of Humboldt County's General Plan, which was adopted in 2017, contains one policy related to energy that is relevant to the Project (Humboldt County 2017). The policy is as follows:

- **E-P6. County Government Energy Consumption**. The County government shall reduce building and transportation energy consumption by implementing energy conservation measures and purchasing renewable energy and energy efficient equipment and vehicles whenever cost-effective. Conservation and renewable energy investments should be planned and implemented in accordance with performance-based action plans and County Greenhouse Gas Emission Reduction goals.

4.9.4.2 City of Eureka General Plan

The City of Eureka's *2040 General Plan* was adopted in October 2018 and establishes a roadmap for long-term physical, social, and economic future for the city. It includes goals, policies, and programs to direct land use and development decisions, manage resources, deliver public services, and provide infrastructure (City of Eureka 2018). The General Plan's goals related to energy that are applicable to the Proposed Plan:

- **Goal U-5**: Increased renewable energy provision and overall energy efficiency and conservation throughout the City.
- **Goal U-5.1**: Energy Conservation. Promote energy conservation, and development of alternative, nonpolluting, renewable energy sources for community power in both the public and private sectors.

4.9.5 Methodology

This section evaluates the effects related to energy that would result from the Proposed Plan and alternatives. Consistent with Appendix F and Section 15126.2 of the California Environmental Quality Act Guidelines, this section qualitatively addresses the Project's energy use.

4.9.6 Thresholds

In accordance with Appendix G of the State CEQA Guidelines, the Proposed Plan would be considered to have a significant effect if it would result in either of the conditions listed below.

- Wasteful, inefficient, or unnecessary consumption of energy resources during project construction or operations.
- Conflict with or obstruction of a state or local plan for renewable energy or energy efficiency.

4.9.7 Effects Analysis of the Project

IMPACT EN-1: Potential for wasteful, inefficient, or unnecessary consumption of energy resources.

Activities associated with implementation of the Project would involve the use of up to 5 small boats to access the sites and light-duty vehicles for worker commute trips, all of which would involve the consumption of petroleum-based gasoline or diesel fuel. There would be an irreversible impact from the consumption of fuels.

Fuel required would likely represent a negligible increase in regional demand and an insignificant amount relative to the more than 19 billion gallons of fuel sold in the state as of 2015 (California Energy Commission 2019). Given the extensive network of fueling stations throughout the Project vicinity, it is not anticipated that new or expanded sources of energy or infrastructure would be required to meet the energy demands of the Project. All activities would be in the service of producing seafood and therefore not anticipated to result in a wasteful, inefficient, or unnecessary consumption of energy resources. Hence, there would be no impact.

IMPACT EN-2—Potential for conflict with or obstruction of a state or local plan for renewable energy or energy efficiency.

There are no state or local plans specifically related to the use of energy resources for Project activities. Activities would involve the use of vehicles and equipment that consume diesel and gasoline. Equipment and vehicles are subject to the state's ongoing regulatory programs, including the in-use off-road diesel fueled fleets regulation and CARB's Portable Equipment Registration Program, both of which have fuel efficiency co-benefits. The

Project would not conflict with any state or local plans for renewable energy or energy efficiency. Hence, there would be no impact.

4.9.8 Alternatives

Alternatives are discussed below. Table 4.9-1 compares the impacts of the Project and alternatives.

4.9.8.1 Alternative 1. Reduced Footprint

With implementation of Alternative 1, maintenance needs would be reduced and therefore there would be less energy consumption. As for the Project, there would be no impact.

4.9.8.2 Alternative 2. Basket-on-Longline Method Only

With implementation of Alternative 2, maintenance needs would be reduced and therefore there would be less energy consumption. As for the Project, there would be no impact.

4.9.8.3 Alternative 3. No Project

Under the no Project alternative, there would be no energy consumption, but existing uses and related impacts would continue.

Table 4.9-1. Levels of Significance of the Project and Alternatives for Energy

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
EN-1: Potential for wasteful, inefficient, or unnecessary consumption of energy resources.	NI	NI	NI	NI
EN-2—Potential for conflict with or obstruction of a state or local plan for renewable energy or energy efficiency.	NI	NI	NI	NI

NI=No Impact, LS=Less than Significant without Mitigation, LSM=Less than Significant with Mitigation, PS=Potentially Significant

4.9.9 References

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4.10 Effects to Hydrology and Water Quality

4.10.1 Environmental Setting

Hydrology and water quality in Humboldt Bay are thoroughly described in the HBMP (HBHRCD 2007) and HBMP EIR (HBHRCD 2006) and those documents are incorporated by reference. Key aspects relevant to this EIR are summarized or excerpted below.

"The ambient water quality in Humboldt Bay is generally good, being determined largely by the quality of the water that enters the Bay from the nearshore Pacific. Measured water quality parameters vary through an annual cycle, with water in the Bay being generally warmer than the water in the near-shore Pacific. Water quality parameters vary seasonally and geographically; for example, water in northern Arcata Bay may be both fresher and colder in winter, and warmer and saltier in summer, than in Entrance Bay. Water quality parameters in Entrance Bay, which are significantly influenced by water in the near-shore Pacific, vary in concert with near-shore water quality; during periods of coastal upwelling, for example, Entrance Bay's waters are often colder and saltier than at other times." (HBHRCD 2006)

4.10.2 Regulatory Framework

"The essential water quality requirements for Humboldt Bay are established by the Water Quality Control Plan for the North Coast Region (the 'Basin Plan', North Coast Regional Water Quality Control Board 2011). The Basin Plan establishes 'objectives' for Humboldt Bay, in order to carry out the basic policy that existing 'beneficial uses' be maintained and that existing water quality not be degraded. The Basin Plan includes numerical criteria for a number of pollutants, but the 'narrative criteria' described in the Basin Plan as objectives, together with the basic 'antidegradation policy' and the required maintenance of beneficial uses, constitute the overarching state mandate for water quality in Humboldt Bay. As a general result, most of the ambient water quality parameters that affect biological populations in Humboldt Bay remain favorable throughout the annual cycle. The upwelling that brings colder bottom waters to the surface along the coast is associated with reduced dissolved oxygen concentrations in Bay waters, which may not meet the narrative criteria in the Basin Plan, but this variation is, effectively, a natural phenomenon rather than a Basin Plan violation… an additional level of regulatory review and oversight is provided by the CalCA and the related Federal Coastal Zone Management Act. Both of these laws, and the associated state and federal regulatory programs, include policy guidance that "polluted runoff" shall not degrade the quality of the coastal environment and adversely affect important Coastal Zone resources and uses." (HBHRCD 2006)

"The State of California has developed an integrated regulatory program for nonpoint-source pollution concerns in the Coastal Zone that includes all of the regulatory and trustee agencies exercising jurisdiction there, and that program is directly applicable to the regulation of water quality in Humboldt Bay. However, the explicit authority for regulating water quality in California, including the water quality in the Coastal Zone, remains with the State Water Resources Control Board and the relevant Regional Boards." (HBHRCD 2006) The CGP (County of Humboldt 2005), City of Arcata General Plan (City of Arcata 2008) and City of Eureka General Plan (City of Eureka 2018) contain further goals and policies related to water quality. Additionally, under Section 303(d) of the CWA, Humboldt Bay is listed for PCBs and dioxin/furan compounds (HBHRCD 2006).

4.10.3 Definition of Significance and Baseline Conditions

This section considers to what degree the Project would involve:

1. Actions that would violate federal, state, regional or local water quality standards set for water quality and for discharge of waste water;
2. Use of, or interference with, ground water such that the amount of flow of groundwater is adversely impacted;
3. Drainage changes that would alter or cause an increase in amount or flow of tidewater or surface flow that would cause or lead to a substantial increase in erosion or sedimentation either in the Management Area or elsewhere;
4. Alteration of drainage pattern 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, which would result in flooding on- or off-site;
5. Added runoff from the Management Area that would exceed the capacity of drainage facilities;
6. The creation of polluted runoff or other general adverse water quality impacts that could affect beneficial uses or degrade higher water quality in water of the State;
7. The placement of housing or other structures within the 100-year flood plain, or other area subject to flooding;
8. Place within a 100-year flood hazard area structures, which 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; and
10. Development in such a manner or location that it would be adversely affected by seiche, tsunami or mudflow.

4.10.4 Effects Analyses of the Project

IMPACT WQ-1: Petroleum spills. The Project will result in the addition of approximately 5 small vessels being used in Humboldt Bay. Petroleum products could be leaked to the bay during vessel fueling or operation. Example products that could be leaked include hydraulic fluid, gasoline and diesel. These substances can be toxic and bioaccumulate in marine organisms. Gasoline can also be flammable. In the event of a spill, marine organisms could be affected by the toxicity of these substances. The effect would be local and temporary because toxicity is reduced through time and space, but potentially significant without mitigation. Mitigation WQ-1 will reduce the chances for spills and the impact to less than significant.

MITIGATION WQ-1: Minimize fuel and petroleum spill risks. As part of the District's lease requirements, Lessees will be required to ensure equipment is appropriately maintained to minimize the potential for spills and to be prepared to manage spills, including by maintaining cleanup materials (e.g., absorbent pads) on all vessels. The District will reserve the right to inspect the vessels to ensure compliance with this mitigation measure.

IMPACT WQ-2: Pollutant/contaminant remobilization. Project activities will temporarily mobilize a minor amount of sediment and contaminants such as PCBs and dioxins. 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 stormy conditions (e.g., strong winds). Furthermore, shellfish are filter feeders which have a positive impact on water quality by filtering pollutants and contaminants from the water column. While it is unknown if culture in Humboldt Bay is beneficial to water quality, the effect of culture on water quality is not adverse. The impact is less than significant without mitigation.

IMPACT WQ-3: Alteration of circulation patterns. 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). 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 environment. Hence, this impact is less than significant without mitigation.

IMPACT WQ-4: Changes to the abundance of suspended organic matter. Cultured shellfish consume natural food sources that are suspended in the water column, including phytoplankton and other organic matter and there is potential competition for this food source between cultured shellfish and other filter feeders. An analysis was conducted to assess the potential cumulative effect on organic matter food sources of the Project, existing culture, and other planned culture in Humboldt Bay (Appendix C). The analysis, based on Gibbs' (2007) model, considered the inlet total volume, tidal exchange volume, the mean clearance rate of cultured shellfish, mean phytoplankton biomass, phytoplankton production, and cultured shellfish biomass to determine potential impacts. The analysis was conducted with consideration towards a greater area of mariculture expansion than is proposed through the Project. Hence, the Project's impacts would be less than those analyzed.

The analysis considered three different ways to evaluate the cumulative impact to organic particulate matter food resources: (1) the effectiveness of shellfish in processing bay water during feeding, as compared to tidal flushing (clearance efficiency); (2) consumption of phytoplankton-derived carbon by shellfish as compared to the total carbon generated by phytoplankton in the bay (filtration pressure); and how fast phytoplankton are turning over (doubling time) compared to their consumption by shellfish (regulation ratio).

While the clearance efficiency calculations indicate that shellfish filtration could exceed the bay's flushing rate if a conservative flushing rate estimate is used, this does not evaluate the impact on carbon and phytoplankton within the bay. The filtration pressure and regulation ratio analyses, which take into account the impact on available phytoplankton, indicate that Humboldt Bay is highly productive and this productivity can withstand substantial cultivated shellfish density without significantly affecting food resources available to other organisms in the bay. The results of the study indicate that the Project with other proposed and existing culture, would have some cumulative effect on bay conditions, but that food resources are likely abundant enough that wild species would not be significantly affected. The potential impact is less than significant.

4.10.5 Alternatives

Project alternatives are discussed below. Levels of significance of the impacts of the Project and alternatives are presented in Table 4.10-1.

4.10.5.1 Alternative 1. Reduced Footprint

The reduced project footprint described for Alternative 1 would result in less area and volume of culture. Impacts would be similar as for the Project but to a lesser magnitude. The same mitigation measures as proposed for the Project would be required to reduce impacts to less than significant.

4.10.5.2 Alternative 2. Basket-on-Longline Method Only

Alternative 2 would have similar impacts as the Project. The limitation of methods would result in negligible differences with regards to hydrology / water quality impacts. The same mitigation measures as proposed for the Project would be required to reduce impacts to less than significant.

4.10.5.3 Alternative 3. No Project

Under the no Project alternative, existing shellfish culture operations would remain and other permitting processes for new culture in the bay would likely continue. Hence, under the no Project alternative, there would be a similar potential for the type of environmental effects described in this EIR, but at a lower magnitude and within a smaller spatial extent.

Table 4.10-1. Levels of Significance of the Project and Alternatives for Energy

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
WQ-1: Minimize fuel and petroleum spill risks	LSM	LSM	LSM	NI
WQ-2: Pollutant/contaminant remobilization	LS	LS	LS	NI

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
WQ-3: Alteration of circulation patterns	LS	LS	LS	NI
WQ-4: Changes to the abundance of suspended organic matter	LS	LS	LS	NI

NI=No Impact, LS=Less than Significant without Mitigation, LSM=Less than Significant with Mitigation, PS=Potentially Significant

4.10.6 References

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4.11 Effects to Land Use

4.11.1 Summary of Present and Possible Future Conditions

Existing uses in the Project are primarily mariculture and recreational uses, including fishing, boating, hunting and kayaking. There are over 900 ac of underutilized, developed land adjacent to Humboldt Bay that are zoned as Coastal Dependent Industrial (CDI) by the County of Humboldt and City of Eureka. The primary historic use of these lands was in the wood product industry (i.e., processing and shipping of wood products). Local jurisdictions, including the District, County of Humboldt and City of Eureka are continually planning for and implementing projects to revitalize these lands. The Project is expected to result in use of some of these areas, primarily for storage of culture equipment and storage, processing and shipping of shellfish. This is expected to occur within already developed buildings with existing, underutilized utilities and transportation systems.

Aquaculture is an allowed use within areas zoned as CDI and the Project is expected to promote the intent of this zoning. It is expected that other uses, in addition to aquaculture, will also develop in these industrial areas, particularly through the economic development efforts of the local jurisdictions. Table 4.11-1 shows the land used zoning of the Project sites.

Table 4.11-1. Land use zoning of project sites.

Site	Land Use Zoning
1	Natural Resources / Water
2	Natural Resources / Water Conservation
3	Natural Resources / Water Conservation

4.11.2 Definition of Significance and Baseline Conditions

The Project would occur in intertidal portions of Humboldt Bay.

Definitions of significance are available from the CEQA checklist. Significance criteria are based on whether the Project would:

- Physically divide an established community
- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project (including, but not limited to the general plan, specific plan, LCP, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect
- Conflict with any applicable Habitat Conservation Plan or Natural Community Conservation Plan.

4.11.3 Effects Analyses of the Project

IMPACT LU-1: Effects on coastal dependent industrial uses. The intertidal sites are not expected to have any effect on industrial uses because industrial uses (including shipping) do not occur within intertidal areas. The subtidal sites are adjacent to parts of the Samoa peninsula that were historically important for shipping, particularly of forest products. The future use of these sites is not known. However, the Project is designed to minimize any potential conflicts with shipping. Specifically, the Subtidal Sites are located away from the shipping channel and from where ships would berth. A review of the sites by the District's Bar Pilots confirmed that the mariculture at the proposed sites will not significantly affect shipping. There could be some impact to non-aquaculture uses due to spatial overlap between the Project and these uses (e.g., the same docks may be used), however, other uses are expected to be compatible with the Project. This impact is considered less than significant without mitigation.

IMPACT LU-2: Conflict with land use plans or policies. The Project area is zoned as follows:

- The Project area within unincorporated Humboldt County jurisdiction is zoned as Natural Resources with Coastal Wetlands and Water Conservation (Humboldt County Code §313-5.4, 313-38).

Aquaculture is a conditionally permitted use within this zoning designation and the Project may require a use permit.

- Areas of the Project within the City of Eureka's jurisdiction are zoned Water Conservation. Aquaculture is an allowable conditional use within these designations (City of Eureka General Plan, Chapter 6 § 6.A.14). A use permit from the City of Eureka may be required for the Project.
- The HBMP allows for mariculture operations within the entire Project area, noting that the "use of the Bay for aquaculture or mariculture is expected to remain primarily within Arcata Bay, which includes areas that have been leased previously by the District, the cities, or the State of California for mariculture purposes. The combining use designation reflects a determination in this Plan that mariculture activities are generally appropriate within the designated area" (HBHRCD 2007). The Project is also consistent with the plan's goal of supporting commercial aquaculture and the plan's policy to identify additional aquaculture activities (Policy HFA-5). The plan recognizes the need to balance harbor, recreation, conservation and mariculture uses of the bay.

The Project is consistent with existing zoning and land use plans and no impact is expected.

IMPACT LU-3: Conflict with a Habitat Conservation Plan or Natural Community Conservation Plan. There is not an approved Habitat Conservation Plan or Natural Community Conservation Plan within the Project area. There would be no impact.

4.11.4 Alternatives

Alternatives are discussed below. Table 4.11-2 compares the impacts of the Project and alternatives.

4.11.4.1 Alternative 1. Reduced Footprint

The reduced project footprint described for Alternative 1 would result in less culture area. Similar to the Project, there would be no land use impact.

4.11.4.2 Alternative 2. Basket-on-Longline Method Only

Alternative 2 would consist of the same land use type, but a more restricted culture method. Similar to the Project, there would be no land use impact.

4.11.4.3 Alternative 3. No Project

Under the no Project alternative, existing shellfish culture operations would remain and other permitting processes for new culture in the bay would likely continue. There would be no land use impact.

Table 4.11-2. Levels of Significance of the Project and Alternatives for Land Uses.

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
LU-1: Effects on CDI uses.	NI	NI	NI	NI
LU-2: Conflict with land use plans or policies.	NI	NI	NI	NI

Impact	Project	Alternative 1	Alternative 2	Alternative 3: No Project
LU-3: Conflict with a Habitat Conservation Plan or Natural Community Conservation Plan.	NI	NI	NI	NI

NI=No Impact, LS=Less than Significant without Mitigation, LSM=Less than Significant with Mitigation, PS=Potentially Significant

4.11.5 References

[HBHRCD] Humboldt Bay Harbor, Recreation and Conservation District. 2007. Humboldt Bay Management Plan. Final.

Section 5.0 Cumulative Impacts

Cumulative impacts assessed under CEQA are those related to two or more individual impacts that are considerable or that incrementally compound other environmental impacts. Cumulative impact analyses must consider other similar past, present, or reasonably foreseeable future projects. To assess cumulative impacts, other similar existing and proposed aquaculture projects in Humboldt Bay are considered for cumulative impacts analysis.

Potential cumulative impacts would be limited to within Humboldt Bay, a discrete area of shellfish culture and related activities. In addition to the Project, there is another proposal to expand intertidal shellfish culture operations in Arcata Bay: the Hog Island Oyster Company Project which is pursuing permits for up to 39 ac of oyster culture in northwest Humboldt Bay. Additionally, Coast Seafoods Company currently operates approximately 293 ac of intertidal shellfish culture in Arcata Bay, and four other companies farm an additional area of approximately 8 ac. There are also approximately 70 raft type structures culturing shellfish in subtidal areas.

When considering current and proposed aquaculture projects in Arcata Bay, without mitigation the Project has the potential to result in significant cumulative impacts. The following is a description of the potential cumulative impacts associated with the Project and proposed mitigation measures to reduce cumulative impacts to less than significant levels. More detail is provided for resource categories that have a higher potential of cumulative impacts (e.g., biological resources).

5.1 Cumulative Impacts: Tribal, Archeological and Cultural Resources

Hog Island Oyster Company is currently seeking permits for a 39-acre oyster farm in northwest Humboldt Bay. Existing shellfish culture and Hog Island Oyster Company's proposed farm would have similar and cumulative impacts on cultural resources as the Project. The Project incorporates mitigation that requires protocols for inadvertent discovery of resources and training for lessees operating at Site 2 (i.e., MITIGATION CR-1, CR-2 and CR-3). With implementation of these mitigation measures, project effects would be less than significant including with consideration towards other current and proposed bay activities.

5.2 Cumulative Impacts: Biological Resources

CUMULATIVE IMPACT BIO-1: Effects of intertidal culture on shorebird species as a result of loss of foraging habitat and alteration of food sources. As discussed in IMPACT BIO-1 above, the expansion of aquaculture in intertidal portions of Arcata Bay has the potential to impact shorebird species through displacement from suitable foraging areas. The placement of aquaculture infrastructure in intertidal habitats could preclude shorebirds from entering all or portions of aquaculture sites, as some species may be wary of objects placed on mudflats. Human disturbance associated with maintenance and other farming activities may also preclude shorebirds from foraging in intertidal sites; in some cases, certain species (e.g., long-billed curlews) may be disproportionately affected due to territorial behavior and/or sensitivity to human disturbance. Alternatively, some shorebirds may be attracted to aquaculture areas due to an increase in foraging resources that grow on the infrastructure. However, even if the most sensitive shorebird species are precluded from foraging in aquaculture areas, the Project's impacts would not meet CEQA criteria for a significant impact, as discussed in IMPACT BIO-1 above. Existing and other proposed culture has the potential to result in similar effects to shorebirds, however most existing culture is in areas of continuous and dis-continuous eelgrass, which occur in relatively low tidal elevations (i.e., less than approximately 1.5 ft MLLW). Although shorebirds can forage in low-elevation eelgrass beds when tides are sufficiently low enough to expose the substrate, shorebirds are expected to forage primarily on unvegetated mudflats that are exposed for longer periods each tide cycle and provide higher-quality foraging habitat for most shorebirds (compared to vegetated areas). The elevation of existing culture limits impacts to shorebirds. With consideration of existing and proposed culture, this impact is less than significant without mitigation.

CUMULATIVE IMPACT BIO-2: Effects of intertidal culture on black brant as a result of loss of foraging habitat and alteration of food sources. As described in IMPACT BIO-2 above, Humboldt Bay is an important spring staging site for black brant because they rely on eelgrass during migration and spring staging. The Project proposes to expand aquaculture in 45 ac of intertidal habitats with the majority of the expansion area occurring in areas that do not provide high-quality eelgrass foraging habitat for brant. Rather, a small proportion (i.e., approximately 0.016 ac) of the Project sites contain eelgrass. Additionally, MITIGATION BIO-3 and BIO-4 will reduce potential eelgrass impacts. Although eelgrass is important to brant during migration and staging, the potential loss of a small proportion of available eelgrass, with consideration of existing and proposed culture, represents a less than significant impact under CEQA without mitigation.

CUMULATIVE IMPACT BIO-3: Potential impact to marine mammals from the potential loss of foraging habitat and restrictions to movement due to placement of aquaculture equipment in intertidal areas. As discussed in IMPACT BIO-3 above, harbor seals and California sea lions can occur in Arcata Bay.

These species are expected to move through, and forage in, the relatively deep channels that occur between shallow intertidal areas and largely avoid moving through intertidal areas where aquaculture will occur. Even if occasionally moving through intertidal areas at sufficiently high tides, aquaculture infrastructure is not expected to restrict movements of marine mammals, as these species would readily navigate around structures. Although harbor seals may use portions of Arcata Bay for haul-out or pupping sites, intertidal aquaculture is not expected to restrict harbor seals from conducting these activities, as the Project footprint represents a small proportion of the potential areas that can be used for haul-outs and aquaculture personnel will avoid flushing harbor seals when loafing on mudflats or other areas (see MITIGATION BIO-1 above). Similarly, existing and proposed culture is expected to have minimal effects on marine mammals, as that culture is not expected to interfere with marine mammal foraging or movements (for the same reasons described above for the Project). Because neither the Project nor existing or proposed culture is expected to result in restricted movements or loss of foraging habitat for marine mammals, this impact is considered less than significant without mitigation.

CUMULATIVE IMPACT BIO-4: Effects of human disturbance (e.g., boat movement, presence of culture workers) on marine mammals and other wildlife. Human disturbance associated with shellfish farmer's visits to aquaculture sites has the potential to flush wildlife from those areas. For instance, at low tide shorebirds and wading birds forage in intertidal mudflats and diving ducks and piscivorous waterbirds (e.g., cormorants and grebes) will forage in channels near intertidal sites. California sea lions may occasionally loaf on aquaculture structures and harbor seals may occasionally haul-out on mudflats in intertidal areas, and both species may occur in channels near intertidal aquaculture sites. These species may be flushed from aquaculture sites as humans approach, potentially resulting in reduced foraging or loafing opportunities and increased energetic costs.

Existing culture operations will have similar potential to impact wildlife through human disturbance. However, roost sites for birds are not limited and foraging waterbirds and energetic costs associated with movement away from aquaculture activities are not expected to result in detectable population-level effects for even the most sensitive species. Similarly, haul-out sites and other loafing areas are not expected to be limited in Arcata Bay. Regardless, because unauthorized harassment of marine mammals is not allowed under the MMPA, all mariculture operations will implement education programs to inform workers of procedures to avoid flushing marine mammals when using boats in Arcata Bay. These include speed restrictions, marine mammal avoidance techniques, and notification requirements if an injured marine mammal is observed. Therefore, cumulative impacts to wildlife associated with human disturbance are less than significant and this impact is considered less than significant with mitigation (see IMPACT BIO-4 and MITIGATION BIO-1).

CUMULATIVE IMPACT BIO-5: Effects of artificial lighting on wildlife. As discussed in IMPACT BIO-5 above, artificial lights are known to have adverse effects on wildlife species, such as migratory birds when bright lights (e.g., floodlights) are visible from the air or fish when lights shine into the water from nearby infrastructure. The Project is not expected to result in a substantial increase in new lighting. New lighting will be minimal and new fixtures will be shielded to minimize off-site glare and to avoid light from shining in the water (see MITIGATION BIO-2 above) to avoid significant impacts to wildlife species. Existing culture may also result in new artificial lighting in aquaculture areas within Arcata Bay. However, no substantial increase in new artificial lighting is expected to occur from new aquaculture development and existing lighting is minimal. Hence, cumulative effects related to artificial lights on wildlife are considered less than significant with the proposed mitigation and this impact is considered less than significant with mitigation (see IMPACT BIO-5 and MITIGATION BIO-2).

CUMULATIVE IMPACT BIO-6: Effects to green sturgeon as a result of potential reduction in prey. As described above for IMPACT BIO-6, shellfish culture does not have inherent aspects that would result in a reduction of prey for green sturgeon. This remains true when considering other activities in the bay, including existing culture. Hence, this impact is less than significant without mitigation.

CUMULATIVE IMPACT BIO-7: Effects on the abundance of suspended organic matter and related effects to other native species. Cultured shellfish consume natural food sources that are suspended in the water column including phytoplankton and other organic matter and there is potential competition for this food source between cultured shellfish and other filter feeders. As described under IMPACT BIO-7 and in Appendix B, the Project considered with other existing and proposed shellfish culture in the bay would have some cumulative effect on bay conditions, but food resources are abundant enough that native species would not be significantly affected. Notably, the analysis in Exhibit B is based on a previously proposed shellfish culture footprint that was substantially larger than what is currently proposed. This potential cumulative impact is less than significant without mitigation.

CUMULATIVE IMPACT BIO-8: Effects to green sturgeon as a result of habitat loss or degradation. As described under IMPACT BIO-8, green sturgeon likely utilize Humboldt Bay for feeding and the Project is unlikely to have a negative effect on prey resources for green sturgeon. Green sturgeon habitat would also be affected by placement of culture equipment on the bottom, which can displace green sturgeon habitat. Current shellfish culture equipment in Humboldt Bay covers approximately 0.76 ac of the bottom (the "benthic footprint") with post, anchors, etc. Structures in the bay not related to shellfish culture (e.g., docks and piles) have not been inventoried well and it is difficult to estimate the benthic footprint of these structures. However, these structures can be characterized as "scattered" along the shoreline and don't appear to occupy a substantial proportion of benthic habitat in the bay. After Project implementation, substantial area for feeding by green sturgeon would remain unaltered. The space between shellfish culture equipment would remain available for use by sturgeon because culture areas are permeable (sturgeon can freely move within the culture areas).

Based on the above, the Project is not expected to have a significant cumulative effect on green sturgeon as a result of habitat loss or degradation. Hence, this impact is less than significant without mitigation.

CUMULATIVE IMPACT BIO-9: Effects to green sturgeon as a result of entanglement. As described under IMPACT BIO-9, as an anadromous species, sturgeon swim among diverse structures in rivers, embayments, and the ocean. They have the sensory ability to detect structures and the swimming ability to avoid them. It is expected that green sturgeon would not collide or become entangled with mariculture equipment or cultured shellfish associated with existing or proposed culture or the Project. Shellfish culture has occurred for decades in West Coast embayments where sturgeon occur, and there is no known record (anecdotal or otherwise) of a sturgeon ever becoming entangled in mariculture equipment. Shellfish culture is not expected to result in entanglement of green sturgeon. Hence, there is no impact.

CUMULATIVE IMPACT BIO-10: Effects on wetland functions. Wetlands, including in Humboldt Bay, provide numerous functions such as primary production, flood protection, nutrient removal/transformation, wildlife habitat and recreational opportunities. These functions are assessed separately under different sections of this impact analysis. In general, the addition of shellfish culture activities to a wetland does not preclude the functions of that wetland. For example, in areas with shellfish culture; plants grow, flood protection functions continue and nutrients are removed and transformed. The Project is not expected to have a significant cumulative effect on wetland functions. Hence, this impact is less than significant without mitigation.

CUMULATIVE IMPACT BIO-11: Effects on eelgrass. As described under IMPACT BIO-11, in Humboldt Bay, eelgrass has critical ecological functions and is important to numerous fish and wildlife species including species listed under the state and federal ESAs. The ecological functions of eelgrass in Humboldt Bay are described well in the HBMP EIR (HBHRCD 2006) which is incorporated by reference to this EIR.

The Project is designed to avoid impacts to eelgrass to the maximum extent possible. The Project sites were identified with specific consideration towards their ability to support shellfish culture without impacting eelgrass. Although eelgrass does occur within some of the sites, it will be largely avoided with implementation of MITIGATION BIO-3–5. Existing culture in Humboldt Bay would have similar impacts to eelgrass.

Because the Project is expected to result in only minor impacts to eelgrass, this impact is considered less than significant with mitigation with consideration towards existing and other proposed culture.

CUMULATIVE IMPACT BIO-12: Potential effect to eelgrass by constraining its expansion into higher elevation areas as a result of sea level rise. The Project's potential impact is assessed in IMPACT BIO-12. Because other existing intertidal culture in the bay is predominantly at lower elevations than the Project area, sea level rise will affect it differently through time than the Project area (i.e., eelgrass may benefit in some areas and be impacted in others). Hence, this impact is considered less than significant without mitigation.

CUMULATIVE IMPACT BIO-13: Potential impacts on Pacific herring spawning sites. As described in IMPACT BIO-13, the Project incorporates mitigation measures to minimize impacts to spawning Pacific herring (MITIGATION BIO-6). It is expected that other projects in the bay will incorporate measures with similar effects and therefore this impact is considered less than significant without mitigation.

CUMULATIVE IMPACT BIO-14: Potential for cultured shellfish to naturalize or establish self-sustaining populations outside of cultivation and the effects of this naturalization on native marine species and communities. As described in IMPACT BIO-14, successful spawning of Pacific oysters south of Wilapay Bay, WA is believed to be rare (Carlton 1992). This is likely also true for Kumamoto oysters, as neither species has become well established in the bay outside of culture areas. Due to the unlikelihood of successful spawning in Humboldt Bay by Pacific and Kumamoto oysters, the Project is considered to have a less than significant impact when considered cumulatively with existing and proposed culture and this impact is considered less than significant without mitigation.

CUMULATIVE IMPACT BIO-15: Effect on benthic habitat and communities from the shellfish culture equipment and cultured shellfish, including initial equipment installation activities, anchoring, posts and material staging. As described above, the total benthic footprint of existing culture, and the Project would be less than 0.9 acres (which is in addition to the unknown benthic footprint created by non-culture related structures). This represents less than 0.011% of the 7,918 ac of Arcata Bay intertidal habitat. Particularly due to the relatively small spatial extent of this benthic footprint, this impact is considered less than significant without mitigation.

CUMULATIVE IMPACT BIO-16: Potential impacts to submerged aquatic vegetation and benthic habitat resulting from bottom scour and outboard motor contact associated with support vessel operations and trampling by workers. Similar impacts as those described for the Project (IMPACT BIO-16) would likely result from existing and other proposed culture in the bay. These impacts would be spread out spatially across culture areas and would not result in any substantial impact in any given area or to any specific habitat type overall. Hence, this impact is considered less than significant without mitigation.

CUMULATIVE IMPACT BIO-17: Potential biological effects of the addition of shellfish culture structures due to potential changes in light transmission through the water column, water flow and sediment transport. Existing and proposed Project culture consists of up to 338 ac of Arcata Bay's 7,918 ac. This is a considerable proportion of Arcata Bay. However, as described above, the effects are not expected to be detrimental, consisting of some reduction in light transmission, and potential sediment erosion and accumulation. This is not expected to result in a substantial effect to the ecological value of the bay or biological resources. Hence this impact is considered less than significant without mitigation.

CUMULATIVE IMPACT BIO-18: Impact on the distribution and dispersal of non-native invertebrate fouling species. Hard substrate will be added by the Project in the form of shellfish shells, ropes/lines, posts and stakes. This substrate will attract both non-native and native fouling organisms. During a study by Boyle et al. (2006) of fouling organism composition and succession at Woodley Island, Humboldt Bay, 34% of all species identified were non-native. It is expected that fouling organisms of shellfish and shellfish culture equipment will also be both native and non-native. This effect is considered neutral as it benefits both natives and non-natives in a similar composition as at other hard substrate. However, there is the potential for activities that involve removal of fouling organisms to further disperse non-native fouling organisms. Certain species such as *Didemnum* spp. may disperse with currents, reproduce and further spread their distribution. The extent that this may actually occur is unknown and warrants research. However, as a precautionary approach, the Project incorporates MITIGATION BIO-7, which will substantially reduce opportunities for dispersal. Other aquaculture projects in the bay are expected to incorporate similar measures. With MITIGATION BIO-7, this impact is less than significant.

CUMULATIVE IMPACT BIO-19: Conflicts with local policies, particularly those described in the HBMP which is a guidance document for the District and the LCPs of the County of Humboldt, City of Eureka and City of Arcata. The Project, existing and other proposed culture are individually and cumulatively consistent with these policies. This area of Humboldt Bay is identified as suitable for mariculture in the HBMP. Additionally, the Project has many design components that limit its effect on ecological resources, consistent with Local Coastal Plans. Funding for the Project was approved by the County Board of Supervisors and District Commissioners, indicating their support for the Project. There is no impact expected.

5.3 Cumulative Impacts: Aesthetics and Visual Resources

Existing and other proposed culture in the Bay will have similar aesthetic impacts as the Project and the effect is cumulative. However, the findings made for the Project's impacts on aesthetics apply similarly when considering cumulative impacts. Particularly, the culture equipment is low profile and produces minimal glare and the use is consistent with the character of Arcata Bay. This cumulative impact is considered less than significant with mitigation.

5.4 Cumulative Impacts: Air Quality

Existing and other proposed culture in the Bay will have similar air quality impacts as the Project and the effect is cumulative. However, particularly because other projects are also expected to comply with AQMD regulations, this cumulative impact is less than significant with mitigation.

5.5 Cumulative Impacts: GHG Emissions

Existing and other proposed culture in the Bay will have similar GHG emissions as the Project and the effect is cumulative. However, the level of GHG emissions resulting from shellfish culture (i.e., boat use and storage and transportation of shellfish) in Humboldt Bay is considered minor and this impact is less than significant.

5.6 Cumulative Impacts: Energy

Existing and other proposed culture in the Bay will have similar energy use as the Project and the effect is cumulative. However, the analysis for the Project similarly applies to existing and other proposed culture. The cumulative impact of the Project and other proposed and existing activities is less than significant without mitigation.

5.7 Cumulative Impacts: Hydrology and Water Quality

Existing and other proposed culture in the Bay will have similar effects to hydrology and water quality as the Project and the effect is cumulative. 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 (IMPACT WQ-4) is a cumulative analysis and the impact is found to be less than significant. Hence, this cumulative impact is considered less than significant with mitigation.

5.8 Cumulative Impacts: Land Use

Existing and other proposed culture in the Bay has similar considerations regarding land use as the Project. They are also designed not to effect coastal dependent uses and are consistent with land use plans and policies. The cumulative effect on land use is less than significant without mitigation.

Section 6.0 Growth Inducing Effects

The purpose of the Project is to allow for an expansion of commercial mariculture activities in Humboldt Bay, to create jobs and improve the local economy, while also increasing local and sustainable seafood production. CEQA Guidelines Section 15126.2 includes fostering economic growth as part of inducing growth. As such, the Project is considered growth inducing. Indeed, a focus of the HBMP (HBHRCD 2007) is to encourage economic activity and an explicit direction to adopt this focus was included by the legislature in the action that created the District.

As noted in other portions of this EIR, there are over 900 ac of underutilized, developed land adjacent to Humboldt Bay that are zoned as CDI by the County of Humboldt and City of Eureka. Underutilization is due to dramatic declines in shipping and wood product industries during the past several decades. The Project would serve to partially revitalize these areas, in some cases potentially removing blight. It would potentially create approximately 16 new jobs in the area. It is likely that these jobs would be filled both by people already living in the region and people relocating to the region. It would also 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.

Section 7.0 Environmentally Superior Alternative

CEQA guidelines require identification of the environmentally superior alternative. Additionally, CEQA Section 15126 states that "If the environmentally superior alternative is the 'no project' alternative, the EIR shall also identify an environmentally superior alternative among the other alternatives".

Without the Project, the extent that mariculture activities will expand in the bay is unknown. However, it is expected that expansion would be less and therefore potential environmental effects would be less without the Project (although the Project effects are mitigated to less than significant under all alternatives). Hence, Alternative 3, the No Project Alternative, is considered the environmentally superior alternative. Of the other alternatives, Alternative 1 is the environmentally superior alternative because it has similar impacts as other alternatives but at a lower magnitude.

Section 8.0 Findings

Detailed mitigation measures have been identified throughout this report that are intended to mitigate Project effects. All of these mitigation measures are identified in Table S-1 (see Executive Summary). After implementation of the proposed mitigation measures, all of the effects associated with the Project would be reduced to a less-than-significant level. The Project would not result in any significant and unavoidable environmental impacts.

Section 9.0 Preparers of the EIR and Persons Consulted

CEQA Lead Agency

Humboldt Bay Harbor, Recreation and Conservation District

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Organizations and Persons Consulted

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Ted Hernandez

Bear River Band of the Rohnerville Rancheria

Erika Collins

Melanie McCavour

Blue Lake Rancheria

Janet Eidsness

Daniel Holsapple

Appendix A. Spatial Coordinates of Culture Sites

Coordinates are in UTM Meters

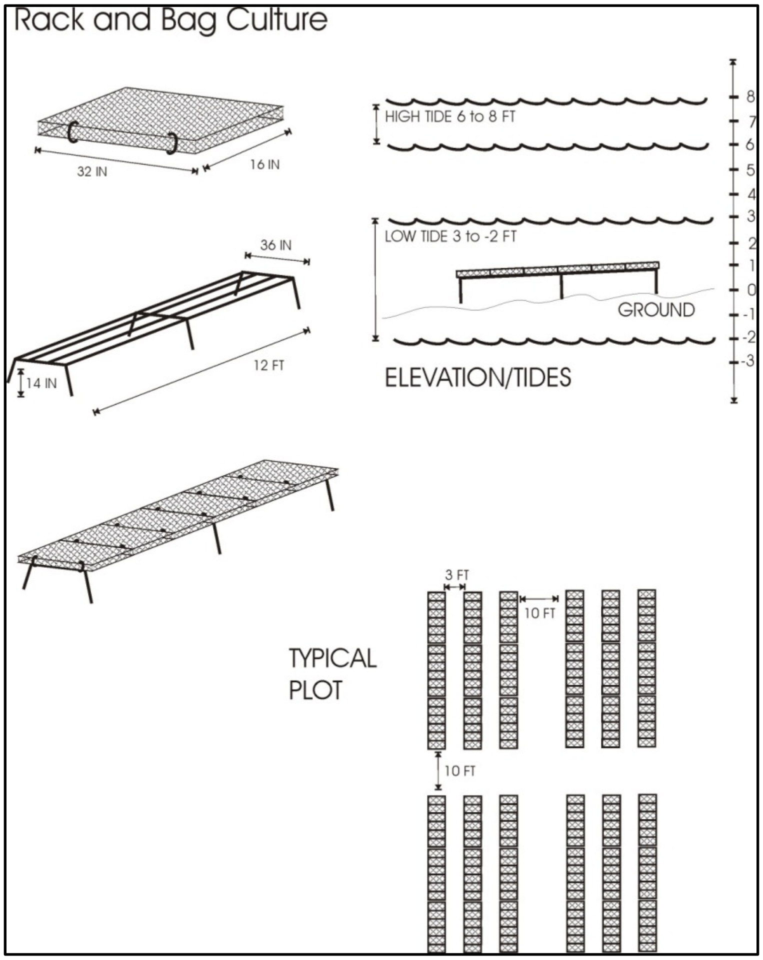
Site	Longitude	Latitude
1	403151.2017	4522022.066
	403120.9531	4521952.926
	403109.8918	4521932.727
	403088.4548	4521911.742
	403013.7387	4521838.601
	402997.4661	4521821.927
	402964.6678	4521776.39
	402932.8635	4521732.232
	402803.6452	4521552.824
	402771.8409	4521508.666
	402710.2673	4521509.878
	402710.2191	4521622.189
	402792.4363	4521828.395
	402789.0464	4521864.412
	402862.1222	4521960.925
	402967.4278	4522089.917
	402967.4278	4522138.514
	403009.0158	4522138.514
	403009.0158	4522177.298
	403037.5199	4522177.298
	403037.5219	4522107.377
	403161.6312	4522105.917
	403151.2017	4522022.066
2	401921.0979	4519513.795
	401817.822	4519493.557
	401807.8366	4519517.312
	402038.6731	4519551.229
	402034.6072	4519558.167
	402119.7491	4519570.239
	402163.5808	4519576.454

Site	Longitude	Latitude
2 Cont.	402245.3924	4519583.192
	402409.1506	4519602.621
	402422.0805	4519575.189
	402265.8675	4519557.953
	402197.0835	4519548.612
	402117.2599	4519542.667
	402022.1511	4519527.382
	401921.0979	4519513.795
3	400637.9126	4518239.577
	400560.1766	4518090.534
	400538.9529	4518100.186
	400541.8713	4518108.759
	400555.7278	4518138.185
	400556.1219	4518139.022
	400573.2312	4518170.796
	400590.3952	4518204.307
	400601.8378	4518233.731
	400606.7418	4518248.443
	400606.7418	4518260.703
	400607.5591	4518269.693
	400617.3671	4518281.953
	400625.5405	4518299.935
	400633.7138	4518323.637
	400637.8004	4518345.705
	400638.6637	4518349.331
	400641.8871	4518362.869
	400644.3391	4518380.033
	400660.6858	4518421.717
	400694.1964	4518508.355
	400710.3858	4518551.912
	400728.5243	4518600.713
	400743.2363	4518639.128
	400780.2514	4518736.601
	400792.2763	4518768.266

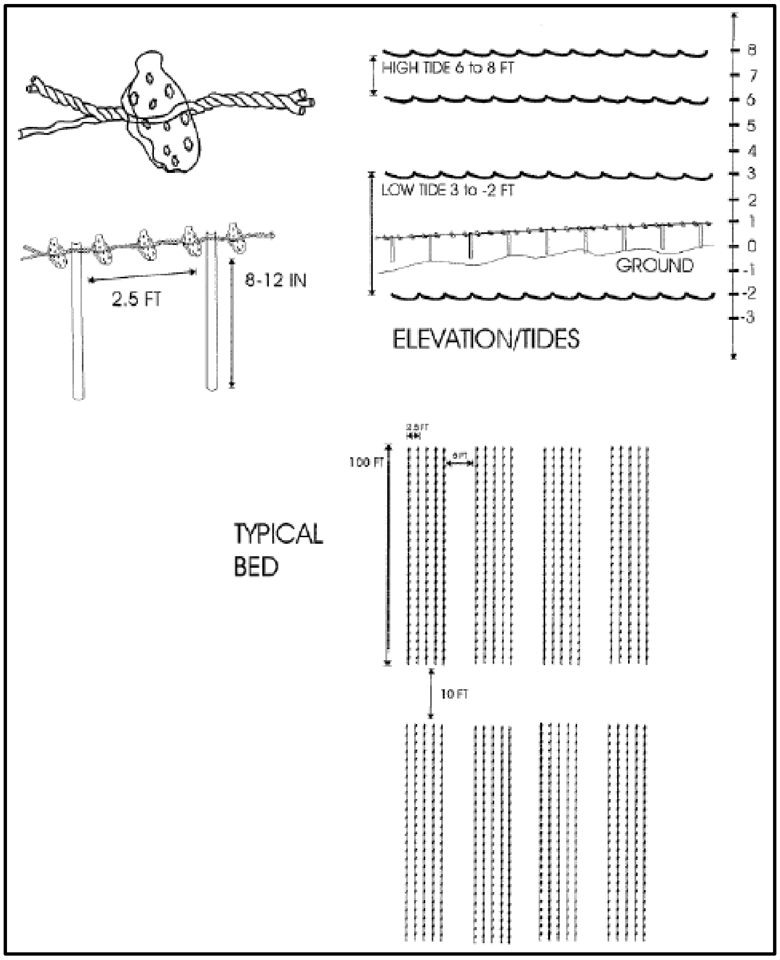
Site	Longitude	Latitude
3 (Cont.)	400816.7963	4518829.566
	400842.1336	4518886.779
	400854.0283	4518909.338
	400865.8362	4518931.733
	400883.8175	4518963.609
	400910.7895	4519003.658
	400946.7521	4519051.063
	400967.1854	4519077.218
	400990.0707	4519104.19
	401010.504	4519132.797
	401038.2933	4519166.307
	401095.5938	4519217.186
	401115.6098	4519230.57
	401125.7979	4519237.674
	401142.6238	4519250.006
	401190.2855	4519281.106
	401231.2563	4519307.368
	401270.6942	4519328.851
	401279.1134	4519334.988
	401291.5149	4519319.527
	401165.064	4519239.731
	401135.8065	4519218.419
	401102.7284	4519194.323
	401071.5606	4519166.917
	401043.3484	4519132.794
	401014.5988	4519090.61
	401008.6877	4519076.907
	400956.8309	4519001.674
	400937.7541	4518975.611
	400891.0024	4518903.066
	400883.9216	4518890.294
	400862.2528	4518851.209
	400811.824	4518713.722
	400744.977	4518531.473
	400637.9126	4518239.577

Appendix B. Example Culture Methods and Pictures

Rack-and-Bag Culture (from CSC 2007)

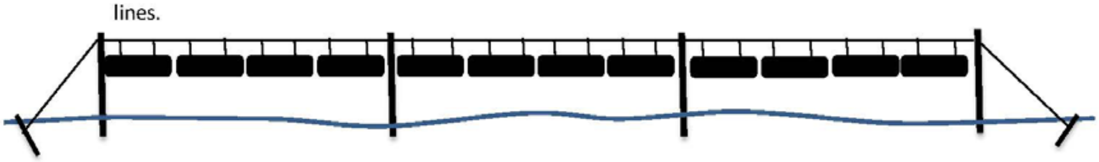


Cultch-on-Longline Culture (from CSC 2007)

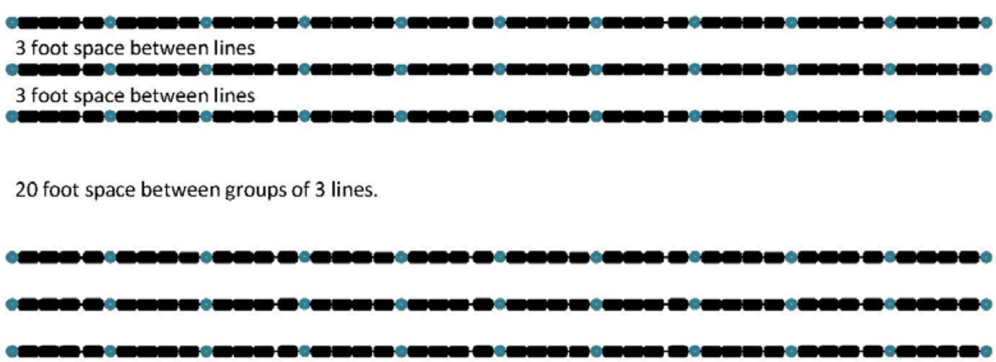


Basket-on-Longline Culture

Structure (Side View): Lines are held up by 2 inch PVC pipe driven into the mud every 10 feet. Anchors made of galvanized fence posts are driven at the ends of each line. The lines are attached to the anchors and tension is created by a fence tightener. The baskets can be clipped and unclipped from the lines.



Spacing (Top View): Lines are 100 feet long and there are 40 baskets on each line. Lines are in groups of 3, with a 3 foot space between each line and a 20 foot space between each group of 3 lines. The 20 foot space is used to access the baskets with a boat.



References (for Appendix B)

[CSC] Coast Seafoods Company. 2007. Coast Seafoods Application for Continued Mariculture Operations in Humboldt Bay, California. Draft Mitigated Negative Declaration. Prepared for Humboldt Bay Harbor, Recreation and Conservation District.

Appendix C. Humboldt Bay Carrying Capacity Analysis

Humboldt Bay Mariculture Carrying Capacity Analysis

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Introduction

In Humboldt Bay, California, there are two current proposals to expand intertidal and subtidal shellfish culture operations: the Humboldt Bay Mariculture Pre-permitting Project ("Pre-Permitting Project"), (Humboldt Bay Harbor, Recreation and Conservation District [HBHRCD] 2014) and the Coast Seafoods Company Permit Renewal and Amendment Project ("Coast Project", HBHRCD 2015). Proposed shellfish culture expansion, along with existing culture, could potentially affect food resources and ecosystems in the bay. This document presents an analysis of the effects to food resources of (1) the Pre-Permitting Project, (2) the Coast Project, and (3) other existing shellfish culture in the bay, including culture maintained by Coast Seafoods Company. The specific research question guiding this analysis is "what cumulative impact will the Pre-Permitting Project and Coast Project have on food resources available to filter feeding organisms in Humboldt Bay?" To assess this question, the analysis uses Gibbs' (2007) indicators of how cultured shellfish affect their food sources.

Cultured shellfish consume natural foods suspended in the water column, including phytoplankton and other organic matter, and potentially compete with other filter feeders for this food. Therefore, shellfish farms may affect naturally occurring species and food webs in the growing region. Various approaches can be taken to assess these effects. Gibbs (2007) noted:

> From a technical perspective, an obvious way forward is to develop complex numerical hydrodynamic-NPZ (nutrient, phytoplankton, zooplankton) carrying capacity models with embedded shellfish energetic models to understand these interactions. However, these models are technically complex, are extremely data hungry, and many argue do not have a particularly good performance record (Herman 1993).

In recognition of these challenges, Gibbs (2007) developed a set of "sustainability performance indicators for assessing the environmental performance of shellfish farms." These indicators provide quantitative guidance on answering the following questions (modified from Gibbs [2007]):

- Does the proposed amount of shellfish culture, when considered in connection with existing shellfish culture, significantly change any other ecological processes, species, populations, or communities within the growing region?
- Does the proposed amount of shellfish culture, when considered in connection with existing shellfish culture, represent a quantity that would control phytoplankton dynamics in the growing region?
- Are the current and proposed levels of shellfish culture at the ecological carrying capacity of the region?

Approach/Methods

Gibbs' (2007) indicators use linear combinations and ratios that compare inlet total volume, tidal exchange volume, the mean clearance rate of cultured shellfish, mean phytoplankton biomass, phytoplankton production, and cultured shellfish biomass. Each of these variables, and the data used to describe them, are presented below.

Inlet Total Volume

The volume of water that occupies an inlet is a value used for several calculations in this analysis. Humboldt Bay consists of three sub-basins: Arcata Bay (North Bay), Entrance Bay, and South Bay (Figure 1). Arcata Bay, where aquaculture occurs and is proposed, has an inlet total volume of 48 and 85 million cubic meters (m^3) at mean low water and mean high water, respectively (Table 1) (Barnhart et al. 1992).

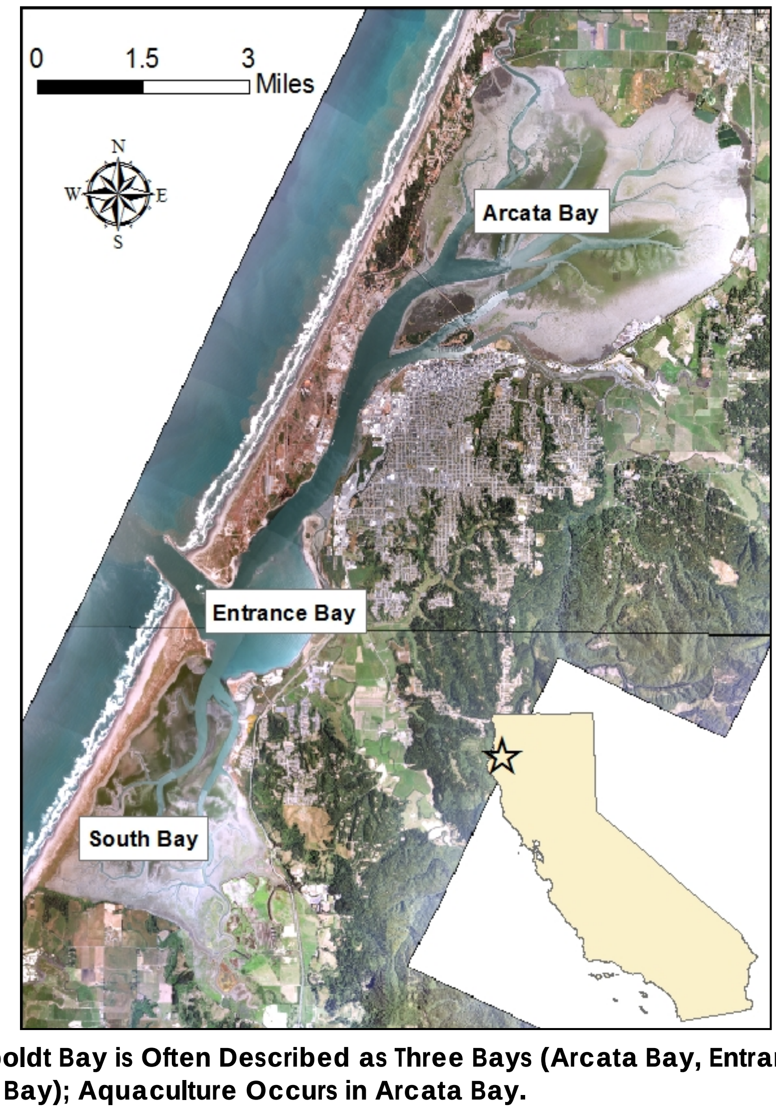

Figure 1. Humboldt Bay is Often Described as Three Bays (Arcata Bay, Entrance Bay, and South Bay); Aquaculture Occurs in Arcata Bay.

Table 1. Area and Water Volume of Humboldt Bay and its Subbasins[1]

Characteristic	South Bay	Entrance Bay	Arcata Bay	Humboldt Bay Total
Area (10^7 m^2) at MLLW	0.71	0.73	1.19	2.63
Area (10^7 m^2) at MHW	1.83	0.79	3.45	6.07
Volume (10^7 m^3) at MLLW	1.24	3.21	4.80	9.25
Volume (10^7 m^3) at MHW	3.70	4.44	8.51	16.65

Notes: m^2 = square meters; MLLW = mean lower low water; MHW = mean high water
Source: Barnhart et al. 1992

Tidal Exchange (Rt)

The mixed semidiurnal tides along the coast of Northern California force large amounts of ocean water in and out of Humboldt Bay on a daily basis. There are various descriptions and values for tidal exchange in Humboldt Bay:

- According to Barnhart et al. (1992), tidal exchange of bay waters with the open ocean can transport 74 million m^3 of water in and out of Humboldt Bay each tidal cycle; this large tidal prism extends into Arcata Bay, where 37.1 million m^3 of water can be flushed in one tidal cycle, removing 43.6% of Arcata Bay's water in as little as 8 hours.
- Gast and Skeesick (1964) estimate that 99% of Arcata Bay water is replaced within 14 tidal cycles.
- In a nationwide comparison of estuaries and their potential for eutrophication, Bricker et al. (2007) lists Humboldt Bay's water residence time as three days.
- Efforts to quantify residence time (or water age) over spatial gradients in Arcata Bay using dye studies demonstrated a pigment half-life of 2.5 days (California Department of Health Services [CDHS] 2006).
- A recent model (Anderson 2010) predicts approximately 20% dye reduction in 24 hours and 70% in 2 weeks in parts of Arcata Bay.

The above estimates of flushing rates yield a range of residence times from approximately 3–14 days in the Project area; substantial differences due to the analytical methods used. The range in estimated flushing rates is not unusual, as Gibbs (2007) notes that determining the flushing rates of inlets and estuaries "can also be at times ambiguous", and determined a mean flushing rate was therefore appropriate in his case study. To calculate metrics that include flushing rates, separate calculations were made for the 85 million m^3 of water in Arcata Bay using residence times of 3, 7, and 14 days, acknowledging the range of uncertainty.

[1] Deepening of navigation channels and opening of previously diked areas to saltwater intrusion (e.g., at McDaniel Slough and lower Jacoby Creek) occurred after these estimates were made and likely increased the area and volume of water in Arcata Bay. No estimates for this increase are available and it is not accounted for in this analysis.

Mean Clearance Rate of the Cultured Shellfish (CR)

Shellfish take water in through an inhalant siphon and then filter out particles on their gills for ingestion. After they remove particulates, they release water back into the water column through the exhalent siphon. Clearance rate (CR) is the volume of water processed (cleared) over a period (L of water per gram of dry tissue weight per hour). Filtration rate (FR) is the mass of particulate matter removed during a period (milligrams of solids per hour per gram of dry tissue weight), and is dependent on the animal's ability to process water (CR) and the concentration of suspended particulate matter in the water column during that time. Gibbs (2007) and our analysis use CR rather than FR because the quantity and quality of suspended particulate matter in the water column vary over time at unknown concentrations. The information not captured in CR is accounted for in portions of the analysis below (i.e., for filtration pressure and regulation ratio calculations), primarily based on average chlorophyll concentrations in the bay.

A thorough review and meta-analysis of oyster clearance rates, documented in 25 publications, yielded an average clearance rate of 2.54 L per gram per hour (L/g/h), with a standard error of ±0.24 (Cranford et al. 2011). This value is compared to reported CRs of 4.78 ±0.28 L/g/h for oysters with a seston-based diet (Cranford et al. 2011). Our approach presents a range of performance indicator values based on these CRs (Tables 3 and 4).

Mean Phytoplankton Biomass

Phytoplankton are often considered the main food source for filter feeders, but any organic matter in the water column can be consumed. Organic matter in the bay can be measured by quantifying chlorophyll concentrations. The Central and Northern California Ocean Observing System at Humboldt State University has chlorophyll-a (chl-*a*) fluorescence time series data from Arcata Bay. For data between 2003–2011, we calculated the seasonal mean chlorophyll concentration as 1.96 micrograms per L (µg/L) in winter, 3.18 in spring, 4.11 in summer, and 2.56 in fall. Harding (1973) reported average chl-*a* of 4.1 µg/L for Humboldt Bay during summer months, and found no horizontal trends within the bay. Based on CeNCOOS data, we use the annual mean chl-*a* concentration of 2.96 µg/L for calculations of phytoplankton standing stock.

Phytoplankton Production

Seasonal variations in phytoplankton primary production rates are not available for Humboldt Bay, but local data exist for an annual estimate and production during summer months. Based on the work of Harding (1973), the average primary production rate of phytoplankton in Arcata Bay during summer months is 33.8 milligrams of carbon per cubic meter per hour (mgC/m^3/hr). Phytoplankton production measured by Harding (1973) per unit area was 1.05 and 1.50 grams of carbon per square meter per day (gC/m^2/day) during low tide and high tide, when accounting for incident light radiation, extinction coefficients, and chl-*a* concentration. The annual rate of phytoplankton production in channel portions of the bay accounted for production of 136 gC/m^2/year (Barnhart et al. 1992).

For calculations that required primary production totals for all of Arcata Bay, we multiplied 136 gC/m^2/year by the area of Arcata Bay at low tide ($1.19 * 10^7$ m^2) for a total annual production of 1,618.4 metric tons of carbon. For calculations that considered finer-scale phytoplankton dynamics (such as turnover rate) and required volumetric estimates, 33.8 mgC/m^3/hr was multiplied by 24 hours, then divided by four to allow for a more conservative estimate based on Barnhart et al.'s (1992) work (note that Harding's (1973) daily per-m^2 production estimates during summer are four times higher than the Barnhart et al. (1992) estimated annual production per m^2 divided by 365 days)[2]. This yielded an average of 203 mgC/m^3/day. A carbon to chl-*a* ratio of 30:1 was used for conversions where needed (Sathyendranath et al. 2009).

Cultured Shellfish Biomass

Dry tissue weight (DTW) is the mass of shellfish tissue after drying at 100°C for 24 hours. DTW is the most accurate way to calculate the total biomass of shellfish in production, and allows comparison of data between species and animal size classes. DTW is also the preferred unit for quantifying CR for shellfish. To calculate the current and proposed biomass of cultured shellfish in Humboldt Bay, we developed shellfish stocking density formulas for each of the culture methods used in the bay (i.e., for each method, we determined the number of shellfish (by size) that would occur in a given area). We then converted the abundance of different-sized animals into DTW using allometric equations that convert shell length to DTW (Kobayashi et al. 1997, Ren et al. 2000). For "seed" production methods (organisms less than 4mm), stocking densities are recorded as kilograms of live weight rather than number of organisms. Therefore, live weight mass was converted to dry tissue weight assuming that DTW is 6% of live weight (Officer et al. 1982, Mann 1979, Spencer et al. 1978). Biomass values per cultivation method were then multiplied by the existing or proposed total area for production (for intertidal sites) or number of raft-type structures (for subtidal sites).

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[2] Harding's (1973) primary production estimates for phytoplankton per unit area during summer months are four times greater than Barnhart et al.'s (1992) estimate for average annual phytoplankton production in shallow and deep channels of Humboldt Bay. We apply this 0.25 correction factor to Harding's production estimate per unit volume during summer to reflect what the annual average production rate would be per year.

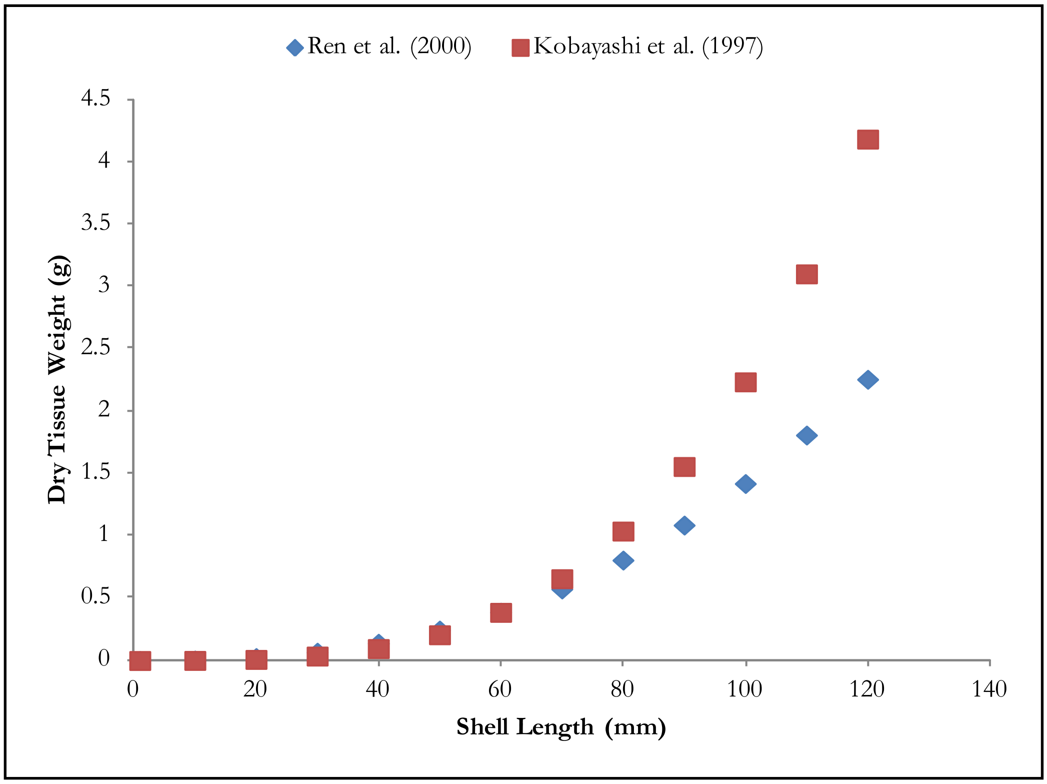

Figure 2. Allometric Relationships between Shell Length and Biomass for Pacific Oysters (Kobayashi et al. 1997, Ren et al. 2000)

The current standing stock of Existing Culture in Humboldt Bay is approximately 13.46 metric tons DTW. This value includes all intertidal locations producing adult oysters as well as subtidal locations producing oyster and clam seed in raft-like structures. Unlike the Coast Project description (HBHRCD 2015), the Pre-Permitting Project description (HBHRCD 2014) does not specify the proportion of specific intertidal culture methods that would be used. For this carrying capacity assessment we assumed 1/3 basket-on-longline, 1/3 cultch-on-longline and 1/3 rack-and-bag methods[3]. The Coast Project and Pre-Permitting Project would add approximately 18.44 and 23.12 metric tons DTW respectively (Table 3). Hence, the total biomass of cultured shellfish in the bay, including from existing culture, the Pre-Permitting Project and the Coast Project would be approximately 55.02 metric tons DTW (Tables 3 and 4)[4].

[3] Also note that the Gibbs model is based on suspended shellfish culture whereas existing and proposed Humboldt Bay culture is elevated off the bottom (not suspended from the water surface) or suspended from rafts. However, the Gibbs model is ultimately based on biomass of cultured bivalves and is applicable to Humboldt Bay culture methods.
[4] Calculations presented in this analysis utilize the shell length to DTW conversion equation presented by Kobayashi et al. (1997). Kobayashi's equation results in a higher total biomass (55.02 metric tons) than the shell length to DTW conversion equation presented by Ren et al. (2000) (39.14 metric tons). Our use of the Kobayashi conversion results in a higher estimate of biomass.

Sustainability Performance Indicators

The following indicators (Gibbs 2007) are used in this assessment, and employ the variables described above within Arcata Bay.

Clearance Efficiency (CE): $CE = R_t/C_t$

CE is a measure of how effectively the shellfish can process bay water during feeding, compared to the efficiency of tidal flushing.

For our analysis:

- R_t is the number of days that it takes Arcata Bay to be flushed by the tide with incoming ocean water. As described above, we used values of 3, 7, and 14 days.
- C_t is the number of days it would take cultured shellfish to clear all the water in Arcata Bay. This value is calculated as the volume of Arcata Bay/volume of water cleared by cultured shellfish each day.

Gibbs (2007) states that CE values less than 0.05 suggest that aquaculture levels "will not be able to induce significant changes to the pelagic functioning" (i.e., connectivity between the embayment and nearby coastal areas). In contrast, CE values greater than 1.0 indicate that water in the bay is flushing slower than the water is being processed by cultured shellfish.

Our approach in calculating C_t considers the percent of time that shellfish cultivation areas are out of the water during low tides (Table 2). Shellfish are not filtering water during that portion of time and, therefore, it was not included in the analysis. The time shellfish are predicted to be out of the water was determined as follows:

- Separately calculated the average ground elevation for the Coast Project, Pre-Permitting Project, Coast's existing culture and other existing culture based on a digital elevation model developed by PWA (2014).
- Added one foot to these averages to account for the approximate height of the shellfish off the bottom.
- Used 1993-2012 NOAA water level data from Humboldt Bay North Spit (https://tidesandcurrents.noaa.gov/) to calculate the percent of time the water level was below the average shellfish elevations (the time a shellfish at the average elevation is in air).

Table 2. Percent of Time Out of Water for Existing and Proposed Shellfish Culture

Condition	Percent of year out of water
Pre-Permitting Project	32%
Coast Expansion	11%
Coast Existing	16%
Other Existing	26%

Filtration Pressure (FP): $FP = B_f/P_p$

FP is an indicator of the consumption of phytoplankton-derived carbon by cultured shellfish compared to the total carbon generated by phytoplankton in the bay. FP also gives an estimate of how much of this energy has been redirected to aquaculture rather than other consumers of this resource. This indicator encompasses the carbon resource flows in a region, but does not account for connectivity with nearby coastal regions, as CE does.

For our analysis:

- B_f is the total carbon extracted from the water column by the shellfish culture every year, and is calculated as follows:

  Total volume cleared per year * amount of carbon in that volume = (total volume cleared per hour * 24 hours * 365 days) * (2.96 µg chl-*a*/L * 30:1 carbon ratio/ 1,000,000 µg per gram)

- P_p is the total carbon fixed by autotrophs in the bay each year, and is calculated as follows:

  Production rate * area = 136 $gC/m^2/year$ * 1.19 * 10^7 m^2 at low tide in Arcata Bay

Gibbs (2007) states that FP values less than 0.05 indicate that very little of the carbon resources generated in the growing region is passing through the culture, suggesting that the culture is having little impact on the system. Values close to 1.0 indicate that the level of culture is nearing the production capacity.

Regulation Ratio (RR): $RR = T_c/T_p$

RR gives a measure of how much control cultured shellfish have on the algal population in the bay by comparing how fast the phytoplankton are turning over (doubling time) to their extraction by cultured shellfish (i.e., finding what percent of phytoplankton is being consumed by shellfish). For our analysis:

- T_c is the ratio of the daily volume of water cleared by the shellfish to the total volume of water in the growing region, and is calculated as follows:

  (CR * biomass * 24 hours)/volume of Arcata Bay

- T_p is the phytoplankton turnover rate, and is calculated from the ratio of the daily mean phytoplankton production ($gC/m^3/day$) to the daily mean phytoplankton concentration (mg/m^3) converted to carbon (gC/m^3). This is calculated as follows:

Daily mean phytoplankton production/daily mean phytoplankton concentration = (33.88 mgC/m^3/hr * 24 hours * 0.25 [correction factor])[5]/(2.96 mg/m^3 average chl concentration * 30:1 carbon ratio)

Based on Gibbs (2007), values less than 0.05 suggest that cultured shellfish are playing a minor role in phytoplankton dynamics (i.e., growth regulation). Values closer to 1.0 suggest that the cultured shellfish control the phytoplankton dynamics in the growing region, implying that there may be costs to competitors that rely on phytoplankton.

Results and Discussion

The objective of the work presented here is to use Gibbs' (2007) sustainability performance indicators to assess, from three perspectives, the potential impacts of cultured shellfish on their food sources (Tables 3 and 4):

- CE accounts for the percent of the total water volume in an embayment that shellfish filter in comparison to the rate at which it is flushed with the ocean.
- FP accounts for the amount of carbon that is fixed by phytoplankton in the system compared to the amount removed by cultured shellfish through feeding.
- RR accounts for the percent of the bay that is filtered by shellfish each day and the ability of that filtration to regulate phytoplankton growth.

Table 3. Analysis of Cultured Shellfish Biomass and Related Sustainability Performance Indicator Values (Assuming a Clearance Rate of 2.54 L/g/h)

Condition	Biomass (DTW MT)	Clearance Efficiency			Filtration Pressure	Regulation Ratio
		CE_3	CE_7	CE_{14}	FP	RR
Coast Existing	10.09	0.018	0.042	0.085	0.010	0.003
Coast Proposed	18.44	0.035	0.082	0.165	0.020	0.005
Other Existing	3.38	0.005	0.013	0.025	0.003	0.001
Mariculture Pre-Permitting Intertidal	19.83	0.029	0.068	0.135	0.016	0.004
Mariculture Pre-Permitting Subtidal	3.29	0.005	0.011	0.022	0.003	0.001
All Projects	55.02	0.088	0.205	0.410	0.050	0.013

[5] See footnote 2 above for explanation of the 0.25 correction factor.

Table 4. Analysis of Cultured Shellfish Biomass and Related Sustainability Performance Indicator Values (Assuming a Clearance Rate of 4.78 L/g/h)

Condition	Biomass (DTW MT)	Clearance Efficiency			Filtration Pressure	Regulation Ratio
		CE_3	CE_7	CE_{14}	FP	RR
Coast Existing	10.09	0.034	0.080	0.160	0.019	0.005
Coast Proposed	18.44	0.066	0.155	0.310	0.038	0.010
Other Existing	3.38	0.010	0.024	0.047	0.006	0.001
Mariculture Pre-Permitting Intertidal	19.83	0.055	0.127	0.254	0.031	0.008
Mariculture Pre-Permitting Subtidal	3.29	0.009	0.021	0.042	0.005	0.001
All Projects	55.02	0.165	0.386	0.771	0.094	0.024

Clearance Efficiency

CE was calculated three ways, using flushing rates of 3, 7, and 14 days, to address different estimates of flushing rates based on several different flushing estimates (Tables 3 and 4). Total CE values calculated assuming a CR of 2.54 L/g/h range between 0.09 and 0.41, and CE values calculated assuming a CR of 4.78 L/g/h range between 0.17 and 0.77. The highest CE value occurs when including all potential and existing culture, with the assumption of the higher clearance rate and longer residence time of 14 days. Although this maximum value suggests that just over ¾ of Arcata Bay will be filtered by cultivated shellfish each day, it is important to consider that this metric only considers the water itself and does not account for phytoplankton (food) abundance or production in the bay.

Filtration Pressure

Total FP values for proposed and existing culture range between 0.05 and 0.09 when analyzed with 2.54 and 4.78 CRs respectively, indicating that the vast majority of carbon fixed by phytoplankton remains available to non-cultured species. Additionally, the primary production estimates used to calculate FP are conservative, in that they assume that production occurs only in the area of Arcata Bay occupied by water all day (i.e low tide area), and do not account for productivity in waters over mudflats during high tide, a situation which could add 30% more carbon to the system during ideal conditions (Headstrom 1994). Moreover, including other sources of particulate organic matter, such as detritus and benthic microalgae, to the total carbon available in the bay would be appropriate, but a lack of local data prevents us from including these resources in the analysis with reasonable confidence. By not including detritus and benthic microalgae in our analysis, our estimates of FP are likely higher than the actual filtration pressure. Additionally, some resources in the bay are generated in response to the presence of the shellfish, through nutrient recycling in the microbial loop, and a large proportion of the carbon passing through the shellfish culture gets recycled through the ecosystem again (Gibbs 2007) (Figure 3).

To check our estimates of biomass for accuracy, we compared them to estimates made by Gibbs (2007). Gibbs (2007) commented that bivalves consume five times their biomass (5:1). We compared our shellfish carbon-biomass calculations to our calculations of the amount of carbon consumed, resulting in an average 3.8:1 ratio at a CR of 2.54 L/g/h and 7.1:1 at a CE of 4.78. Our estimates correspond well with Gibbs (2007).

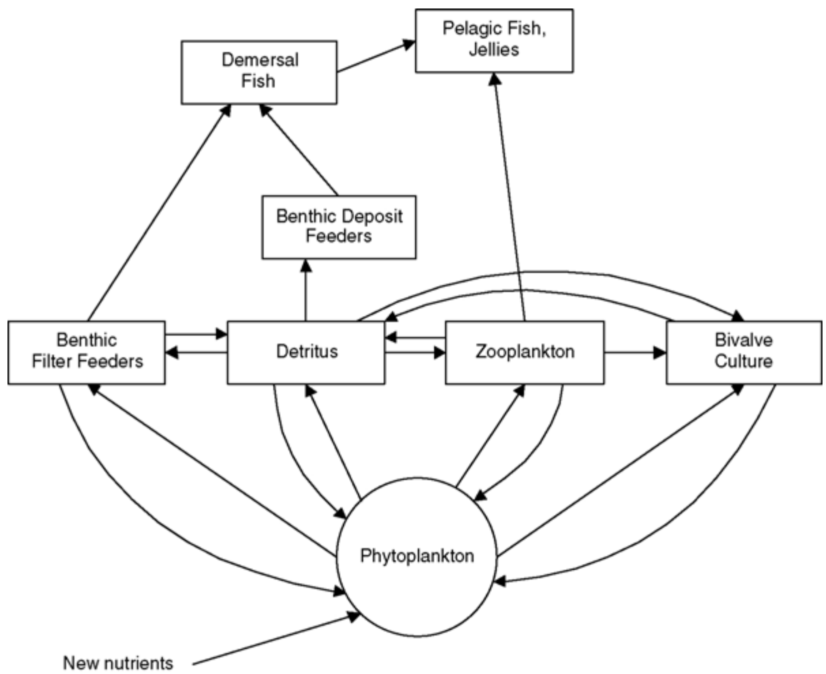

Figure 3. Theoretical Food Web in Aquaculture Area, with Culture Included; Arrows Represent Flow of Energy (Carbon) through the Web; Only the Major Energy Pathways are Shown. Source: Modified from Gibbs 2007

Regulation Ratio

All RR values in this analysis are well below the 0.05 threshold (Tables 3 and 4). The fast phytoplankton turnover rate (T_p=2.28) creates conditions under which the standing stock could replace itself several times per day. RR values suggest that the existing and proposed shellfish culture would have a negligible role in phytoplankton dynamics.

Conclusions

The sustainability performance indicators used in this analysis address the potential effects of current and proposed shellfish culture in Arcata Bay. As described above, where there is data uncertainty, all our assumptions err conservatively towards higher potential effects to phytoplankton abundance (food resources). For example:

- The primary production estimates used to calculate FP do not account for productivity in waters over mudflats during high tide, a situation which could add 30% more carbon to the system during ideal conditions (Headstrom 1994).

- Particulate organic matter types other than phytoplankton, such as detritus and benthic microalgae, are potentially important food sources that are not considered in this analysis due to a lack of local data on which to base the analysis.
- We assume that all shellfish are constantly feeding while submerged under water, which is an overestimate because shellfish particulate consumption varies with sediment concentration. For example, when total particulate matter in the water column is over 5 mg/L, gills start to clog, affecting respiration and triggering a reduction in the clearance rate (Cranford et al. 2011; Galimany et al. 2013).
- Nutrient recycling by the shellfish is not considered, where excreted inorganic nutrients can be taken up by phytoplankton directly or regenerated by bacteria into inorganic nutrients that can stimulate phytoplankton growth.

CE values indicate that the amount of filtration by cultured shellfish in Arcata Bay may already be greater than 5% of the bay's flushing rate with adjacent waters, and that with the quantity of shellfish proposed by the Project and Coast Project, filtration could approach the flushing rate (i.e., CE value of 0.77 assuming a worst-case scenario flushing rate and the higher of the two CRs). However, unlike the other metrics, it is not necessarily detrimental for an ecosystem to have CE values this high. CE does not account for the amount of organic matter in the water, primary production rates, and the ability of the resources being consumed to be rapidly recirculated into the ecosystem though fecal decomposition, the microbial loop, and subsequent new primary production. While a CE value above one indicates that the clearance rate exceeds the flushing rate, it does not answer the more pertinent question of what impact that flushing has on available amounts of carbon and phytoplankton within the ecological system. While all metrics must be considered together, FP and RR are better metrics to specifically address what cumulative impact the projects will have on available food resources in Humboldt Bay.

The FP calculations based on the higher CR indicate that 9% of the carbon fixed by phytoplankton in the bay would be diverted to cultured shellfish and 5% would be diverted assuming the lower CR. It is noteworthy that these calculations do not take into account a large portion of carbon consumed by shellfish that doesn't leave the bay when the shellfish are harvested, but is recycled in the ecosystem[6].

Lastly, the RR value is below 0.05 for all levels of shellfish culture analyzed. This metric directly pertains to the regulation of phytoplankton dynamics and best answers our research question. The phytoplankton turnover rate is too fast to be significantly affected by current and proposed shellfish culture, and therefore the cumulative impact from existing culture and the proposed projects appears to be negligible as measured by this metric.

These performance indicator metrics provide useful guidance for assessing the cumulative effects of current and proposed shellfish culture on food resources in Arcata Bay. CE values are relatively high, particularly when

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[6] This includes feces and pseudo-feces produced by shellfish.

employing the conservative assumptions of slow flushing rates and a higher CR. However, CE does not consider the actual food resources (e.g., phytoplankton). Values for the metrics that do consider food resources (i.e., for FP and RR) are substantially lower. This provides an indication that, for its size, Humboldt Bay is highly productive and this productivity can withstand a substantial cultured shellfish density without affecting food resources available to other organisms in the bay. This is likely due to strong upwelling events in nearby ocean waters coupled with rapid phytoplankton turnover rates. Considered together, the performance indicators provide an indication that existing and proposed shellfish culture would have some effect on bay conditions but that food resources are abundant enough that non-cultured (wild) species will not be significantly affected by changes in food availability resulting from the Coast Project and Pre-Permitting Project.

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Appendix D. Site Selection Process

Humboldt Bay Mariculture Pre-Permitting Project
Site Selection Process

The first step in site selection for the Humboldt Bay Mariculture Pre-Permitting Project (Project) was to restrict the Project to north Humboldt Bay, because this is the area of Humboldt Bay envisioned for mariculture activities in the Humboldt Bay Management Plan[1]. Next, within north Humboldt Bay, the following criteria were used to identify appropriate sites:

1. Avoid existing leases.
2. Avoid areas with dense eelgrass.
3. Avoid marine mammal haul out areas.
4. Avoid areas where culture is prohibited by the State Department of Health.
5. Potential for successful commercial shellfish culture.

Once suitable areas for culture were identified, site boundaries were further refined to minimize the amount of patchy eelgrass within each site.

[1] Humboldt Bay Harbor, Recreation and Conservation District. 2007. Humboldt Bay Management Plan. Final.

Constraints

Constraint 1: Existing Tideland Leases

An objective of the Project is to create jobs and improve the local economy. In order not to interfere with existing economic activity, it was determined that existing tideland leases should be avoided. Hence, the 4,671 acres of existing tideland leases in north Humboldt Bay (Figure 1) were not considered for Project siting.

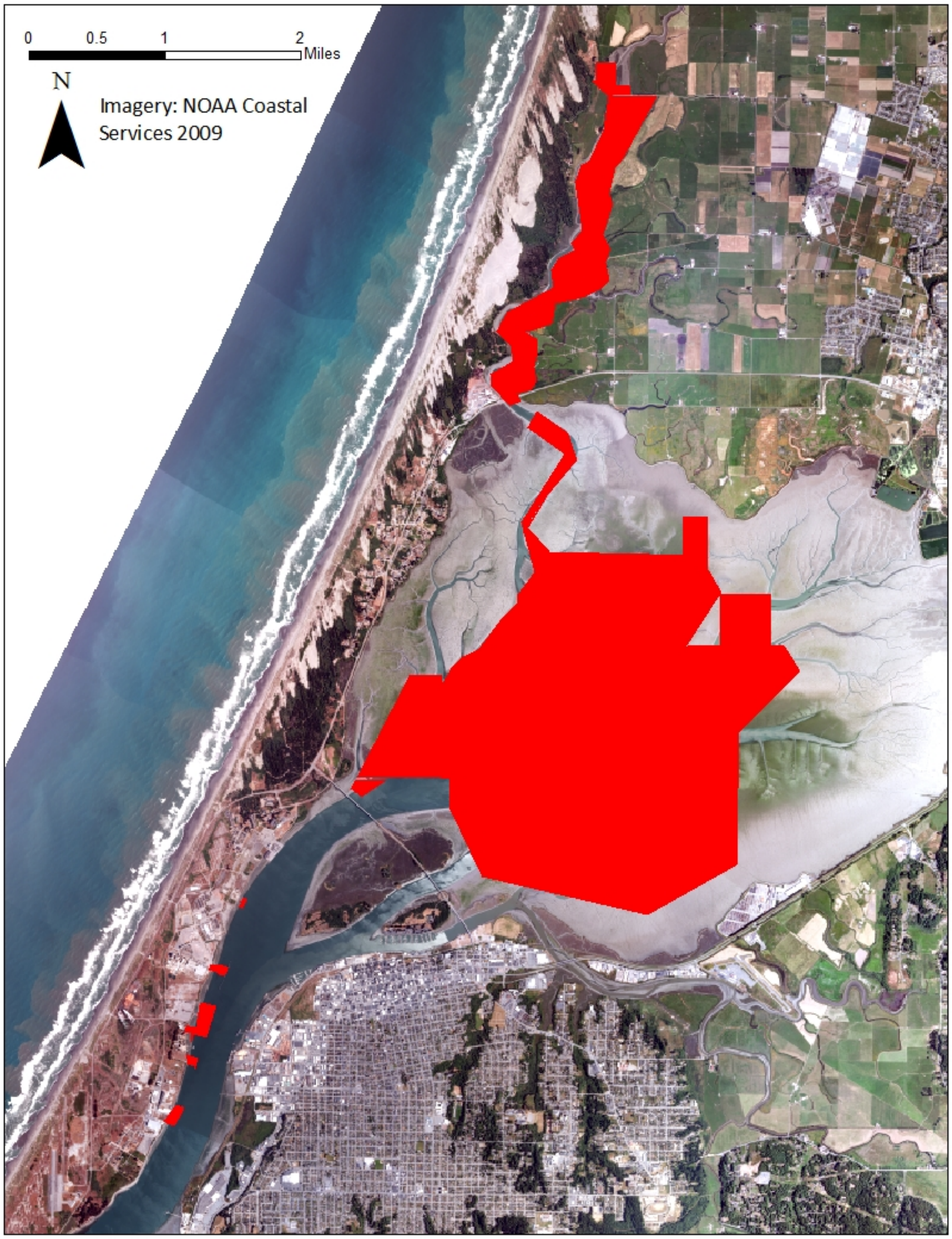

Figure 1. Existing tideland leases avoided by the Mariculture Pre-Permitting Project.

Constraint 2: Dense Eelgrass (*Zostera marina*)

The Project seeks to minimize effects to native eelgrass. This would be achieved through Project siting and mitigation measures. Figure 2 depicts areas mapped by NOAA Coastal Services in 2009 as having dense (>84% cover) eelgrass. These areas were avoided. A large proportion of the dense eelgrass distribution overlaps with existing tideland leases (Constraint 1). In total, 5,160 acres were avoided due to Constraint 1 (Existing Leases) and Constraint 2 (Dense Eelgrass).

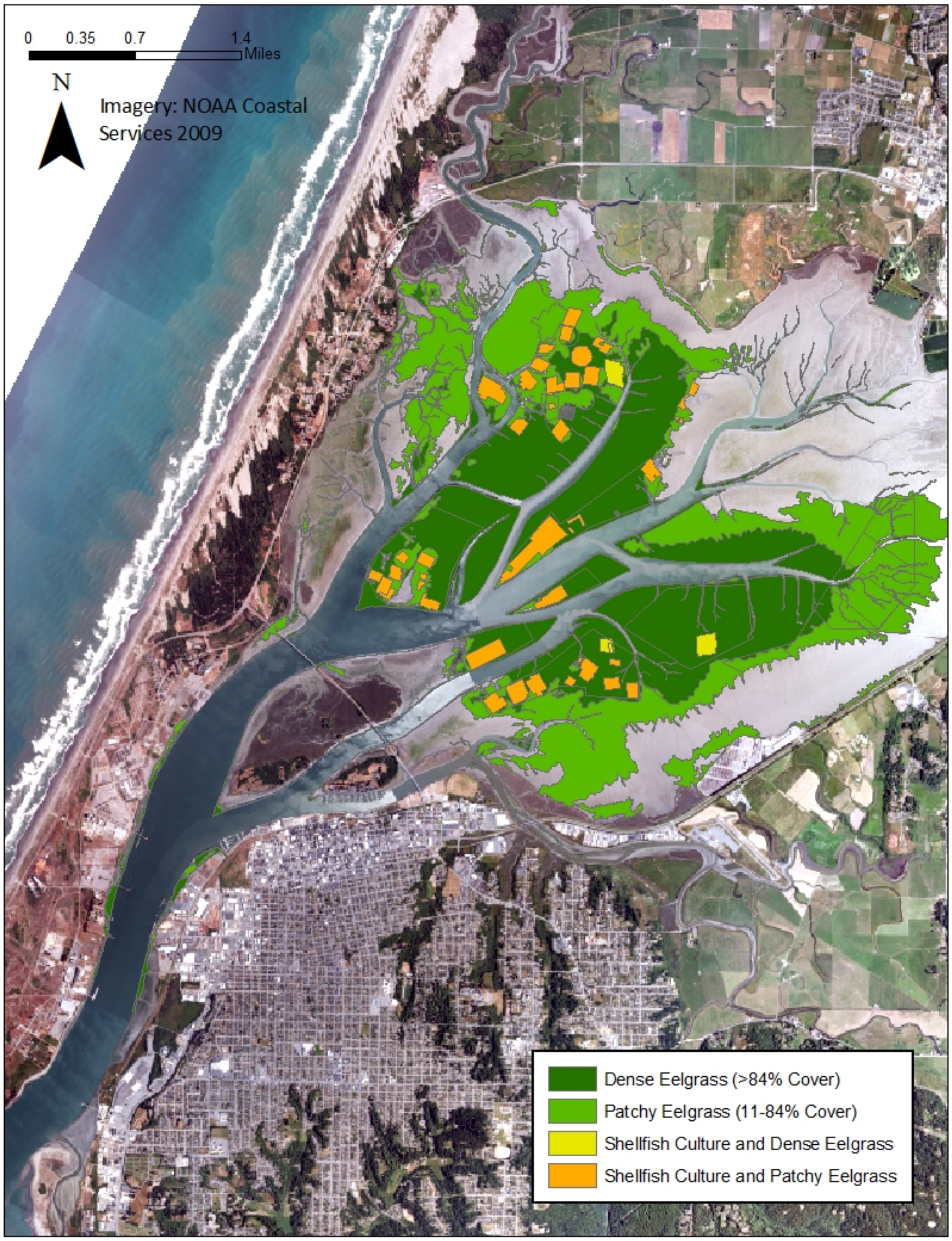

Figure 2. Eelgrass habitats in north Humboldt Bay based on mapping by NOAA Coastal Services in 2009.

Constraint 3: Marine mammal haulout areas.

The Project strives to avoid impacts to marine mammals. Based on our research, there is only one marine mammal haul out outside of existing leases (Constraint 1) and dense eelgrass (Constraint 2). This site is utilized by harbor seals (*Phoca vitulina*). The Project was designed to avoid this location; the nearest Project Site (Site 1) is approximately 400 meters away.

Figure 3. Identified marine mammal (harbor seal) haul out site.

Constraint 4: Water Quality: Shellfish Culture Prohibition Area

The California Department of Health Services has identified two areas in Humboldt Bay where culture of shellfish for human consumption is prohibited[2] (Figure 4). These areas were avoided.

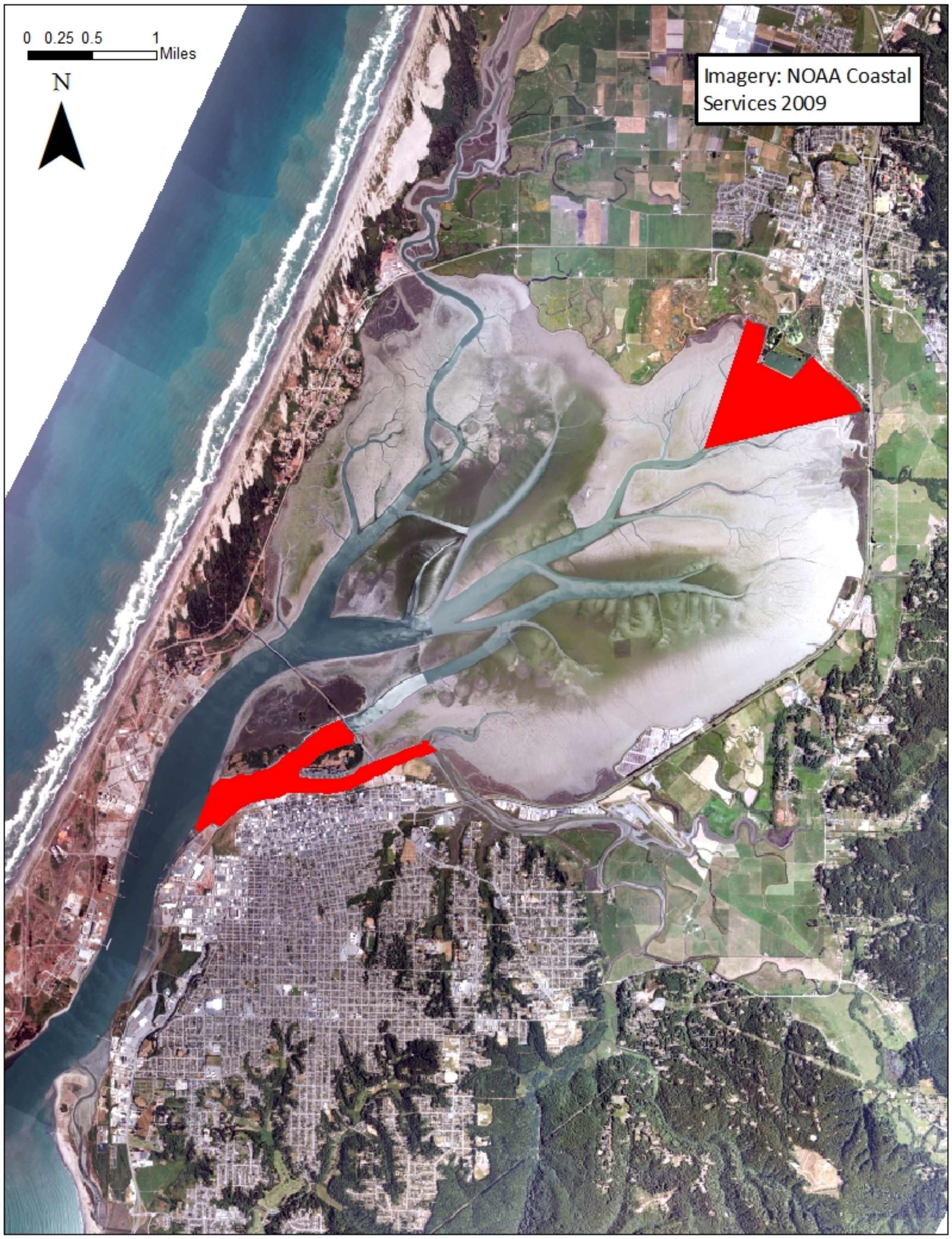

Figure 4. Areas prohibited for culture of shellfish for human consumption by the California Department of Health Services.

[2] California Department of Health Services. 2006. Shellfish growing area classification for Humboldt Bay: twelve-year sanitary survey report. Technical Report #06-11.

Assessment of Suitability for Shellfish Culture

Areas not excluded from consideration due to Constraints 1-4 were evaluated to determine suitability for economically viable shellfish culture. Input was obtained from culturists with experience in Bodega Bay, Tomales Bay, Humboldt Bay and Washington State. Suitability was based primarily on elevation; accessibility at various tide heights; and substrate (i.e., there was a focus on substrate that is firm enough to efficiently walk on). These parameters were assessed in the field by the District and culturists. Based on the assessment, the four intertidal sites described in the EIR were identified.

Selected Sites

As described above, sites were selected by (1) identifying constraints and avoiding them; and (2) identifying economically viable culture areas outside of the constrained areas, through consultation with experienced culturists. Areas in northeastern Humboldt Bay were also avoided due to public comments opposing shellfish culture in that area resulting in 3 candidate sites. Constraints to siting and identified sites are depicted in Figure 5. Efforts were also made to avoid areas with patchy eelgrass. To do this, the sites are located at elevations that are in the upper limits of where culture may be viable. As shown in Table 1, there is a small amount of eelgrass within the project sites. Eelgrass will be avoided as described in the Project's Environmental Impact Report.

Table 1. Acres of Eelgrass within each Project Site as Mapped in 2017 (SHN 2017).

Site	Acres with Eelgrass	Acres without Eelgrass	Percent of Site with Eelgrass	Total Area
1	0.015641	29.184359	0.054%	29.2
2	0.000049	3.899951	0.001%	3.90
3	0.000296	11.799704	0.003%	11.8
Total	0.015986	44.884014	0.036%	44.9

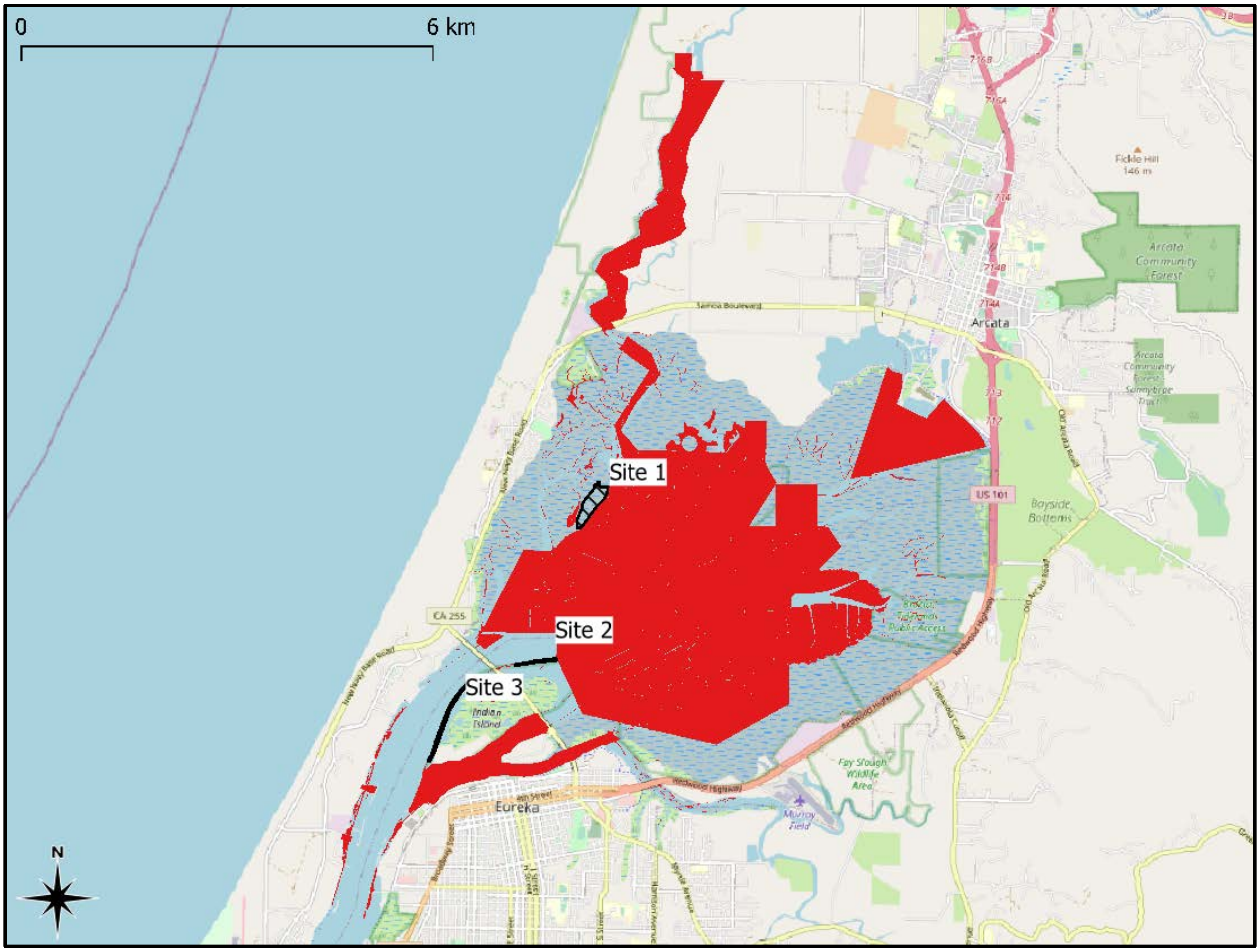

Figure 5. Areas with constraints to Project siting and selected sites.