



July 5, 2022

Governor's Office of Planning & Research

Jul 5 2022

Jan Novak
Port of Oakland
Environmental Programs and Planning Division
530 Water Street
Oakland, CA 94607
TurningBasins@portoakland.com

STATE CLEARINGHOUSE

Dear Mr. Novak:

Oakland Harbor Turning Basins Widening (Project)
Notice of Preparation (NOP)
SCH# 2022050647

The California Department of Fish and Wildlife (Department) received a NOP from the Port of Oakland (Port) for the Project pursuant the California Environmental Quality Act (CEQA) and CEQA Guidelines.¹

Thank you for the opportunity to provide comments and recommendations regarding those activities involved in the Project that may affect California fish and wildlife. Likewise, we appreciate the opportunity to provide comments regarding those aspects of the Project that the Department, by law, may be required to carry out or approve through the exercise of its own regulatory authority under the Fish and Game Code.

Department ROLE

The Department is California's Trustee Agency for fish and wildlife resources and holds those resources in trust by statute for all the people of the state. (Fish & G. Code, Section 711.7, subd. (a) & 1802; Pub. Resources Code, Section 21070; CEQA Guidelines Section 15386, subd. (a).) The Department, in its trustee capacity, has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species. (*Id.*, Section 1802.) Similarly for purposes of CEQA, the Department is charged by law to provide, as available, biological expertise during public agency environmental review efforts, focusing specifically on projects and related activities that have the potential to adversely affect fish and wildlife resources. The Department is also responsible for marine biodiversity protection under the Marine Life Protection Act in coastal marine waters of California, and ensuring fisheries are sustainably managed under the Marline Life Management Act.

¹ CEQA is codified in the California Public Resources Code in section 21000 et seq. The "CEQA Guidelines" are found in Title 14 of the California Code of Regulations, commencing with section 15000.

The Department is also submitting comments as a Responsible Agency under CEQA. (Pub. Resources Code, Section 21069; CEQA Guidelines, Section 15381.) The Department may need to exercise regulatory authority as provided by the Fish and Game Code. To the extent implementation of the Project as proposed may result in take as defined by State law of any species protected under the CESA (Fish & Game Code, Section 2050 et seq.), related authorization as provided by the Fish and Game Code will be required. Pursuant to our jurisdiction, the Department has the following comments and recommendations regarding the Project.

REGULATORY REQUIREMENTS

California Endangered Species Act: Please be advised that a CESA permit will be recommended if the Project has the potential to result in “take” of plants or animals listed under CESA, either during construction or over the life of the project. Issuance of a CESA permit is subject to CEQA documentation; the CEQA document must specify impacts, mitigation measures, and a mitigation monitoring and reporting program. If the Project will impact CESA listed species, early consultation is encouraged, as significant modification to the Project and mitigation measures may be required to obtain a CESA Permit.

CEQA requires a Mandatory Finding of Significance if a project is likely to substantially restrict the range or reduce the population of a threatened, rare, or endangered species. (Pub. Resources Code, Section 21001, subd. (c), 21083; CEQA Guidelines, Sections 15380, 15064, and 15065). Impacts must be avoided or mitigated to less-than-significant levels unless the CEQA Lead Agency makes and supports Findings of Overriding Consideration (FOC). The CEQA Lead Agency’s FOC does not eliminate the Project proponent’s obligation to comply with Fish and Game Code section 2080.

PROJECT DESCRIPTION SUMMARY

Proponent: Port of Oakland

Objective: The objective of the Project is to improve the efficiency of vessels entering and exiting the Oakland Harbor, the Project proposes to increase the width of existing turning basins to accommodate large vessels and a length of 1,310 feet. Primary Project activities include dredging to deepen the turning basin to 50 feet below mean lower low water, remove shoreline structures within the widening area, pile removal, bulkhead removal and installation, new anchor/tie back installation.

Location: Along the eastern shoreline of San Francisco Bay in Oakland Inner and Outer Harbors within the Cities of Oakland and Alameda, Alameda County.

Timeframe: The Project is proposed to start in July 2027 and take approximately 2.5 years to complete.

MARINE BIOLOGICAL SIGNIFICANCE

The San Francisco Bay-Delta is the second largest estuary in the United States and supports numerous aquatic habitats and biological communities. It encompasses 479 square miles, including shallow mudflats. This ecologically significant ecosystem supports both state and federally threatened and endangered species and sustains important commercial and recreational fisheries.

STATE AND FEDERALLY LISTED AND COMMERCIALLY/RECREATIONALLY IMPORTANT SPECIES

Protected species under the State and Federal Endangered Species Acts that could potentially be present near Project activities include:

- Chinook salmon (*Oncorhynchus tshawytscha*), state and federally threatened (Sacramento River Spring-run), state and federally endangered (Sacramento River Winter-run)
- Steelhead (*Oncorhynchus mykiss*), federally threatened (Central California Coast and Central Valley evolutionary significant units)
- Green sturgeon (*Acipenser medirostris*), federal threatened (Southern Distinct Population Segment)
- White Sturgeon (*A. transmontanus*), state species of special concern
- Longfin smelt (*Spirinchus thaleichthys*), state-threatened
- Brown pelican (*Pelecanus occidentalis californicus*), state fully protected
- California least tern (*Sternula antillarum browni*), federal and state endangered and state fully protected

Several species with important commercial/recreational fisheries value and habitat value for spawning and rearing could potentially be present near Project activities. These include:

- Dungeness crab (*Cancer magister*),
- Pacific herring (*Clupea pallasi*),
- Rockfish (*Sebastes* spp.),
- California halibut (*Paralichthys californicus*)
- Surfperches (*Embiotocidae*).
- Eelgrass (*Zostera marina*).

COMMENTS AND RECOMMENDATIONS

The Department offers the comments and recommendations below to assist the Port in adequately identifying and/or mitigating the Project's significant, or potentially significant, direct and indirect impacts on fish and wildlife (biological) resources.

Editorial comments or other suggestions may also be included to improve the document.

I. Marine Project Level Impacts and Other Considerations

Work Windows

Comment: The NOP addresses work windows that were put into place by multiple state and federal agencies under the San Francisco Bay Long Term Management Strategy (LTMS) (attached). As described in the NOP, work is planned to take place within the specified work windows during the anticipated 2.5 years of construction. The general in-water work window for dredging and pile driving activity is June 1 through November 30. However, Least Terns, a state endangered and fully protected species, are present nearby and could be impacted by Project activities. If potential impacts to Least Terns are identified, the work window to avoid impacts to this species and other aquatic species would be August 1 through November 30.

Recommendations: The Department recommends that the Draft Environmental Impact Report (DEIR) discuss the work window to avoid impacts to certain species. The DEIR should also address the potential for impacts, both direct and indirect, to Least Terns.

Dredging

Comment: The NOP mentions that the majority of dredged material would be placed at a beneficial use site with some contaminated sediment being disposed at a land fill. It is not clear if this will account for 100% of the material. The Department expects all uncontaminated material to be beneficially reused within San Francisco Bay.

Recommendations: The Department recommends that the DEIR discuss whether any uncontaminated material will be placed anywhere other than a beneficial reuse site or be used for the specific purpose of habitat restoration or creation. The Department recommends the DEIR include a complete accounting, to the extent known, of where the estimated amount of material may be reused or disposed.

Hydroacoustic Impacts

Comment: The NOP describes the installation of a new bulkhead using steel and concrete walls. The extent to which pile driving and other construction related in-water activities will be necessary for the installation of this structure is not clear.

Recommendations: The Department recommends the DEIR discuss whether pile driving will occur and the expected materials and methods that will be utilized to

construct the new bulkhead. If pile driving is anticipated to occur, the Department recommends the following minimization measures:

- A vibratory hammer should be used to the maximum extent feasible.
- If an impact a hammer is necessary, a soft start technique should be implemented.
- Impact pile driving should occur at low tide, if possible.
- All impact pile driving should use a wood cushion block between the hammer and pile.
- Impact pile driving larger diameter steel and concrete piles should include a bubble curtain for additional sound attenuation.

If hydroacoustic sound levels are still anticipated to exceed the interim hydroacoustic thresholds for injury to fish (attached), the DEIR should include discussion on consultation with the Department to receive incidental take coverage via a 2081(b) Incidental Take Permit for potential take of state listed species.

Eelgrass

Comment: There is documented eelgrass habitat within and near both the Oakland Inner and Outer harbors. It is not clear from the NOP whether eelgrass may be present and/or impacted from the proposed Project activities.

Recommendations: The Department recommends the DEIR discuss the potential impacts to eelgrass from Project activities. If it is determined that impacts may occur, the DEIR should also discuss avoidance measures and surveys will occur prior to and during construction such as:

- Pre- and post-construction eelgrass surveys consistent with the recommendations within the California Eelgrass Mitigation Policy (attached)
- Installation of turbidity curtains
- Light monitoring
- Vessel transit routes to avoid eelgrass during the process of construction

ENVIRONMENTAL DATA

CEQA requires that information developed in environmental impact reports and negative declarations be incorporated into a data base which may be used to make subsequent or supplemental environmental determinations. (Pub. Resources Code, § 21003, subd. (e).) Accordingly, please report any special status species and natural communities detected during Project surveys to the California Natural Diversity Database (CNDDB). The CNDDB field survey form can be found at the following link: <https://wildlife.ca.gov/Data/CNDDB/SubmittingData#44524420-pdf-field-survey-form>. The completed form can be mailed electronically to CNDDB at the following email

Jan Novak
Port of Oakland
July 5, 2022
Page 6

address: CNDDB@wildlife.ca.gov. The types of information reported to CNDDB can be found at the following link: <https://wildlife.ca.gov/Data/CNDDB/Plants-and-Animals>.

FILING FEES

The Project, as proposed, would have an impact on fish and/or wildlife, and assessment of filing fees is necessary. Fees are payable upon filing of the Notice of Determination by the Lead Agency and serve to help defray the cost of environmental review by the Department. Payment of the fee is required in order for the underlying project approval to be operative, vested, and final. (Cal. Code Regs, tit. 14, Section 753.5; Fish & G. Code, Section 711.4; Pub. Resources Code, Section 21089.)

CONCLUSION

The Department appreciates the opportunity to comment on NOP to assist the Port in identifying and mitigating Project impacts on biological resources.

Questions regarding this letter or further coordination should be directed to Arn Aarreberg, Environmental Scientist, Marine Region at (707) 791-4195 or Arn.Aarreberg@wildlife.ca.gov.

Sincerely,



Craig Shuman, D. Env
Marine Regional Manager

Enclosures

Interim Criteria for Injury to Fish from Pile Driving Activities
National Marine Fisheries Service California Eelgrass Mitigation Policy
San Francisco Bay Long Term Management Strategy Environmental Work Windows

cc: Becky Ota, Environmental Program Manager
Department of Fish and Wildlife
Becky.Ota@wildlife.ca.gov

Eric Wilkins, Senior Environmental Scientist
Department of Fish and Wildlife
Eric.Wilkins@wildlife.ca.gov

Jan Novak
Port of Oakland
July 5, 2022
Page 7

Arn Aarreberg, Environmental Scientist
Department of Fish and Wildlife
Arn.Aarreberg@wildlife.ca.gov

Marcia Grefsrud, Environmental Scientist
Department of Fish and Wildlife
Marcia.Grefsrud@wildlife.ca.gov

Xaiver Fernandez, Environmental Program Manager
Regional Water Quality Control Board
Xavier.Fernandez@Waterboards.ca.gov

Kevin Lunde, Senior Environmental Scientist
Regional Water Quality Control Board
Kevin.Lunde@Waterboards.ca.gov

Brenda Goeden, Senior Environmental Scientist
San Francisco Bay Conservation and Development Commission
Brenda.Goeden@bcdc.ca.gov

State Clearinghouse (SCH No. 2022050647)
state.clearinghouse@opr.ca.gov

Maintenance Dredging Work Windows by Area and Species

Revised Draft Work Windows (Green)
1/06/21

Site	Species	January 1-15 16-31	February 1-15 16-28	March 1-15 16-31	April 1-15 16-30	May 1-15 16-31	June 1-15 16-30	July 1-15 16-31	August 1-15 16-31	September 1-15 16-30	Ocober 1-15 16-31	November 1-15 16-30	December 1-15 16-31															
SF Bay Bridge to Sherman Island	Chinook Salmon and Steelhead	Consultation Required January to May					Work Window																					
Carquinez Bridge to Collinsville	Delta Smelt Water ≤10' *	Consultation Required January to December																										
Napa and Petaluma Rivers, Sonoma Creek	Steelhead	Consultation Required January to July								Work Window August to November				Consultation Required November to December														
Napa River	Delta Smelt	Work Window January	Consultation Required February to July							Work Window August to December																		
All areas within 45 meters of eelgrass habitat	Dungeness Crab	Work Window January to April				Consultation Required May to June		Work Window July to December																				
San Francisco Bay from Pinole Point to Redwood Creek	Pacific Herring	Consultation Required January to March 15			Work Window March 16 to November																							
Richardson Bay & San Francisco Waterfront (Hard stop at November 30th)	Pacific Herring	Consultation Required January to March 15			Work Window March 16 to November																							
Waters of Marin County from the Golden Gate Bridge to Richmond-San Rafael Bridge	Coho Salmon	Consultation Required January to May					Work Window June to October					Consultation Required November to December																
Berkeley Marina to San Lorenzo Creek within 1 mile of coastline	California Least Tern	Work Window January to March 15			Consultation Required March 16 to July				Work Window August to December																			
South of Highway 92 Bridge (San Mateo-Hayward)	California Least Tern	Work Window January to May					Consultation Required June to September 15			Work Window September to December																		
In areas with eelgrass beds	California Least Tern	Consultation Required January to December																										
Baywide in areas of salt marsh habitat	California Clapper Rail	Consultation Required January to December																										
Baywide within 250 feet of salt marsh habitat	California Clapper Rail	Work Window January	Consultation Required February to August							Work Window September to December																		
In and adjacent to salt marsh habitat	Salt Marsh Harvest Mouse	Consultation Required January to December																										
Within 300 feet of known roost site	California Brown Pelican	Work Window January to June					Consultation Required July to September			Work Window October to December																		

For more detailed information, see Appendix F of the LTMS Management Plan or the LTMS EIR/EIS.

* Depths are represented in MLLW, and are project depth, not including over dredge allowance

**This chart is for operations and maintenance dredging of existing navigational facilities. Other species may be affected by work in other areas.

WORK WINDOW

CONSULTATION REQUIRED

MEMORANDUM

June 12, 2008

From: Fisheries Hydroacoustic Working Group

Subject: Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities

To: Applicable Agency Staff

The signatory agencies, identified below, have agreed in principle to use the attached Interim Criteria for Injury to Fish from Pile Driving Activities. The agreement was concluded at a meeting in Vancouver, Washington on June 10-11, 2008 with key technical and policy staff from the Federal Highway Administration, NOAA Fisheries, U.S. Fish and Wildlife Service, the Departments of Transportation from California, Oregon, and Washington; and national experts on sound propagation activities that affect fish and wildlife species of concern. The agreed upon criteria identify sound pressure levels of 206 dB peak and 187 dB accumulated sound exposure level(SEL) for all listed fish except those that are less than 2 grams. In that case, the criteria for the accumulated SEL will be 183 dB.

These criteria will apply to all new projects beginning no later than 60 days from the date of this memorandum. During the interim 60 day period, the Transportation Agencies will work with the Services to identify projects currently in the consultation process and reach agreement on which criteria will be used to assess project effects.

The agencies agree to review the science periodically and revise the threshold and cumulative levels as needed to reflect current information. Behavioral impacts to fish and impacts to marine mammals are not addressed in this agreement. Sub-injurious effects will continue to be discussed in future meetings.

The respective agencies also agree to develop appropriate training for staff on these revised criteria, as well as a process to review and possibly refine the criteria, when appropriate.

For questions or concerns about the revised criteria, we recommend staff contact their agency environmental coordinator or agency expert on pile driving issues.

Carol S. Atkins



Federal Highway Administration*

*FHWA supports the use of these interim criteria in the states signing this agreement in principle. FHWA leaves the schedule for implementation to the discretion of the state DOTs in cooperation with their respective FHWA Division Offices and the Services.

Michael Jahan



NOAA Fisheries – NWR

Russell M. Strock



NOAA Fisheries – SWR

Ken S. Berg



US Fish and Wildlife Service Region 1

Michael E. Dagnes Jr.



US Fish and Wildlife Service Region 8

[Signature]

California Department of Transportation

[Signature]

California Department of Fish and Game



H.C. Farley, Geo-Environmental Mgr.

Oregon Department of Transportation



Meganulahs

Washington State Department of Transportation



Washington State
Department of
Transportation



NOAA FISHERIES

West Coast Region

California Eelgrass Mitigation Policy and Implementing Guidelines

October 2014



Photo credit: www.Lorenz-Avelar.com

Table of Contents

I. NATIONAL MARINE FISHERIES SERVICE'S (NMFS) CALIFORNIA EELGRASS MITIGATION POLICY.....	1
A. POLICY STATEMENT	1
B. EELGRASS BACKGROUND AND INFORMATION.....	2
C. PURPOSE AND NEED FOR EELGRASS MITIGATION POLICY	3
D. RELEVANCE TO OTHER FEDERAL AND STATE POLICIES	4
1. <i>Corps/EPA Mitigation Rule and supporting guidance</i>	4
2. <i>State of California Wetland Conservation Policies</i>	4
3. <i>NOAA Aquaculture Policy and National Shellfish Initiative</i>	5
4. <i>NOAA Seagrass Conservation Guidelines</i>	6
5. <i>Southern California Eelgrass Mitigation Policy</i>	6
II. IMPLEMENTING GUIDELINES FOR CALIFORNIA.....	6
A. EELGRASS HABITAT DEFINITION.....	7
B. SURVEYING EELGRASS.....	8
1. <i>Survey Parameters</i>	8
2. <i>Eelgrass Mapping</i>	10
3. <i>Survey Period</i>	11
4. <i>Reference Site Selection</i>	11
C. AVOIDING AND MINIMIZING IMPACTS TO EELGRASS	11
1. <i>Turbidity</i>	12
2. <i>Shading</i>	12
3. <i>Circulation patterns</i>	13
4. <i>Nutrient loading</i>	14
5. <i>Sediment loading</i>	14
D. ASSESSING IMPACTS TO EELGRASS HABITAT	14
1. <i>Direct Effects</i>	16
2. <i>Indirect Effects</i>	16
E. MITIGATION OPTIONS	17
1. <i>Comprehensive management plans</i>	17
2. <i>In-kind mitigation</i>	18
3. <i>Mitigation banks and in-lieu-fee programs</i>	18
4. <i>Out-of-kind mitigation</i>	19
F. IN-KIND MITIGATION FOR IMPACTS TO EELGRASS	19
1. <i>Mitigation Site Selection</i>	19
2. <i>Mitigation Area Needs</i>	20
3. <i>Mitigation Technique</i>	23
4. <i>Mitigation Plan</i>	24
5. <i>Mitigation Timing</i>	24
6. <i>Mitigation Monitoring and Performance Milestones</i>	25
7. <i>Mitigation Reporting</i>	27
8. <i>Supplemental Mitigation</i>	27
G. SPECIAL CIRCUMSTANCES.....	27
1. <i>Localized Temporary Impacts</i>	28
2. <i>Localized Permanent Impacts</i>	28
III. GLOSSARY OF TERMS.....	29
IV. LITERATURE CITED	31

- ATTACHMENT 1.** Graphic depiction of eelgrass habitat definition including spatial distribution and aerial coverage of vegetated cover and unvegetated eelgrass habitat.
- ATTACHMENT 2.** Example Eelgrass Habitat Percent Vegetated Cover.
- ATTACHMENT 3.** Flow chart depicting timing of surveys and monitoring.
- ATTACHMENT 4.** Eelgrass transplant monitoring report.
- ATTACHMENT 5.** Wetlands mitigation calculator formula and parameters.
- ATTACHMENT 6.** Example calculations for application of starting and final mitigation ratios for impacts to eelgrass habitat in southern California.
- ATTACHMENT 7.** Example mitigation area multipliers for delay in initiation of mitigation activities.
- ATTACHMENT 8.** Summary of Eelgrass Transplant Actions in California

I. National Marine Fisheries Service's (NMFS) California Eelgrass Mitigation Policy

A. Policy Statement

It is NMFS' policy to recommend **no net loss of eelgrass habitat function** in California.

For all of California, compensatory mitigation should be recommended for the loss of existing eelgrass habitat function, but only after avoidance and minimization of effects to eelgrass have been pursued to the maximum extent practicable. Our approach is congruous with the approach taken in the federal Clean Water Act guidelines under section 404(b)(1) (40 CFR 230). In absence of a complete functional assessment, eelgrass distribution and density should serve as a proxy for eelgrass habitat function. Compensatory mitigation options include comprehensive management plans, in-kind mitigation, mitigation banks and in-lieu-fee programs, and out-of-kind mitigation. While in-kind mitigation is preferred, the most appropriate form of compensatory mitigation should be determined on a case-by-case basis.

Further, it is the intent of this policy to ensure that there is no loss associated with delays in establishing compensatory mitigation. This should be accomplished by creating a greater amount of eelgrass than is lost, if the mitigation is performed contemporaneously or after the impacts occur. To achieve this, NMFS, in most instances, should recommend compensatory mitigation for vegetated and unvegetated eelgrass habitat be successfully completed at a ratio of at least 1.2:1 mitigation area to impact area. This ratio is based on present value calculation¹ using a discount rate of 0.03 (NOAA-DARP 1999). This ratio assumes that restored eelgrass habitat achieves habitat function comparable to existing eelgrass habitat within a period of three years or less (Hoffman 1986, Evans & Short 2005, Fonseca *et al.* 1990).

For ongoing projects, once mitigation has been successfully implemented to compensate for the loss of eelgrass habitat function within a specified footprint, NMFS should not recommend additional mitigation for subsequent loss of eelgrass habitat if 1) ongoing project activities result in subsequent loss of eelgrass habitat function within the same footprint for which mitigation was completed and 2) the project applicant can document that no new area of eelgrass habitat is impacted by project activities.

This policy does not address mitigation for potential eelgrass habitat. NMFS recognizes impacts to potential eelgrass habitat may preclude eelgrass movement or expansion to suitable unvegetated areas in the future, potentially resulting in declines in eelgrass abundance over time. In addition, it does not address other shallow water habitats. Regulatory protections in the estuarine/marine realm typically focus on wetlands and submerged aquatic vegetation. Mudflats, sandflats, and other superficially bare habitats do not garner the same degree of recognition and

¹ Present Value (PV) is a calculation used in finance to determine the present day value of an amount that is received at a future date. The premise of the equation is that receiving something today is worth more than receiving the same item at a future date; $PV = C_1/(1+r)^n$ where C_1 = resource at period 1, r = interest or discount rate, n =number of periods.

concern, even though these are some of the most productive and fragile ecosystems (Reilly *et al.* 1999). NMFS will continue to collaborate with federal and state partners on these issues.

B. Eelgrass Background and Information

Eelgrass species (*Zostera marina* L. and *Z. pacifica*) are seagrasses that occur in the temperate unconsolidated substrate of shallow coastal environments, enclosed bays, and estuaries. Eelgrass is a highly productive species and is considered to be a "foundation" or habitat forming species. Eelgrass contributes to ecosystem functions at multiple levels as a primary and secondary producer, as a habitat structuring element, as a substrate for epiphytes and epifauna, and as sediment stabilizer and nutrient cycling facilitator. Eelgrass provides important foraging areas and shelter to young fish and invertebrates, food for migratory waterfowl and sea turtles, and spawning surfaces for invertebrates and fish such as the Pacific herring. Eelgrass also provides a significant source of carbon to the detrital pool which provides important organic matter in sometimes food-limited environments (e.g., submarine canyons). In addition, eelgrass has the capacity to sequester carbon in the underlying sediments and may help offset carbon emissions. Given the significance and diversity of the functions and services provided by seagrass, Costanza *et al.* (2007) determined seagrass ecosystems to be one of Earth's most valuable.

California supports dynamic eelgrass habitats that range in extent from less than 11,000 acres to possibly as much as 15,000 acres statewide. This is inclusive of estimates for poorly documented beds in smaller coastal systems as well as open coastal and insular areas. While among the most productive of habitats, the overall low statewide abundance makes eelgrass one of the rarest habitats in California. Collectively just five systems, Humboldt Bay, San Francisco Bay, San Diego Bay, Mission Bay and Tomales Bay support over 80 percent of the known eelgrass in the state. The uneven distribution of eelgrass resources increases the risk to this habitat and also contributes to its dynamic nature. Further, the narrow depth range within which eelgrass can occur further places this habitat at risk in the face of global climate change and sea level rise predictions.

Seagrass habitat has been lost from temperate estuaries worldwide (Duarte 2002, Lotze *et al.* 2006, Orth *et al.* 2006). While both natural and human-induced mechanisms have contributed to these losses, impacts from human population expansion and associated pollution and upland development is the primary cause (Short and Wyllie-Echeverria 1996). Human activities that affect eelgrass habitat distribution and abundance, including, but not limited to, urban development, harbor development, aquaculture, agricultural runoff, effluent discharges, and upland land use associated sediment discharge (Duarte 2008) occur throughout California. For example, dredging and filling; shading and alteration of circulation patterns; and watershed inputs of sediment, nutrients, and unnaturally concentrated or directed freshwater flows can directly and indirectly destroy eelgrass habitats. Conversely, in many areas great strides have been made at restoring water quality and expanding eelgrass resources through directed efforts at environmental improvements and resource enhancement. While improvements in eelgrass management have occurred overall, the importance of eelgrass both ecologically and economically, coupled with ongoing human pressure and potentially increasing degradation and losses associated with climate change, highlight the need to protect, maintain, and where feasible, enhance eelgrass habitat.

C. Purpose and Need for Eelgrass Mitigation Policy

Eelgrass warrants a strong protection strategy because of the important biological, physical, and economic values it provides, as well as its importance to managed species under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Vegetated shallows that support eelgrass are also considered special aquatic sites under the 404(b)(1) guidelines of the Clean Water Act (40 C.F.R. § 230.43). The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) developed this policy to establish and support a goal of protecting this resource and its habitat functions, including spatial coverage and density of eelgrass habitats. This NMFS policy and implementing guidelines are being shared with agencies and the public to ensure there is a clear and transparent process for developing eelgrass mitigation recommendations.

Pursuant to the MSA, eelgrass is designated as an essential fish habitat (EFH) habitat area of particular concern (HAPC) for various federally-managed fish species within the Pacific Coast Groundfish Fishery Management Plan (FMP) (PFMC 2008). An HAPC is a subset of EFH that is rare, particularly susceptible to human-induced degradation, especially ecologically important, and/or located in an environmentally stressed area. HAPC designations are used to provide additional focus for conservation efforts.

This policy and guidelines support but do not expand upon existing NMFS authorities under the MSA, the Fish and Wildlife Coordination Act (FWCA), and the National Environmental Policy Act (NEPA). Pursuant to the EFH provisions of the MSA, FWCA, and obligations under the NEPA as a responsible agency, NMFS annually reviews and provides recommendations on numerous actions that may affect eelgrass resources throughout California. Section 305(b)(1)(D) of the MSA requires NMFS to coordinate with, and provide information to, other federal agencies regarding the conservation and enhancement of EFH. Section 305(b)(2) requires all federal agencies to consult with NMFS on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH. Under section 305(b)(4) of the MSA, NMFS is required to provide EFH Conservation Recommendations to federal and state agencies for actions that would adversely affect EFH (50 C.F.R. § 600.925). NMFS makes its recommendations with the goal of avoiding, minimizing, or otherwise compensating for adverse effects to EFH. When impacts to NMFS trust resources are unavoidable, NMFS may recommend compensatory mitigation to offset those impacts. In order to fulfill its consultative role, NMFS may also recommend, among other things, the development of mitigation plans, habitat distribution maps, surveys and survey reports, progress milestones, monitoring programs, and reports verifying the completion of mitigation activities.

Eelgrass impact management and mitigation throughout California has historically been undertaken without a statewide strategy. Federal actions with impacts to eelgrass require considerable NMFS staff time for project review, coordination and development of conservation recommendations. As federal staff resources vary with budgets, and threats to aquatic resources remain steady or increase, regulatory streamlining and increased efficiency are crucial for continued protection of important coastal habitats, including eelgrass. The California Eelgrass Mitigation Policy (CEMP) is meant to increase efficiency of existing regulatory authorities in a

programmatic manner, provide transparency to federal agencies and action proponents, and ensure that unavoidable impacts to eelgrass habitat are fully and appropriately mitigated. It is the intent of NMFS to collaborate with other federal, state, and local agencies charged with the protection of marine resources to seek a unified approach to actions affecting eelgrass such that consistency across agencies with respect to this resource may be enhanced.

D. Relevance to Other Federal and State Policies

Based on our understanding of existing federal and state policies regarding aquatic resource conservation, the CEMP does not conflict with existing policies and complements the federal and state wetland policies as described below. NMFS does not intend to make any recommendations, which, if adopted by the action agency and carried out, would violate other federal, state, or local laws. The CEMP also complements the NOAA Aquaculture Policy and National Shellfish Initiative and builds upon the NOAA Seagrass Conservation Guidelines and the Southern California Eelgrass Mitigation Policy.

1. Corps/EPA Mitigation Rule and supporting guidance

In 2008, the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Corps) issued revised regulations governing compensatory mitigation for authorized impacts to wetlands, streams, and other waters of the U.S. under Section 404 of the Clean Water Act. The regulations emphasize avoiding impacts to wetlands and other water resources. For unavoidable impacts, the rule incorporates Natural Resource Council recommendations to improve planning, implementing and managing wetland replacement projects, including: science-based assessment of impacts and compensation measures, watershed assessments to drive mitigation sites and plans, measurable and enforceable ecological performance standards for evaluating mitigation projects, mitigation monitoring to document whether the mitigation employed meets ecological performance standards, and complete compensation plans. The regulations also encourage the expansion of mitigation banking and in lieu fee agreements to improve the quality and success of compensatory mitigation projects.

The NMFS policy to recommend no net loss of eelgrass function and the eelgrass mitigation guidelines offered herein align with the provisions of the EPA and Corps mitigation rule, but provide more specific recommendations on how to avoid and minimize impacts to eelgrass and how to implement eelgrass surveys, assessments, mitigation, and monitoring.

2. State of California Wetland Conservation Policies

The 1993 State of California Wetlands Conservation Policy established a framework and strategy to ensure no overall net loss and long-term gain in the quantity, quality, and permanence of wetlands acreage and values in California in a manner that fosters creativity, stewardship, and respect for private property, reduce procedural complexity in administration of state and federal wetlands conservation programs, and encourage partnerships to make landowner incentive programs and cooperative planning efforts the primary focus of wetlands conservation and restoration.

The State of California is also developing a Wetland and Riparian Area Protection Policy. The first phase of this effort was published as the “Preliminary Draft Wetland Area Protection Policy” with the purpose of protecting all waters of the State, including wetlands, from dredge and fill discharges. It includes a wetland definition and associated delineation methods, an assessment framework for collecting and reporting aquatic resource information, and requirements applicable to discharges of dredged or fill material. The draft specifies that dredge or fill projects will provide for replacement of existing beneficial uses through compensatory mitigation. The preliminary policy includes a determination that compensatory mitigation will sustain and improve the overall abundance, diversity and condition of aquatic resources in a project watershed area.

Based on the definition of wetlands included in these state wetland policies, the policies do not directly apply to subtidal eelgrass habitat, but may apply to intertidal eelgrass habitat. The NMFS policy of recommending no net loss to eelgrass habitat function and recommendations for compensatory mitigation for eelgrass impacts complement the state protection policies for wetlands.

3. NOAA Aquaculture Policy and National Shellfish Initiative

In 2011, NOAA released the National Marine Aquaculture Policy and the National Shellfish Initiative. The Policy encourages and fosters sustainable aquaculture development that provides domestic jobs, products, and services and that is in harmony with healthy, productive, and resilient marine ecosystems, compatible with other uses of the marine environment, and consistent with the National Policy for the Stewardship of the Ocean, our Coasts, and the Great Lakes (National Ocean Policy). The goal of the Initiative is to increase populations of bivalve shellfish in our nation’s coastal waters—including oysters, clams, abalone, and mussels—through both sustainable commercial production and restoration activities. The Initiative supports shellfish industry jobs and business opportunities to meet the growing demand for seafood, while protecting and enhancing habitat for important commercial, recreational, and endangered and threatened species and species recovery. The Initiative also highlights improved water quality, nutrient removal, and shoreline protection as benefits from shellfish production and restoration. Both the Policy and the Initiative seek to improve interagency coordination for permitting commercial and restoration shellfish projects, as well as support research and other data collection to assess and refine conservation strategies and priorities.

The regulatory efficiencies, transparency, and compensation for impacts to eelgrass promoted by the CEMP directly support the National Aquaculture Policy statements and National Shellfish Initiative through: (1) protection of eelgrass, an important component of productive and resilient coastal ecosystems in California and habitat for wild species, and (2) improved coordination with federal partners regarding planning and permitting for commercial shellfish projects. Furthermore, research conducted under the direction of the National Shellfish Initiative could be informed by and also inform NMFS consultations regarding eelgrass impacts and mitigation in California.

4. NOAA Seagrass Conservation Guidelines

The NOAA publication, “Guidelines for the Conservation and Restoration of Seagrasses in the United States and Adjacent Waters” (1998) was developed by Mark Fonseca of NOAA’s Beaufort Laboratory along with Jud Kenworthy and Gordon Thayer and was funded by NOAA’s Coastal Ocean Program. The document presents an overview of seagrass conservation and restoration in the United States, discusses important issues that should be addressed in planning seagrass restoration projects, describes different planting methodologies, proposes monitoring criteria and means for evaluation success, and discusses issues faced by resource managers. The CEMP considers information presented in the Fonseca *et al.* document, but deviates in some cases in order to provide reasonable and practicable guidelines for eelgrass conservation in California.

5. Southern California Eelgrass Mitigation Policy

In southern and central California, eelgrass mitigation has been addressed in accordance with the Southern California Eelgrass Mitigation Policy applied by NMFS, US Fish & Wildlife Service, California Department of Fish and Wildlife, California Coastal Commission, US Army Corps of Engineers, and other resource and regulatory agencies since 1991, and which has generally been effective at ensuring eelgrass impacts are mitigated in most circumstances. Given the success of the Southern California Eelgrass Mitigation Policy over its 20-year history, this policy reflects an expansion of the application of the Southern California policy with minor modifications to ensure a high standard of statewide eelgrass management and protection. This policy will supersede the Southern California Eelgrass Mitigation Policy for all areas of California upon its adoption.

II. Implementing Guidelines for California

This policy and guidelines will serve as the guidance for staff and managers within NMFS for developing recommendations concerning eelgrass issues through EFH and FWCA consultations and NEPA reviews throughout California. This policy will inform NMFS’s position on eelgrass issues for California in other roles as a responsible, advisory, or funding agency or trustee. In addition, this document provides guidance to assist NMFS in performing its consultative role under the statutes described above. Finally, pursuant to NMFS obligation to provide information to federal agencies under Section 305(b)(1)(D) of the MSA, this policy serves that role by providing information intended to further the conservation and enhancement of EFH. Should this policy or guidelines be inconsistent with any formally-promulgated NMFS regulations, those formally-promulgated regulations will take precedence over any inconsistent provisions of this policy.

While many of the activities impacting eelgrass are similar across California, eelgrass stressors and growth characteristics differ between southern California (U.S./Mexico border to Pt. Conception), central California (Point Conception to San Francisco Bay entrance), San Francisco Bay, and northern California (San Francisco Bay to the California/Oregon border). The amount of scientific information available to base management decisions on also differs among areas within California, with considerably more information and history with eelgrass habitat management in southern California than the other regions. Gaps in region-specific scientific

information do not override the need to be protective of eelgrass habitat while relying on the best information currently available from areas within and outside of California. Although the primary orientation of this policy is toward statewide use, where indicated below, specific elements of this policy may differ between southern California, central California, northern California and San Francisco Bay.

NMFS will continue to explore the science of eelgrass habitat and improve our understanding of eelgrass habitat function, impacts, assessment techniques, and mitigation efficacy. Approximately every 5 years, NMFS intends to evaluate monitoring and survey data collected by federal agencies and action proponents per the recommendations of these guidelines. NMFS managers will determine if updates to these guidelines are appropriate based on information evaluated during the 5-year review. Updates to these guidelines and supporting technical information will be available on the NMFS website.

The information below serves as a common starting place for NMFS recommendations to achieve no net loss of eelgrass habitat function. NMFS employees should not depart from the guidelines provided herein without appropriate justification and supervisory concurrence. However, the recommendations that NMFS ultimately makes should be provided on a case-by-case basis to provide flexibility when site specific conditions dictate. In the EFH context, NMFS recommendations are provided to the action agency, which has final approval of the action; in accordance with the MSA, the action agency may take up NMFS recommendations or articulate its reasons for not following the recommendations. In the FWCA context, NMFS makes recommendations which must be considered, but the action agency is ultimately responsible for the wildlife protective measures it adopts (if any). For these reasons, neither this policy nor its implementing guidelines are to be interpreted as binding on the public.

A. Eelgrass Habitat Definition

Eelgrass distribution fluctuates and can expand, contract, disappear, and recolonize areas within suitable environments. Vegetated eelgrass areas can expand by as much as 5 meters (m) and contract by as much as 4 m annually (Donoghue 2011). Within eelgrass habitat, eelgrass is expected to fluctuate in density and patch extent based on prevailing environmental factors (*e.g.*, turbidity, freshwater flows, wave and current energy, bioturbation, temperature, etc.). To account for seagrass fluctuation, Fonseca *et al.* (1998) recommends that seagrass habitat include the vegetated areas as well as presently unvegetated spaces between seagrass patches.

In addition, there is an area of functional influence, where the habitat function provided by the vegetated cover extends out into adjacent unvegetated areas. Those functions include detrital enrichment, energy dampening and sediment trapping, primary productivity, alteration of current or wave patterns, and fish and invertebrate use, among other functions. The influence of eelgrass on the local environment can extend up to 10 m from individual eelgrass patches, with the distance being a function of the extent and density of eelgrass comprising the bed as well as local biologic, hydrographic, and bathymetric conditions (Bostrom and Bonsdorff 2000, Bostrom *et al.* 2001, Ferrell and Bell 1991, Peterson *et al.* 2004, Smith *et al.* 2008, van Houte-Howes *et al.* 2004, Webster *et al.* 1998). Detrital enrichment will generally extend laterally as well as down slope from the beds, while fish and invertebrates that utilize eelgrass beds may move away from the

eelgrass core to areas around the bed margins for foraging and in response to tides or diurnal cycles (Smith *et al.* 2008).

To encompass fluctuating eelgrass distribution and functional influence around eelgrass cover, for the purposes of this policy and guidelines, eelgrass habitat is defined as areas of vegetated eelgrass cover (any eelgrass within 1 m² quadrat and within 1 m of another shoot) bounded by a 5 m wide perimeter of unvegetated area (See Attachment 1 for a graphical depiction of this definition). Unvegetated areas may have eelgrass shoots a distance greater than 1 m from another shoot, and may be internal as well as external to areas of vegetated cover. For isolated patches and on a case-by-case basis, it may be acceptable to include an unvegetated area boundary less than or greater than 5 m wide. The definition excludes areas of unsuitable environmental conditions such as hard bottom substrates, shaded locations, or areas that extend to depths below those supporting eelgrass. Suitable depths can vary substantially depending upon site-specific conditions. In general, eelgrass does not extend deeper than 12 feet mean lower low water (MLLW) in most protected bays and harbors in Southern California, and is more limited in Central and Northern California embayments. However, eelgrass can grow much deeper in entrance channels and offshore areas

B. Surveying Eelgrass

NMFS may recommend action agencies conduct surveys of eelgrass habitat to evaluate effects of a proposed action. Eelgrass habitat should be surveyed using visual or acoustic methods and mapping technologies and scales appropriate to the action, scale, and area of work. Surveys should document both vegetated eelgrass cover as well as unvegetated areas within eelgrass habitat (See section II.A. for definition). Assessing impacts to eelgrass habitat relies on the completion of quality surveys and mapping. As such, inferior quality of surveys and mapping (*e.g.*, completed at an inappropriate scale or using inappropriate methods) may make proper evaluation of impacts impossible, and may result in a recommendation from NMFS to re-survey and re-map project areas. Also, to account for fluctuations in eelgrass habitat due to environmental variations, a reference site(s) should be incorporated into the survey (See section V.B.4 below for more details).

1. Survey Parameters

Because eelgrass growth conditions in California vary, eelgrass mapping techniques will also vary. Diver transects or boundary mapping may be suited to very small scale mapping efforts, while aerial and/or acoustic survey with ground-truthing may be more suited to larger survey areas. Aerial and above-water visual survey methods should be employed only where the lower limit of eelgrass is clearly visible or in combination with methods that adequately inventory eelgrass in deeper waters.

The survey area should be scaled as appropriate to the size of the potential action and the potential extent and distribution of eelgrass impacts, including both direct and indirect effects. The resolution of mapping should be adequate to address the scale of effects reasonably expected to occur. For small projects, such as individual boat docks, higher mapping resolution is appropriate in order to detect actual effects to eelgrass at a scale meaningful to the project size. At larger scales, the mapping resolution may be less refined over a larger area, assuming that

minor errors in mapping will balance out over the larger scale. Survey reports should provide a detailed description of the survey coverage (*e.g.*, number, location, and type of samples) and any interpolation methods used in the mapping.

While many parameters may be useful to describe eelgrass habitat condition (*e.g.*, plant biomass, leaf length, shoot:root ratios, epiphytic loading), many are labor intensive and may be impractical for resource management applications on a day-to-day basis. For this reason, four parameters have been identified for use in eelgrass habitat surveys and assessment of effects of an action on eelgrass. These parameters that should be articulated in eelgrass surveys are: 1) spatial distribution, 2) areal extent, 3) percentage of vegetated cover, and 4) the turion (shoot) density.

a) Spatial Distribution

The spatial distribution of eelgrass habitat should be delineated by a contiguous boundary around all areas of vegetated eelgrass cover extending outward a distance of 5 m, excluding gaps within the vegetated cover that have individual plants greater than 10 m from neighboring plants. Where such separations occur, either a separate area should be defined, or a gap in the area should be defined by extending a line around the void along a boundary defined by adjacent plants and including the 5 meter perimeter. The boundary of the eelgrass habitat should not extend into areas where depth, substrate, or existing structures are unsuited to supporting eelgrass habitat.

b) Aerial Extent

The eelgrass habitat aerial extent is the quantitative area (*e.g.*, square meters) of the spatial distribution boundary polygon of the eelgrass habitat. The total aerial extent should be broken down into extent of vegetated cover and extent of unvegetated habitat. Areal extent should be determined using commercially available geo-spatial analysis software. For small projects, coordinate data for polygon vertices could be entered into a spreadsheet format, and area could be calculated using simple geometry.

c) Percent Vegetated Cover

Eelgrass vegetated cover exists when one or more leaf shoots (turions) per square meter is present. The percent bottom cover within eelgrass habitat should be determined by totaling the area of vegetated eelgrass cover and dividing this by the total eelgrass habitat area. Where substantial differences in bottom cover occur across portions of the eelgrass habitat, the habitat could be subdivided into cover classes (*e.g.*, 20% cover, 50% cover, 75% cover).

d) Turion (Shoot) Density

Turion density is the mean number of eelgrass leaf shoots per square meter within mapped eelgrass vegetated cover. Turion density should be reported as a mean \pm the standard deviation of replicate measurements. The number of replicate measurements (n) should be reported along with the mean and deviation. Turion densities are determined only within vegetated areas of

eelgrass habitat and therefore, it is not possible to measure a turion density equal to zero. If different cover classes are used, a turion density should be determined for each cover class.

2. Eelgrass Mapping

For all actions that may directly or indirectly affect eelgrass habitat, an eelgrass habitat distribution map should be prepared on an accurate bathymetric chart with contour intervals of not greater than 1 foot (local vertical datum of MLLW). Exceptions to the detailed bathymetry could be made for small projects or for projects where detailed bathymetry may be infeasible. Unless region-specific mapping format and protocols are developed by NMFS (in which case such region-specific mapping guidance should be used), the mapping should utilize the following format and protocols:

a) *Bounding Coordinates*

Horizontal datum - Universal Transverse Mercator (UTM), NAD 83 meters, Zone 11 (for southern California) or Zone 10 (for central, San Francisco Bay, and northern California) is the preferred projection and datum. Another projection or datum may be used; however, the map and spatial data should include metadata that accurately defines the projection and datum.

Vertical datum - Mean Lower Low Water (MLLW), depth in feet.

b) *Units*

Transects, grids, or scale bars should be expressed in meters. Area measurements should be in square meters.

c) *File Format*

A spatial data layer compatible with readily available commercial geographic information system software producing file formats compatible with ESRI® ArcGIS software should be sent to NMFS when the area mapped supports at least 10 square meters of eelgrass. For those areas supporting less than 10 square meters of eelgrass, a table may alternatively be provided giving the vertices bounding x, y coordinates of the eelgrass areas in a spreadsheet or an ASCII file format. In addition to a spatial layer and/or table, a hard-copy map should be included with the survey report. The projection and datum should be clearly defined in the metadata and/or an associated text file.

Eelgrass maps should, at a minimum, include the following:

- A graphic scale bar, north arrow, legend, horizontal datum and vertical datum;
- A boundary illustrating the limits of the area surveyed;
- Bathymetric contours for the survey area, including both the action area(s) and reference site(s) in increments of not more than 1 foot;
- An overlay of proposed action improvements and construction limits;
- The boundary of the defined eelgrass habitat including an identification of area exclusions based on physical unsuitability to support eelgrass habitat; and

- The existing eelgrass cover within the defined eelgrass habitat at the time of the survey.

3. Survey Period

All mapping efforts should be completed during the active growth period for eelgrass (typically March through October for southern California, April through October for central California, April through October for San Francisco Bay, and May through September for northern California) and should be considered valid for a period of 60 days to ensure significant changes in eelgrass distribution and density do not occur between survey date and the project start date. The 60 day period is particularly important for eelgrass habitat survey conducted at the very beginning of the growing season, if eelgrass habitat expansion occurs as the growing season progresses. A period other than 60 days could be warranted and should be evaluated on a case-by-case basis, particularly for surveys completed in the middle of the growing season. However, when the end of the 60-day validity period falls outside of the region-specific active growth period, the survey could be considered valid until the beginning of the next active growth period. For example, a survey completed in southern California in the August-October time frame would be valid until the resumption of the active growth phase (i.e., in most instances, March 1). In some cases, NMFS and the action agency may agree to surveys being completed outside of the active growth period. For surveys completed during or after unusual climatic events (e.g., high fluvial discharge periods, El Niño conditions), NMFS staff should be contacted to determine if any modifications to the common survey period are warranted.

4. Reference Site Selection

Eelgrass habitat spatial extent, aerial extent, percent cover and turion density are expected to naturally fluctuate through time in response to natural environmental variables. As a result, it is necessary to correct for natural variability when conducting surveys for the purpose of evaluating action effects on eelgrass or performance of mitigation areas. This is generally accomplished through the use of a reference site(s), which is expected to respond similarly to the action area in response to natural environmental variability. It is beneficial to select and monitor multiple reference sites rather than a single site and to utilize the average reference site condition as a metric for environmental fluctuations. This is especially true when a mitigation site is located within an area of known environmental gradients, and reference sites may be selected on both sides of the mitigation site along the gradient. Environmental conditions (e.g., sediment, currents, proximity to action area, shoot density, light availability, depth, onshore and watershed influences) at the reference site(s) should be representative of the environmental conditions at the impact area (Fonseca *et al.* 1998). Where practical, the reference site(s) should be at least the size of the anticipated impact and/or mitigation area to limit the potential for minor changes in a reference site (e.g., propeller scarring or ray foraging damage) overly affecting mitigation needs. The logic for site(s) selection should be documented in the eelgrass mitigation planning documents.

C. Avoiding and Minimizing Impacts to Eelgrass

This section describes measures to avoid and minimize impacts to eelgrass caused by turbidity, shading, nutrient loading, sedimentation and alteration of circulation patterns. Not all measures

are equally suited to a particular project or condition. Measures to avoid or minimize impacts should be focused on stressors where the source and control are within the purview of the permittee and action agency. Action agencies in coordination with NMFS should evaluate and establish impact avoidance and minimization measures on a case-by-case basis depending on the action and site-specific information, including prevailing current patterns, sediment source, characteristics, and quantity, as well as the nature and duration of work.

1. Turbidity

To avoid and minimize potential turbidity-related impacts to eelgrass:

- Where practical, actions should be located as far as possible from existing eelgrass; and
- In-water work should occur as quickly as possible such that the duration of impacts is minimized.

Where proposed turbidity generating activities must occur in proximity to eelgrass and increased turbidity will occur at a magnitude and duration that may affect eelgrass habitat, measures to control turbidity levels should be employed when practical considering physical and biological constraints and impacts. Measures may include:

- Use of turbidity curtains where appropriate and feasible;
- Use of low impact equipment and methods (e.g., environmental buckets, or a hydraulic suction dredge instead of clamshell or hopper dredge, provided the discharge may be located away from the eelgrass habitat and appropriate turbidity controls can be provided at the discharge point);
- Limiting activities by tide or day-night windows to limit light degradation within eelgrass habitat;
- Utilizing 24-hour dredging to reduce the overall duration of work and to take advantage of dredging during dark periods when photosynthesis is not occurring; or
- Other measures that an action party may propose and be able to employ to minimize potential for adverse turbidity effects to eelgrass.

NMFS developed a flowchart for a stepwise decision making process as guidance for action agencies to determine when to implement best management practices (BMPs) for minimizing turbidity from dredging actions as part of a programmatic EFH consultation in San Francisco Bay. The parameters considered in the flow chart are relevant to all marine areas of California. This document is posted on the NMFS West Coast Region web page (http://www.westcoast.fisheries.noaa.gov/habitat/habitat_types/seagrass_info/california_eelgrass.html) and may be used to evaluate avoidance and minimization measures for any project that generates increased turbidity.

2. Shading

A number of potential design modifications may be used to minimize effects of shading on eelgrass. Boat docks, ramps, gangways, and similar structures should avoid eelgrass habitat to the maximum extent feasible. If avoidance of eelgrass or habitat is infeasible, impacts should be minimized by utilizing, to the maximum extent feasible, design modifications and construction materials that allow for greater light penetration. Action modifications should include, but are not limited to:

- Avoid siting over-water or landside structures in areas where shading of eelgrass habitat would occur;
- Maximizing the north-south orientation of the structure;
- Maximizing the height of the structure above the water;
- Minimizing the width and supporting structure mass to decrease shade effects;
- Relocating the structure in deeper water and limiting the placement of structures in shallow areas where eelgrass occurs to the extent feasible; and
- Utilizing light transmitting materials in structure design.

Construction materials used to increase light passage beneath the structures may include, but are not limited to, open grating or adequate spacing between deck boards to allow for effective illumination to support eelgrass habitat. The use of these shade reducing options may be appropriate where they do not conflict with safety, ADA compliance, or structure utility objectives.

NMFS developed a stepwise key as guidance for action agencies to determine which combination of modifications are best suited for minimizing shading effects from overwater structures on eelgrass as part of a programmatic EFH consultation in San Francisco Bay. The parameters considered in the flow chart are relevant to all marine areas of California. This document is posted on the West Coast Region web page (http://www.westcoast.fisheries.noaa.gov/habitat/habitat_types/seagrass_info/california_eelgrass.html) and may be used to evaluate avoidance and minimization measures for any project that results in shading.

3. Circulation patterns

Where appropriate to the scale and nature of potential eelgrass impacts, action parties should evaluate if and how the action may alter the hydrodynamics of the action area such that eelgrass habitat within or in proximity to the action area may be adversely affected. To maintain good water flow and low residence time of water within eelgrass habitat, action agencies should ensure actions:

- Minimize scouring velocities near or within eelgrass beds;
- Maintain wind and tidal circulation to the extent practical by considering orientation of piers and docks to maintain predominant wind effects;
- Incorporate setbacks on the order of 15 to 50 meters from eelgrass habitat where practical to allow for greater circulation and reduced impact from boat maneuvering, grounding, and propeller damage, and to address shading impacts; and
- Minimize the number of piles and maximize pile spacing to the extent practical, where piles are needed to support structures.

For large-scale actions in the proximity of eelgrass habitats, NMFS may request specific modeling and/or field hydrodynamic assessments of the potential effects of work on characteristics of circulation within eelgrass habitat.

4. Nutrient loading

Where appropriate to the scale and nature of potential eelgrass impacts, the following measures should be considered for implementation to reduce the potential for excessive nutrient loading to eelgrass habitat:

- diverting site runoff from landscaped areas away from discharges around eelgrass habitat;
- implementation of fertilizer reduction program;
- reduction of watershed nutrient loading;
- controlling local sources of nutrients such as animal wastes and leach fields; and
- maintaining good circulation and flushing conditions within the water body.

Reducing nutrient loading may also provide opportunities for establishing eelgrass as mitigation for project impacts.

5. Sediment loading

Watershed development and changes in land use may increase soil erosion and increase sedimentation to downstream embayments and lagoons.

- To the extent practicable, maintain riparian vegetation buffers along all streams in the watershed.
- Incorporate watershed analysis into agricultural, ranching, and residential/commercial development projects.
- Increase resistance to soil erosion and runoff. Sediment basins, contour farming, and grazing management are examples of key practices.
- Implement best management practices for sediment control during construction and maintenance operations (*e.g.*, Caltrans 2003).

Reducing sediment loading may also provide opportunities for establishing eelgrass as mitigation for project impacts in systems for which sedimentation is a demonstrable limiting factor to eelgrass.

D. Assessing Impacts to Eelgrass Habitat

If appropriate to the statute under which the consultation occurs, NMFS should consider both direct and indirect effects of the project in order to assess whether a project may impact eelgrass. NMFS is aware that many of the statutes and regulations it administers may have more specific meanings for certain terms, including “direct effect” and “indirect effect”, and will use the statutory or regulatory meaning of those terms when conducting consultations under those statutes.² Nevertheless, it is useful for NMFS to consider effects experienced

² In the EFH context, adverse effects include any impact that reduces quality and/or quantity of EFH, including direct or indirect physical, chemical, or biological alterations of the waters or substrate (50 CFR 600.910). The Council of Environmental Quality (CEQ) regulations regarding NEPA implementation (40 CFR 1508.8(a)) define direct and indirect impacts of an action for the purposes of NEPA. Other NMFS statutes provide their own definitions regarding effects.

contemporaneously with project actions (both at the project site and away from the project site) and which might occur later in time.

Generally, effects to eelgrass habitat should be assessed using pre- and post-project surveys of the impact area and appropriate reference site(s) conducted during the time period of maximum eelgrass growth (typically March through October for southern California, April through October for central California, April through October for San Francisco Bay, and May through September for northern California). NMFS should consider the likelihood that the effects would occur before recommending pre- and post-project eelgrass surveys. The pre-construction survey of the eelgrass habitat in the action area and an appropriate reference site(s) should be completed within 60 days before start of construction. After construction, a post-action survey of the eelgrass habitat in the action area and at an appropriate reference site(s) should be completed within 30 days of completion of construction, or within the first 30 days of the next active growth period following completion of construction that occurs outside of the active growth period. Copies of all surveys should be provided to the lead federal agency, NMFS, and other interested regulatory and/or resource agencies within 30 days of completing the survey. The recommended timing of surveys is intended to minimize changes in eelgrass habitat distribution and abundance during the period between survey completion and construction initiation and completion. For example, a post-action survey completed beyond 30 days following construction or outside of the active growing season may show declines in eelgrass habitat as a result of natural senescence rather than the action.

The lead federal agency and NMFS should consider reference area eelgrass performance, physical evidence of impact, turbidity and construction activities monitoring data, as well as other documentation in the determination of the impacts of the action undertaken. Impact analyses should document whether the impacts are anticipated to be complete at the time of the assessment, or whether there is an anticipation of continuing eelgrass impacts due to chronic or intermittent effects. Where eelgrass at the impact site declines coincident with and similarly to decline at the reference site(s), the percentage of decline at the reference site should be deducted from the decline at the impact site. However, if eelgrass expands within the reference site(s), the impact site should only be evaluated against the pre-construction condition of the reference site and not the expanded condition. If an action results in increased eelgrass habitat relative to the reference sites, this increase could potentially be considered (subject to the caveats identified herein) by NMFS and the action agency as potential compensation for impacts to eelgrass habitat that occur in the future (see Section II. E. 3). An assessment should also be made as to whether impacts or portions of the impact are anticipated to be temporary. Information supporting this determination may be derived from the permittee, NMFS, and other resource and regulatory agencies, as well as other eelgrass experts.

For some projects, environmental planning and permitting may take longer than 60 days. To accommodate longer planning schedules, it may also be necessary to do a preliminary eelgrass survey prior to the pre-construction survey. This preliminary survey can be used to anticipate potential impacts to eelgrass for the purposes of mitigation planning during the permitting process. In some cases, preliminary surveys may focus on spatial distribution of eelgrass habitat only or may be a qualitative reconnaissance to allow permittees to incorporate avoidance and minimization measures into their proposed action or to plan for future mitigation needs. The pre-

and post-project surveys should then verify whether impacts occur as anticipated, and if planned mitigation is adequate. In some cases, a preliminary survey could be completed a year or more in advance of the project action.

1. Direct Effects

Biologists should consider the potential for localized losses of eelgrass from dredging or filling, construction-associated damage, and similar spatially and temporally proximate impacts (these effects could be termed “direct”). The actual area of the impact should be determined from an analysis that compares the pre-action condition of eelgrass habitat with the post-action conditions from this survey, relative to eelgrass habitat change at the reference site(s).

2. Indirect Effects

Biologists should also consider effects caused by the action which occur away from the project site; furthermore, effects occurring later in time (whether at or away from the project site) should also be considered. Biologists should consider the potential for project actions to alter conditions of the physical environment in a manner that, in turn, reduce eelgrass habitat distribution or density (*e.g.*, elevated turbidity from the initial implementation or later operations of an action, increased shading, changes to circulation patterns, changes to vessel traffic that lead to greater groundings or wake damage, increased rates of erosion or deposition).

For actions where the impact cannot be fully determined until a substantial period after an action is taken, an estimate of likely impacts should be made prior to implementation of the proposed action based on the best available information (*e.g.*, shading analyses, wave and current modeling). A monitoring program consisting of a pre-construction eelgrass survey and three post-construction eelgrass surveys at the impact site and appropriate reference site(s) should be performed. The action party should complete the first post-construction eelgrass survey within 30 days following completion of construction to evaluate any immediate effects to eelgrass habitat. The second post-construction survey should be performed approximately one year after the first post-construction survey during the appropriate growing season. The third post-construction survey should be performed approximately two years after the first post-construction survey during the appropriate growing season. The second and third post-construction surveys will be used to evaluate if indirect effects resulted later in time due to altered physical conditions; the time frames identified above are aligned with growing season (attempting a survey outside of the growing season would show inaccurate results).

A final determination regarding the actual impact and amount of mitigation needed, if any, to offset impacts should be made based upon the results of two annual post-construction surveys, which document the changes in the eelgrass habitat (areal extent, bottom coverage, and shoot density within eelgrass) in the vicinity of the action, compared to eelgrass habitat change at the reference site(s). Any impacts determined by these monitoring surveys should be mitigated. In the event that monitoring demonstrates the action to have resulted in greater eelgrass habitat impacts than initially estimated, additional mitigation should be implemented in a manner consistent with these guidelines. In some cases, adaptive management may allow for increased success in eelgrass mitigation without the need for additional mitigation.

E. Mitigation Options

The term mitigation is defined differently by various federal and State laws, regulations and policies. In a broad sense, mitigation may include a range of measures from complete avoidance of adverse effects to compensation for adverse effects by preserving, restoring or creating similar resources at onsite or offsite locations. The Corps and EPA issued regulations governing compensatory mitigation to offset unavoidable adverse effects to waters of the United States authorized by Clean Water Act section 404 permits and other permits issued by the Corps (73 FR 19594; April 10, 2008). For those regulations (33 CFR 332.2 and 40 CFR 230.92, respectively), the Corps and EPA, define "compensatory mitigation" as "the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse effects which remain after all appropriate and practicable avoidance and minimization has been achieved."

When impacts to eelgrass would occur, the action agency should develop a mitigation plan to achieve no net loss in eelgrass function following the recommended steps in this policy. If NMFS determines a mitigation plan is needed, and it was not included with the EFH Assessment for the proposed action, NMFS may recommend, either as comments on the EFH Assessment or as an EFH Conservation Recommendation, that one be provided. Potential mitigation options are described below. The action agency should consider site specific conditions when determining the most appropriate mitigation option for an action.

1. Comprehensive management plans

NMFS supports the development of comprehensive management plans (CMPs) that protect eelgrass resources within the context of broader ecosystem needs and management objectives. Recommendations different from specific elements described below for in-kind mitigation may be appropriate where a CMP (*e.g.*, an enforceable programmatic permit, Special Area Management Plan, harbor plan, or ecosystem-based management plan) exists that is considered to provide adequate population-level and local resource distribution protections to eelgrass. One such CMP under development at the time these guidelines were developed is *City of Newport Beach Eelgrass Protection Mitigation Plan for Shallow Water in Lower Newport Bay: An Ecosystem Based Management Plan*. If satisfactorily completed and adopted, it is anticipated the protection measures for eelgrass within this area would be adequate to meet the objectives of this policy.

In general, it is anticipated that CMPs may be most appropriate in situations where a project or collection of similar projects will result in incremental but recurrent impacts to a small portion of local eelgrass populations through time (*e.g.*, lagoon mouth maintenance dredging, maintenance dredging of channels and slips within established marinas, navigational hazard removal of recurrent shoals, shellfish farming, and restoration or enhancement actions). In order to ensure that these alternatives provide adequate population-level and local resource distribution protections to eelgrass and that the plan is consistent with the overall conservation objectives of this policy, NMFS should be involved early in the plan's development.

2. In-kind mitigation

In-kind compensatory mitigation is the creation, restoration, or enhancement of habitat to mitigate for adverse impacts to the same type of habitat. In most cases in-kind mitigation is the preferred option to compensate for impacts to eelgrass. Generally, in-kind mitigation should achieve a final mitigation ratio of 1.2:1 across all areas of the state, independent of starting mitigation ratios. A starting mitigation ratio is the ratio of mitigation area to impact area when mitigation is initiated. The final mitigation ratio is the ratio of mitigation area to impact area once mitigation is complete. The 1.2:1 ratio assumes: (1) there is no eelgrass function at the mitigation site prior to mitigation efforts, (2) eelgrass function at the mitigation site is achieved within three years, (3) mitigation efforts are successful, and (4) there are no landscape differences (*e.g.*, degree of urban influence, proximity to freshwater source), between the impact site and the mitigation site. Variations from these assumptions may warrant higher or lower mitigation ratios. For example, a higher ratio would be appropriate for an enhancement project where the mitigation site has some level of eelgrass function prior to the mitigation action.

Typically, in-kind eelgrass mitigation involves transplanting or seeding of eelgrass into unvegetated habitat. Successful in-kind mitigation may also warrant modification of physical conditions at the mitigation site to prepare for transplants (*e.g.*, alter sediment composition, depth, etc.). In some areas, other in-kind mitigation options such as removing artificial structures that preclude eelgrass growth may be feasible. If in-kind mitigation that does not include transplants or seeding is proposed, post-mitigation monitoring as described below should be implemented to verify that mitigation is successful.

Information provided below in Section II.F includes specific recommendations for in-kind mitigation, including site selection, reference sites, starting mitigation ratios, mitigation methods, mitigation monitoring and performance criteria. Many of the recommendations provided in these guidelines for eelgrass assessments, surveys, and mitigation may apply throughout the state even if a non-transplant mitigation option is proposed.

3. Mitigation banks and in-lieu-fee programs

In 2006 and 2011, the NMFS Southwest Region (merged with the Northwest Region in 2013 to form the West Coast Region) signed interagency Memorandum of Understandings that established and refined a framework for developing and using combined or coordinated approaches to mitigation and conservation banking and in-lieu-fee programs in California. Other signatory agencies include: the California Resources Agency, California Department of Fish and Wildlife, the Corps, the US Fish & Wildlife Service, the EPA, the Natural Resource Conservation Service, and the State Water Resources Control Board.

Under this eelgrass policy, NMFS supports the use of mitigation bank and in-lieu fee programs to compensate for impacts to eelgrass habitat, where such instruments are available and where such programs are appropriate to the statutory structure under which mitigation is recommended. Mitigation banks and in-lieu fee conservation programs are highly encouraged by NMFS in heavily urbanized waters. Credits should be used at a ratio of 1:1 if those credits have been established for a full three-year period prior to use. If the bank credits have been in place for a

period less than three years, credits should be used at a ratio determined through application of the wetland mitigation calculator (King and Price 2004).

At the request of the action party, and only with approval of NMFS and other appropriate resource agencies and subject to the caveats below, surplus eelgrass area that, after 60-months, exceeds the mitigation needs, as defined in section II.F.6 Mitigation Monitoring and Performance Milestones, has the potential to be considered for future mitigation needs. Additionally, only with the approval of NMFS and other appropriate resource agencies and subject to the caveats below, eelgrass habitat expansion resulting from project activities, and that otherwise would not have occurred, has the potential to be considered for future mitigation needs. Exceeding mitigation needs does not guarantee or entitle the action party or action agency to credit such mitigation to future projects, since every future project must be considered on a case-by-case basis (including the location and type of impact) and viewed in light of the relevant statutory authorities.

4. Out-of-kind mitigation

Out-of-kind compensatory mitigation means the adverse impacts to one habitat type are mitigated through the creation, restoration, or enhancement of another habitat type. In most cases, out-of-kind mitigation is discouraged, because eelgrass is a rare, special-status habitat in California. There may be some scenarios, however, where out-of-kind mitigation for eelgrass impacts is ecologically desirable or when in-kind mitigation is not feasible. This determination should be made based on an established ecosystem plan that considers ecosystem function and services relevant to the geographic area and specific habitat being impacted. Any proposal for out-of-kind mitigation should demonstrate that the proposed mitigation will compensate for the loss of eelgrass habitat function within the ecosystem. Out-of-kind mitigation that generates services similar to eelgrass habitat or improves conditions for establishment of eelgrass should be considered first. NMFS and the federal action agency should be consulted early when out-of-kind mitigation is being proposed in order to determine if out-of-kind mitigation is appropriate, in coordination with other relevant resource agencies (e.g., California Department of Fish and Wildlife, California Coastal Commission, U.S. Fish and Wildlife Service)

F. In-kind Mitigation for Impacts to Eelgrass

As all mitigation project specifics will be determined on a case-by-case basis, circumstances may exist where NMFS staff will need to modify or deviate from the recommended measures described below before providing their recommendation to action agencies.

1. Mitigation Site Selection

Eelgrass habitat mitigation sites should be similar to the impact site. Site selection should consider distance from action, depth, sediment type, distance from ocean connection, water quality, and currents. Where eelgrass that is impacted occurs in marginally suitable environments, it may be necessary to conduct mitigation in a preferable location and/or modify the site to be better suited to support eelgrass habitat creation. Mitigation site modification should be fully coordinated with NMFS staff and other appropriate resource and regulatory agencies. To the extent feasible, mitigation should occur within the same hydrologic system

(e.g., bay, estuary, lagoon) as the impacts and should be appropriately distributed within the same ecological subdivision of larger systems (e.g., San Pablo Bay or Richardson Bay in San Francisco Bay), unless NMFS and the action agency concur that good justification exists for altering the distribution based on valued ecosystem functions and services.

In identifying potentially suitable mitigation sites, it is advisable to consider the current habitat functions of the mitigation site prior to mitigation use. In general, conversion of unvegetated subtidal areas or disturbed uplands to eelgrass habitats may be considered appropriate means to mitigate eelgrass losses, while conversion of other special aquatic sites (e.g., salt marsh, intertidal mudflats, and reefs) is unlikely to be considered suitable. It may be necessary to develop suitable environmental conditions at a site prior to being able to effectively transplant eelgrass into a mitigation area. Mitigation sites may need physical modification, including increasing or lowering elevation, changing substrate, removing shading or debris, adding wave protection or removing impediments to circulation.

2. Mitigation Area Needs

In-kind mitigation plans should address the components described below to ensure mitigation actions achieve no net loss of eelgrass habitat function. Alternative contingent mitigation should be specified and included in the mitigation plan to address situations where performance milestones are not met.

a) *Impacts to Areal Extent of Eelgrass Habitat*

Generally, mitigation of eelgrass habitat should be based on replacing eelgrass habitat extent at a 1.2 (mitigation) to 1 (impact) mitigation ratio for eelgrass throughout all regions of California. However, given variable degrees of success across regions and potential for delays and mitigation failure, NMFS calculated *starting* mitigation ratios using “The Five-Step Wetland Mitigation Ratio Calculator” (King and Price 2004) developed for NMFS Office of Habitat Conservation. The calculator utilizes methodology similar to Habitat Equivalency Analysis (HEA), which is an accepted method to determine the amount of compensatory restoration needed to provide natural resource services that are equivalent to loss of natural resource services following an injury (<http://www.darrp.noaa.gov/economics/pdf/heaovery.pdf>). HEA is commonly used by NOAA during damage assessment cases, including those involving seagrass. Similar to HEA, the mitigation calculator is based on the “net present value” approach to asset valuation, an economics concept used to compare values of all types of investments, and then modified to incorporate natural resource services. Using the calculator allows for consistency in methodology for all areas within California, avoids arbitrary identification of size of the mitigation area, and avoids cumulative loss to eelgrass habitat that would likely occur with a standard 1:1 ratio (because of the complexity of eelgrass mitigation and the time for created eelgrass to achieve full habitat function).

The calculator includes a number of metrics to determine appropriate ratios that focus on comparisons of quality and quantity of function of the mitigation relative to the site of impact to ensure full compensation of lost function. (see Attachment 4). Among other metrics, the calculator employs a metric of likelihood of failure within the mitigation site based on regional mitigation failure history. As such, the mitigation calculator identifies a recommended starting

mitigation ratio (the mitigation area to eelgrass impact area) based on regional history of success in eelgrass mitigation. Increased initial mitigation site size should be considered to provide greater assurance that the performance milestones, as specified in Section II.F.6, will be met. This is a common practice in the eelgrass mitigation field to reduce risk of falling short of mitigation needs (Thom 1990). Independent of starting mitigation ratio utilized for a given mitigation action, mitigation success should generally be evaluated against a ratio of 1.2:1.

The elevated starting mitigation ratio should be applied to the area of impact to vegetated eelgrass cover only. For unvegetated eelgrass habitat, a starting mitigation ratio of 1.2:1 is appropriate.

To determine the recommended starting mitigation ratio for each region, the percentage of transplant successes and failures was examined over the history of transplanting in the region. NMFS staff examined transplants projects over the past 25 years in all mitigation regions (see Attachment 6). Eelgrass mitigation in Southern California has a 35-year history with 66 transplants performed over that period. In the past 25 years, a total of 47 eelgrass transplants for mitigation purposes have been conducted in Southern California. Forty-three of these were established long enough to evaluate success for these transplants. The overall failure rate, with failure defined as not meeting success criteria established for the project, was 13 percent. Eelgrass mitigation within central California has a better history of successful completion than within southern California, San Francisco Bay, and northern California. However, the number of eelgrass mitigation actions conducted in this region is low and limited to areas within Morro Bay. While the success of eelgrass mitigation in central California has been high, the low number of attempts makes mitigation in this region uncertain. Eelgrass habitat creation/restoration in San Francisco Bay and in northern California has had varied success.

In all cases, best information available at the time of this policy's development was used to determine the parameter values entered into the calculator formula. As regional eelgrass mitigation success changes and the results of ongoing projects become available, the starting mitigation ratio may be updated. Updates in mitigation calculator inputs should not be made on an individual action basis, because the success or lack of success of an individual mitigation project may not reflect overall mitigation success for the region. Rather NMFS should re-evaluate the regional transplant history approximately every 5 years, increasing the record of transplant success in 5 year increments for new projects implemented after NMFS' adoption of these guidelines. If the 5-year review shows that new efforts are more successful than those from the beginning of the 25-year period, NMFS staff should consider removing early projects (*e.g.*, those completed 20 years prior) from the analysis.

On a case-by-case basis and in consultation with action agencies, NMFS may consider proposals with different starting mitigation ratios where sufficient justification is provided that indicates the mitigation site would achieve the no net loss goal. In addition, CMPs could consider different starting mitigation ratios, or other mitigation elements and techniques, as appropriate to the geographic area addressed by the CMP.

Regardless of starting mitigation ratio, eelgrass mitigation should be considered successful, if it meets eelgrass habitat coverage over an area that is 1.2 times the impact area with comparable

eelgrass density as impacted habitat. Please note, delayed implementation, supplemental transplant needs, or NMFS and action agency agreement may result in an altered mitigation area. In the EFH consultation context, NMFS may recommend an altered mitigation area during implementation of the federal agency's mitigation plan following EFH consultation or NEPA review, or as an EFH Conservation Recommendation if the federal agency re-initiates EFH consultation.

(1) Southern California (Mexico border to Pt. Conception)

For mitigation activities that occur concurrent to the action resulting in damage to existing eelgrass habitat, a starting ratio of 1.38 to 1 (transplant area to vegetated cover impact area) should be recommended to counter the regional failure risk. That is, for each square meter of vegetated eelgrass cover adversely impacted, 1.38 square meters of new habitat with suitable conditions to support eelgrass should be planted with a comparable bottom coverage and eelgrass density as impacted habitat.

(2) Central California (Point Conception to mouth of San Francisco Bay).

For mitigation activities that occur concurrent to the action resulting in damage to existing eelgrass habitat, a starting ratio of 1.20 to 1 (transplant area to vegetated cover impact area) should be recommended based on a 0 percent failure rate over the past 25 years (4 transplant actions). It should however be noted that all of these successful transplants included a greater area of planting than was necessary to achieve success such that the full mitigation area would be achieved, even with areas of minor transplant failure.

(3) San Francisco Bay (including south, central, San Pablo and Suisun Bays).

For mitigation activities that occur concurrent to the action resulting in damage to the existing eelgrass bed resource, a ratio of 3.01 to 1 (transplant area to vegetated cover impact area) should be recommended based on a 60 percent failure rate over the past 25 years (10 transplant actions). That is, for each square meter adversely impacted, 3.01 square meters of new habitat with suitable conditions to support eelgrass should be planted with a comparable bottom coverage and eelgrass density as impacted habitat.

(4) Northern California (mouth of San Francisco Bay to Oregon border).

For mitigation activities that occur concurrent to the action resulting in damage to the existing eelgrass habitat, a starting ratio of 4.82 to 1 (transplant area to vegetated cover impact area) should be recommended based on a 75 percent failure rate over the past 25 years (4 transplant actions). That is, for each square meter of eelgrass habitat adversely impacted, 4.82 square meters of new habitat with suitable conditions to support eelgrass should be planted with a comparable bottom coverage and eelgrass density as impacted habitat.

b) Impacts to Density of Eelgrass Beds

Degradation of existing eelgrass habitat that results in a permanent reduction of eelgrass turion density greater than 25 percent, and that is a statistically significant difference from pre-impact density, should be mitigated based on an equivalent area basis. The 25 percent and statistically significant threshold is believed reasonable based on supporting information (Fonseca *et al.* 1998, WDFW 2008), and professional practice under SCEMP. In these cases, eelgrass remains present at the action site, but density may be potentially affected by long-term chronic or intermittent effects of the action. Reduction of density should be determined to have occurred when the mean turion density of the impact site is found to be statistically different ($\alpha=0.10$ and $\beta=0.10$) from the density of a reference and at least 25 percent below the reference mean during two annual sampling events following implementation of an action. The number of samples taken to describe density at each site (*e.g.*, impact and reference) should be sufficient to provide for appropriate statistical power. For small impact areas that do not allow for a sample size that provides statistical power, alternative methods for pre- and post- density comparisons could be considered. Mitigation for reduction of turion density without change in eelgrass habitat area should be on a one-for-one basis either by augmenting eelgrass density at the impact site or by establishing new eelgrass habitat comparable to the change in density at the impact site. For example, a 25 percent reduction in density of 100-square meters (100 turions/square meter) of eelgrass habitat to 75 turions/square meter should be mitigated by the establishing 25 square meters of new eelgrass habitat with a density at or above the 100 turions/square meter pre-impact density.

3. Mitigation Technique

In-kind mitigation technique should be determined on a case-by-case basis. Techniques for eelgrass mitigation should be consistent with the best available technology at the time of mitigation implementation and should be tailored to the specific needs of the mitigation site. Eelgrass transplants have been highly successful in southern and central California, but have had mixed results in San Francisco Bay and northern California. Bare-root bundles and seed buoys have been utilized with some mixed success in northern portions of the state. Transplants using frames have also been used with some limited success. For transplants in southern California, plantings consisting of bare-root bundles consisting of 8-12 individual turions each have proven to be most successful (Merkel 1988).

Donor material should be taken from the area of direct impact whenever practical, unless the action resulted in reduced density of eelgrass at the area of impact. Site selections should consider the similarity of physical environments between the donor site and the transplant receiver site and should also consider the size, stability, and history of the donor site (*e.g.*, how long has it persisted and is it a transplant site). Plants harvested should be taken in a manner to thin an existing bed without leaving any noticeable bare areas. For all geographic areas, no more than 10 percent of an existing donor bed should be harvested for transplanting purposes. Ten percent is reasonable based on recommendations in Thom *et al.* (2008) and professional practice under SCEMP. Harvesting of flowering shoots for seed buoy techniques should occur only from widely separated plants.

It is important for action agencies to note that state laws and regulations affect the harvesting and transplantation of donor plants and permission from the state, where required, should be obtained; for example, California Department of Fish and Wildlife may need to provide written authorization for harvesting and transplanting donor plants and/or flowering shoots.

4. Mitigation Plan

NMFS should recommend that a mitigation plan be developed for in-kind mitigation efforts. During consultation, NMFS biologists should request that mitigation plans be provided at least 60 days prior to initiation of project activities to allow for NMFS review. When feasible, mitigation plans should be developed based on preliminary or pre-project eelgrass surveys. When there is uncertainty regarding whether impacts to eelgrass will occur, and the need for mitigation is based on comparison of pre- and post-project eelgrass surveys, NMFS biologists should request that the mitigation plan be provided no more than 60 days following the post-project survey to allow for NMFS review and minimize any delay in mitigation implementation.

At a minimum, the mitigation plan should include:

- Description of the project area
- Results of preliminary eelgrass survey and pre/post-project eelgrass surveys if available (see Section II.B.1 and II.B.2)
- Description of projected and/or documented eelgrass impacts
- Description of proposed mitigation site and reference site(s) (see Section II.B.4)
- Description of proposed mitigation methods (see Section II.F.3)
- Construction schedule, including specific starting and ending dates for all work including mitigation activities. (see Section II.F.5)
- Schedule and description of proposed post-project monitoring and when results will be provided to NMFS
- Schedule and description of process for continued coordination with NMFS through mitigation implementation
- Description of alternative contingent mitigation or adaptive management should proposed mitigation fail to achieve performance measures (see Section II.F.6)

5. Mitigation Timing

Mitigation should commence within 135 days following the initiation of the in-water construction resulting in impact to the eelgrass habitat, such that mitigation commences within the same eelgrass growing season as impacts occur. If possible, mitigation should be initiated prior to or concurrent with impacts. For impacts initiated within 90 days prior to, or during, the low-growth period for the region, mitigation may be delayed to within 30 days after the start of the following growing season, or 90 days following impacts, whichever is longer, without the need for additional mitigation as described below. This timing avoids survey completion during the low growth season, when results may misrepresent progress towards performance milestones.

Delays in eelgrass mitigation result in delays in ultimate reestablishment of eelgrass habitat functions, increasing the duration and magnitude of project impacts to eelgrass. To offset loss of eelgrass habitat function that accumulates through delay, an increase in successful eelgrass

mitigation is needed to achieve the same compensatory habitat function. Because habitat function is accumulated over time once the mitigation habitat is in place, the longer the delay in initiation of mitigation, the greater the additional habitat area needed (i.e., mitigation ratio increasingly greater than 1.2:1) to offset losses. Unless a specific delay is authorized or dictated by the initial schedule of work, federal action agencies should determine whether delays in mitigation initiation in excess of 135 days warrant an increased final mitigation ratio. If increased mitigation ratios are warranted, NMFS should recommend higher mitigation ratios (see Attachment 7). Where delayed implementation is authorized by the action agency, the increased mitigation ratio may be determined by utilizing the Wetlands Mitigation Calculator (King and Price 2004) with an appropriate value for parameter D (See Attachment 4). Examples of delay multipliers generated using the Wetlands Mitigation Calculator are provided in Attachment 5.

Conversely, implementing mitigation ahead of impacts can be used to reduce the mitigation needs by achieving replacement of eelgrass function and services ahead of eelgrass losses. If eelgrass is successfully transplanted three years ahead of impacts, the mitigation ratio would drop from 1.2:1 to 1:1. If mitigation is completed less than three years ahead of impacts, the mitigation calculator can be used to determine the appropriate intermediate mitigation ratio.

6. Mitigation Monitoring and Performance Milestones

In order to document progress and persistence of eelgrass habitat at the mitigation site through and beyond the initial establishment period, which generally is three years, monitoring should be completed for a period of five years at both the mitigation site and at an appropriate reference site(s) (Section II.B.4. Reference Site Selection). Monitoring at a reference site(s) may account for any natural changes or fluctuations in habitat area or density. Monitoring should determine the area of eelgrass and density of plants at 0, 12, 24, 36, 48, and 60 months after completing the mitigation. These intervals will provide yearly updates on the establishment and persistence of eelgrass during the growing season. These monitoring recommendations are consistent with findings of the National Research Council (NRC 2001), the Corps requirements for compensatory mitigation (33 CFR 332.6(b)), and other regional resource policies (Corps 2010, Evans and Leschen 2010, SFWMD 2007).

All monitoring work should be conducted during the active eelgrass growth period and should avoid the recognized low growth season for the region to the maximum extent practicable (typically November through February for southern California, November through March for central California, November through March for San Francisco Bay, and October through April for northern California). Sufficient flexibility in the scheduling of the 6 month surveys should be allowed in order to ensure the work is completed during this active growth period. Additional monitoring beyond the 60-month period may be warranted in those instances where the stability of the proposed mitigation site is questionable, where the performance of the habitat relative to reference sites is erratic, or where other factors may influence the long-term success of mitigation. Mitigation plans should include a monitoring schedule that indicates when each of the monitoring events will be completed.

The monitoring and performance milestones described below are included as eelgrass transplant success criteria in the SCEMP. These numbers represent milestones and associated timelines

typical of successful eelgrass habitat development based on NMFS' experience with: (1) conducting eelgrass surveys and monitoring and (2) reviewing mitigation monitoring results for projects implemented under SCEMP. Restored eelgrass habitat is expected to develop through an initial 3 year monitoring period such that, within 36 months following planting, it meets or exceeds the full coverage and not less than 85 percent of the density relative to the initial condition of affected eelgrass habitat. Restored eelgrass habitat is expected to sustain this condition for at least 2 additional years.

Monitoring events should evaluate the following performance milestones:

Month 0 – Monitoring should confirm the full coverage distribution of planting units over the initial mitigation site as appropriate to the geographic region.

Month 6 – Persistence and growth of eelgrass within the initial mitigation area should be confirmed, and there should be a survival of at least 50 percent of the initial planting units with well-distributed coverage over the initial mitigation site. For seed buoys, there should be demonstrated recruitment of seedlings at a density of not less than one seedling per four (4) square meters with a distribution over the extent of the initial planting area. The timing of this monitoring event should be flexible to ensure work is completed during the active growth period.

Month 12 – The mitigation site should achieve a minimum of 40 percent coverage of eelgrass and 20 percent density of reference site(s) over not less than 1.2 times the area of the impact site.

Month 24 – The mitigation site should achieve a minimum of 85 percent coverage of eelgrass and 70 percent density of reference site(s) over not less than 1.2 times the area of the impact site.

Month 36 – The mitigation site should achieve a minimum of 100 percent coverage of eelgrass and 85 percent density of reference site(s) over not less than 1.2 times the area of the impact site.

Month 48 – The mitigation site should achieve a minimum of 100 percent coverage of eelgrass and 85 percent density of reference site(s) over not less than 1.2 times the area of the impact site.

Month 60 – The mitigation site should achieve a minimum of 100 percent coverage of eelgrass and 85 percent density of reference site(s) over not less than 1.2 times the area of the impact site.

Performance milestones may be re-evaluated or modified if declines at a mitigation site are also demonstrated at the reference site, and therefore, may be a result of natural environmental stressors that are unrelated to the intrinsic suitability of the mitigation site. In the EFH consultation context, NMFS should provide recommendations regarding modification of performance milestones as technical assistance during interagency coordination as described in

the mitigation plan or as EFH Conservation Recommendations if the federal action agency re-initiates EFH consultation.

7. Mitigation Reporting

NMFS biologists should request monitoring reports and spatial data for each monitoring event in both hard copy and electronic version, to be provided within 30 days after the completion of each monitoring period to allow timely review and feedback from NMFS. These reports should clearly identify the action, the action party, mitigation consultants, relevant points of contact, and any relevant permits. The size of permitted eelgrass impact estimates, actual eelgrass impacts, and eelgrass mitigation needs should be identified, as should appropriate information describing the location of activities. The report should include a detailed description of eelgrass habitat survey methods, donor harvest methods and transplant methods used. The reports should also document mitigation performance milestone progress (see II.F.6. Mitigation Monitoring and Performance Milestones). The first report (for the 0-month post-planting monitoring) should document any variances from the mitigation plan, document the sources of donor materials, and document the full area of planting. The final mitigation monitoring report should provide the action agency and NMFS with an overall assessment of the performance of the eelgrass mitigation site relative to natural variability of the reference site to evaluate if mitigation responsibilities were met. An example summary is provided in Attachment 3.

8. Supplemental Mitigation

Where development of the eelgrass habitat at the mitigation site falls short of achieving performance milestones during any interim survey, the monitoring period should be extended and supplemental mitigation may be recommended to ensure that adequate mitigation is achieved. In the EFH consultation context, NMFS should provide recommendations regarding extended monitoring as technical assistance during interagency coordination as described in the mitigation plan or as EFH Conservation Recommendations if the federal action agency re-initiates EFH consultation. In some instances, an adaptive management corrective action to the existing mitigation area may be appropriate. In the event of a mitigation failure, the action agency should convene a meeting with the action party, NMFS, and applicable regulatory and/or resource agencies to review the specific circumstances and develop a solution to achieve no net loss in eelgrass habitat function.

As indicated previously, while in-kind mitigation is preferred, the most appropriate form of compensatory mitigation should be determined on a case-by-case basis. In cases where it is demonstrated that in-kind replacement is infeasible, out-of-kind mitigation may be appropriate over completion of additional in-kind mitigation. The determination that an out-of-kind mitigation is appropriate will be made by NMFS, the action agency, and the applicable regulatory agencies, where a regulatory action is involved.

G. Special Circumstances

Depending on the circumstances of each individual project, NMFS may make recommendations different from those described above on a case by case basis. For the scenarios described below,

for example, NMFS could recommend a mitigation ratio or 1:1 or for use of out-of-kind mitigation. Because NMFS needs a proper understanding of eelgrass habitat in the project area and potential impacts of the proposed project to evaluate the full effects of authorized activities, NMFS should not make recommendations that diverge from these guidelines if they would result in surveys, assessments or reports inferior to those which might be obtained through the guidance in Section II. The area thresholds described below are taken from the SCEMP and/or reflect recommendations NMFS staff have repeatedly made during individual EFH consultations. These thresholds minimize impacts to eelgrass habitat quality and quantity, based on NMFS' experience with: (1) conducting eelgrass surveys and monitoring and (2) reviewing project monitoring results for projects implemented under SCEMP. The special circumstance included for shellfish aquaculture longlines is supported by Rumrill and Poulton (2004) and the NMFS Office of Aquaculture.

1. Localized Temporary Impacts

NMFS may consider modified target mitigation ratios for localized temporary impacts wherein the damage results in impacts of less than 100 square meters and eelgrass habitat is fully restored within the damage footprint within one year of the initial impact (e.g., placement of temporary recreational facilities, shading by construction equipment, or damage sustained through vessel groundings or environmental clean-up operations). In such cases, the 1.2:1 mitigation ratio should not apply, and a 1:1 ratio of impact to recovery would apply. A monitoring program consisting of a pre-construction eelgrass survey and three post-construction eelgrass surveys at the impact site and appropriate reference site(s) should be completed in order to demonstrate the temporary nature of the impacts. NMFS should recommend that surveys be completed as follows: 1) the first post-construction eelgrass survey should be completed within 30 days following completion of construction to evaluate direct effects of construction, 2) the second and third post-construction surveys should be performed approximately one year after the first post-construction survey, and approximately two years after the first post-construction survey, respectively, during the appropriate growing season to confirm no indirect, or longer term effects resulted from construction. A compelling reason should be demonstrated before any reduced monitoring and reporting recommendations are made.

2. Localized Permanent Impacts

- a) If both NMFS and the authorizing action agencies concur, the compensatory mitigation elements of this policy may not be necessary for the placement of a single pipeline, cable, or other similar utility line across existing eelgrass habitat with an impact corridor of no more than 1 meter wide. NMFS should recommend the completion of pre- and post-action surveys as described in section II.B. and II.D. The actual area of impact should be determined from the post-action survey. NMFS should recommend the completion of an additional survey (after 1 year) to ensure that the action or impacts attributable to the action have not exceeded the 1-meter corridor width. NMFS should recommend that, if the post-action or 1 year survey demonstrates a loss of eelgrass habitat greater than the 1-meter wide corridor, mitigation should be undertaken.
- b) If both NMFS and the authorizing action agencies concur that the spacing of shellfish aquaculture longlines does not result in a measurable net loss of eelgrass habitat in the project

area, then mitigation associated with local losses under longlines may not be necessary. NMFS should recommend the completion of pre- and post-action surveys as described in section II.B. and II.D. NMFS should recommend the completion of additional post-action monitoring surveys (to be completed approximately 1 year and 2 years following implementation of the action) to ensure that the action or impacts attributable to the action have not resulted in net adverse impacts to eelgrass habitat. NMFS should recommend that, if the 1-year or 2-year survey demonstrates measurable impact to eelgrass habitat, mitigation should be undertaken. c) NMFS should consider mitigation on a 1:1 basis for impacts less than 10 square meters to eelgrass patches where impacts are limited to small portions of well-established eelgrass habitat or eelgrass habitat that, despite highly variable conditions, generally retain extensive eelgrass, even during poor years. A reduced mitigation ratio should not be considered where impacts would occur to isolated or small eelgrass habitat areas within which the impacted area constitutes more than 1% of the eelgrass habitat in the local area during poor years.

c) If NMFS concurs and suitable out-of-kind mitigation is proposed, compensatory mitigation may not be necessary for actions impacting less than 10 square meters of eelgrass.

III. Glossary of Terms

Except where otherwise specified, the explanations of the following terms are provided for informational purposes only and are described solely for the purposes of this policy; where a NMFS statute, regulation, or agreement requires a different understanding of the relevant term, that understanding of the term will supplant these explanations provided below.

Compensatory mitigation – restoration, establishment, or enhancement of aquatic resources for the purposes of offsetting unavoidable authorized adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

Ecosystem – a geographically specified system of organisms, the environment, and the processes that control its dynamics. Humans are an integral part of an ecosystem.

Ecosystem function – ecological role or process provided by a given ecosystem.

Ecosystem services – contributions that a biological community and its habitat provide to the physical and mental well-being of the human population (e.g., recreational and commercial opportunities, aesthetic benefits, flood regulation).

Eelgrass habitat – areas of vegetated eelgrass cover (any eelgrass within 1 square meter quadrat and within 1 m of another shoot) bounded by a 5 m wide perimeter of unvegetated area

Essential fish habitat (EFH) – EFH is defined in the MSA as “...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.”

EFH Assessment – An assessment as further explained in 50 C.F.R. § 600.920(e).

EFH Consultation – The process explained in 50 C.F.R. § 600.920

EFH Conservation Recommendation – provided by the National Marine Fisheries Service (NMFS) to a federal or state agency pursuant to section 305(b)(4)(A) of the Magnuson-Stevens Act regarding measures that can be taken by that agency to conserve EFH. As further explained in 50 C.F.R. § 600.925, EFH Conservation Recommendations may be provided as part of an EFH consultation with a federal agency, or may be provided by NMFS to any federal or state agency whose actions would adversely affect EFH .

Habitat – environment in which an organism(s) lives, including everything that surrounds and affects its life, including biological, chemical and physical processes.

Habitat function – ecological role or process provided by a given habitat (*e.g.*, primary production, cover, food, shoreline protection, oxygenates water and sediments, etc.).

In lieu fee program – a program involving the restoration, establishment, and/or enhancement of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation needs; an in lieu fee program works like a mitigation bank, however, fees to compensate for impacts to habitat function are collected prior to establishing an on-the-ground conservation/restoration project.

In-kind mitigation – mitigation where the adverse impacts to a habitat are mitigated through the creation, restoration, or enhancement of the same type of habitat.

Mitigation – action or project undertaken to offset impacts to an existing natural resource.

Mitigation bank – a parcel of land containing natural resource functions/values that are conserved, restored, created and managed in perpetuity and used to offset unavoidable impacts to comparable resource functions/values occurring elsewhere. The resource functions/values contained within the bank are translated into quantified credits that may be sold by the banker to parties that need to compensate for the adverse effects of their activities.

Out-of-kind mitigation – mitigation where the adverse impacts to one habitat type are mitigated through the creation, restoration, or enhancement of another habitat type

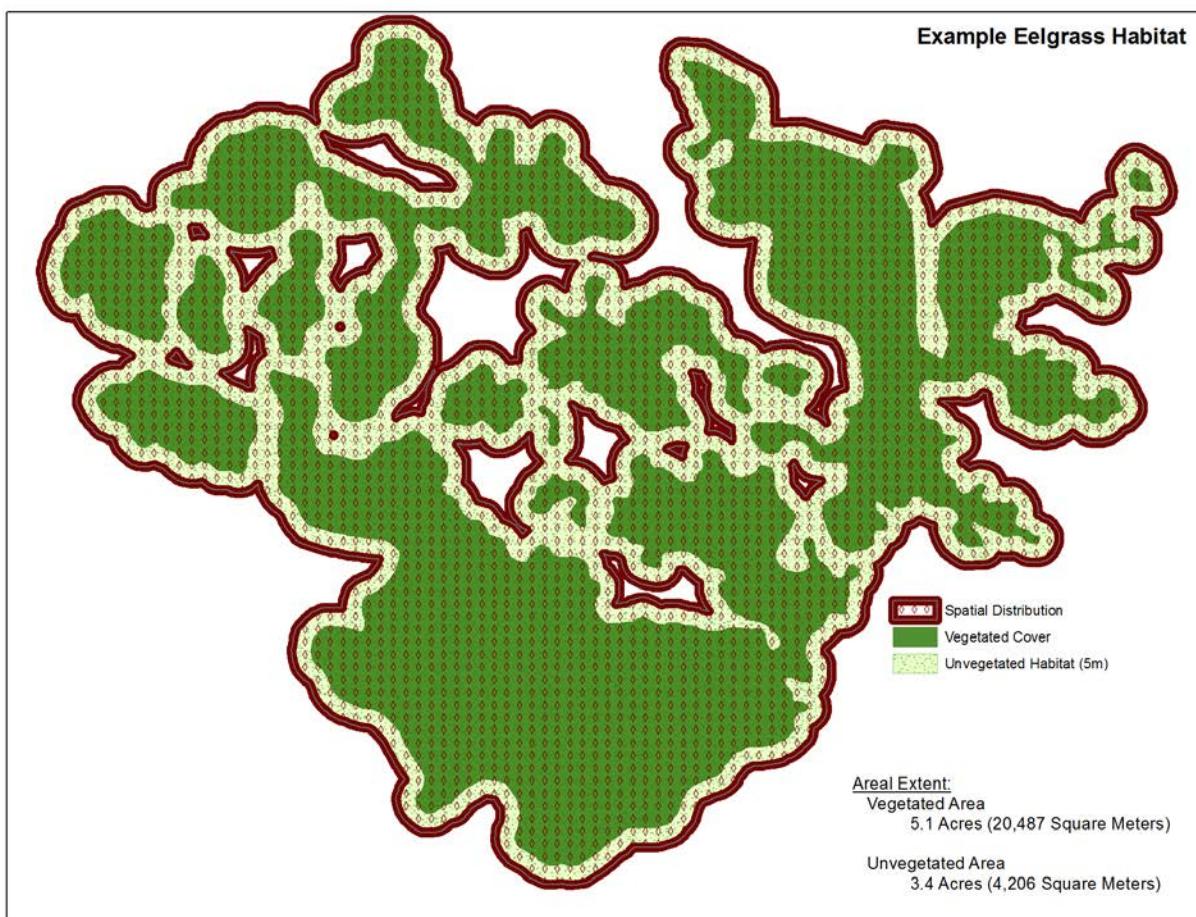
IV. Literature Cited

- Bostrom, C. and E. Bonsdorff. 2000. Zoobenthic community establishment and habitat complexity—the importance of seagrass shoot density, morphology and physical disturbance for faunal recruitment. *Marine Ecology Progress Series* 205:123-138.
- Bostrom, C., E. Bonsdorff, P. Kangas, and A. Norkko. 2002. Long-term changes of a Brackish-water eelgrass (*Zostera marina* L.) community indicate effects of coastal eutrophication. *Estuarine, Coastal and Shelf Science* 55: 795-804.
- California Department of Transportation. 2003. Storm Water Quality Handbooks: Construction Site Best Management Practices (BMPs) Manual.
- Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V.O., Paruelo, J., Raskin, R.G., Sutton, P., and M. van den Belt. 1997. The value of the world's ecosystem services and natural capital. *Nature* 387: 253-260.
- Council on Environmental Quality (CEQ). Regulations 1508 – National Environmental Policy Act (40 CFR 1508).
- Donoghue, C. 2011. Technical Memorandum: Operational Definition of an Eelgrass (*Zostera marina*) Bed. A Summary of a Workgroup Discussion and Related Analysis. Washington State Department of Natural Resources. October 2011.
- Duarte, C. M. 2002. The future of seagrass meadows. *Environmental Conservation* 29(2):192-206.
- Duarte, C.M., Dennison, W.C., Orth, R.J.W. and T.J.B. Carruthers. 2008. The charisma of coastal ecosystems: addressing the imbalance. *Estuaries and Coasts: J CERF* 31:233–238.
- Evans, N.T. and Leschen, A. 2010. Technical guidelines for the delineation, restoration, and monitoring of eelgrass (*Zostera marina*) in Massachusetts coastal waters. Massachusetts Division of Marine Fisheries Technical Report TR-43. 8 p.
- Evans, N. T., and F. T. Short. 2005. Functional trajectory models for assessment of transplanted eelgrass, *Zostera marina* L., in the Great Bay Estuary, New Hampshire. *Estuaries* 28(6):936-947.
- Ferrell, D. J., and J.D. Bell. 1991. Differences among assemblages of fish associated with *Zostera capricorni* and bare sand over a large spatial scale. *Marine Ecology Progress Series* 72:15-24.
- Fonseca, M.S., Kenworthy, W.J., Thayer, G.W. 1998. Guidelines for the conservation and restoration of seagrasses in the United Stated and adjacent waters. NOAA Coastal Ocean Program Decision Analysis Series, No. 12. NOAA Coastal Ocean Office, Silver Spring, MD. 222 p.

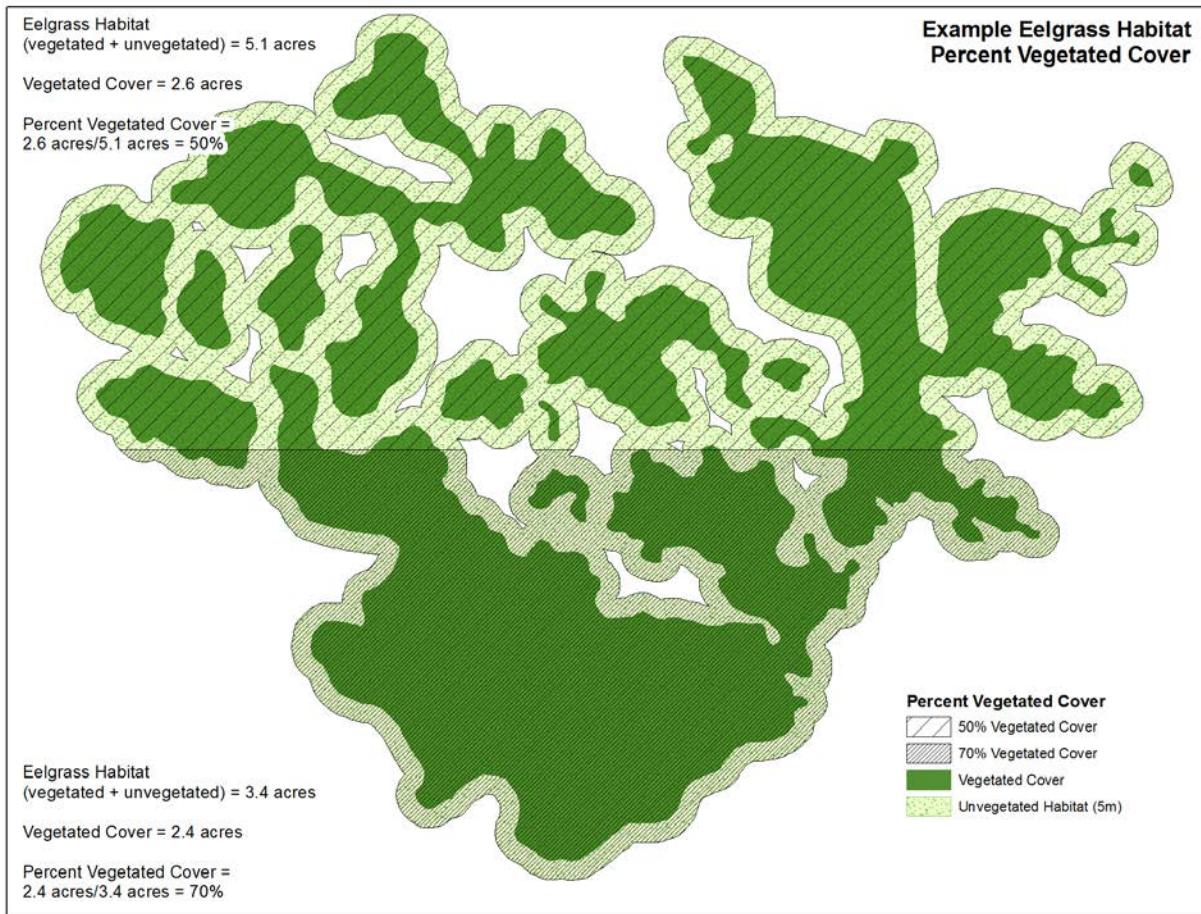
- Fonseca, M. S., W. J. Kenworthy, D. R. Colby, K. A. Rittmaster, and G. W. Thayer. 1990. Comparisons of fauna among natural and transplanted eelgrass *Zostera marina* meadows: criteria for mitigation. *Marine Ecology Progress Series* 65:251-264
- Hoffman, R. S. 1986. Fishery Utilization of Eelgrass (*Zostera marina*) Beds and Non-vegetated Shallow Water Areas in San Diego Bay. SWR-86-4, NMFS/SWR.
- King, D. M., and E. W. Price. 2004. Developing Defensible Wetland Mitigation Ratios: A Companion to "The Five-step Wetland Mitigation Ratio Calculator." Prepared by King and Associates, Inc. for NOAA, Office of Habitat Conservation, Habitat Protection Division.
- Lotze, H. K., H. S. Lenihan, B. J. Bourque, R. H. Bradbury, R. G. Cooke, M. C. Kay, S. M. Kidwell, M. X. Kirby, C. H. Peterson, and J. B. C. Jackson. 2006. Depletion, degradation, and recovery potential of estuaries and coastal seas. *Science* 312:1806-1809.
- Merkel, K. W. 1988. Growth and survival of transplanted eelgrass: The importance of planting unit size and spacing. In: Proceedings of the California Eelgrass Symposium. Chula Vista, CA.
- National Oceanic and Atmospheric Administration-Damage Assessment and Restoration Program (NOAA-DARP). 1999. Discounting and the treatment of uncertainty in natural resource damage assessment. *Technical Paper 99-1*.
- National Research Council. 2001. Compensating for Wetlands Losses under the Clean Water Act. National Academy Press, Washington DC, USA.
- Orth, R. J., T. J. B. Carruthers, W. C. Dennison, C. M. Duarte, J. W. Fourqurean, K. L. Heck, Jr., A. R. Hughes, G. A. Kendrick, W. J. Kenworthy, S. Olyarnik, F. T. Short, M. Waycott, and S. L. Williams. 2006. A global crisis for seagrass ecosystems. *BioScience* 56(12):987-996.
- Pacific Fishery Management Council (PFMC). 2008. Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery as Amended Through Amendment 19.
- Peterson, C.H., R.A. Lutich Jr., F. Micheli, and G.A. Skilleter. 2004. Attenuation of water flow inside seagrass canopies of differing structure. *Marine Ecology Progress Series* 268: 81-92.
- 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. <http://hdl.handle.net/1794/3798>

- Short, F. T., and S. Wyllie-Echeverria. 1996. Natural and human-induced disturbance of seagrasses. *Environmental Conservation* 23(1):17-27.
- Smith, Timothy M., J. S. Hindell, G. P. Jenkins, and R. M. Connolly. 2008. Edge effects on fish associated with seagrass and sand patches. *Marine Ecology Progress Series* 359:203-213.
- South Florida Water Management District. 2007. Environmental Monitoring Report Guidelines. Environmental Resource Regulation Department. 18 p.
- Thom, R.N. 1990. A review of eelgrass (*Zostera marina L.*) transplanting projects in the Pacific Northwest. *The Northwest Environmental Journal* 6:121-137.
- Thom, R.N., J. Gaekle, A. Borde, M. Anderson, M. Boyle, C. Durance, M. Kyte, P. Schlenger, J. Stutes, D. Weitkamp, S. Wyllie-Echeverria, and S. Rumrill. 2008. Eelgrass (*Zostera marina L.*) restoration in the Pacific Northwest: recommendations to improve project success. U.S. Department of Energy. Technical Report WA-RD 706.1.
- United States Army Corps of Engineers. 2010. New England District Compensatory Mitigation Guidance. 94 p.
- van Houte-Howes, S.J. Turner, and C. A. Pilditch. 2004. Spatial Differences in Macroinvertebrate Communities in Intertidal Seagrass Habitats and Unvegetated Sediment in Three New Zealand Estuaries. *Estuaries* 27(6):945-957.
- Washington Department of Fish and Wildlife. 2008. Eelgrass/macroalgae habitat interim survey guidelines (<http://wdfw.wa.gov/publications/00714/>).
- Webster, P.J., A.A. Rowden, and M.J. Attrill. 1998. Effect of shoot density on the infaunal macro-invertebrate community within a *Zostera marina* seagrass bed. *Estuarine, Coastal and Shelf Science* 47: 351-357.

ATTACHMENT 1. Graphic depiction of eelgrass habitat definition including spatial distribution and aerial coverage of vegetated cover and unvegetated eelgrass habitat.

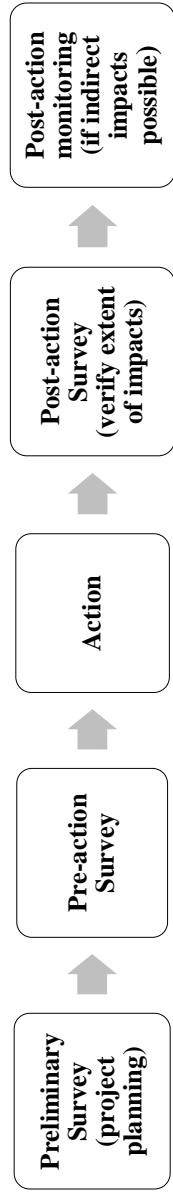


ATTACHMENT 2. Example Eelgrass Habitat Percent Vegetated Cover.



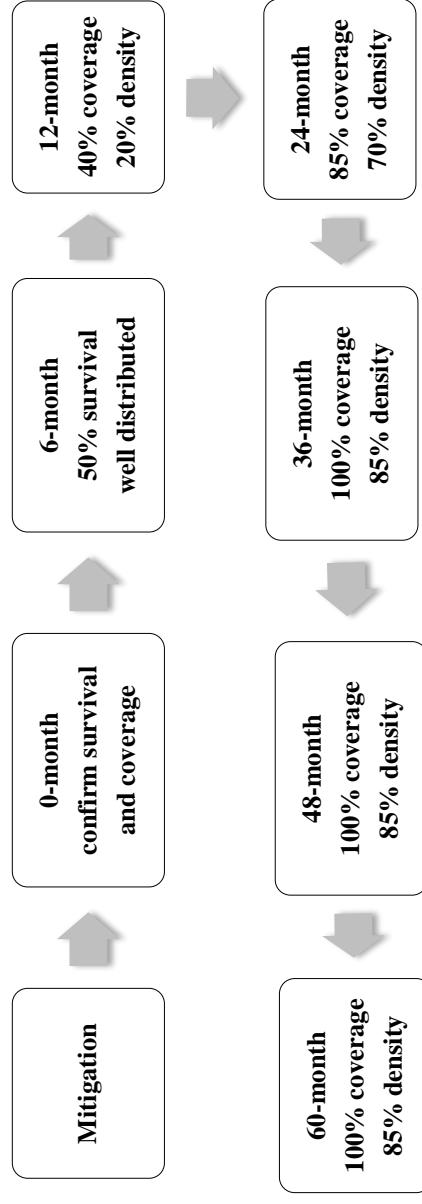
ATTACHMENT 3. Flow chart depicting timing of surveys and monitoring.

a) Eelgrass impact surveys



- All surveys should be completed during the growing season
- Surveys should be completed at the impact site and an appropriate reference site(s)
- A preliminary survey completed for planning purposes may be completed a year or more in advance of the action.
- Pre-action and post-action surveys should be completed within 60 days of the action.
- A survey is good for 60 days, or if that 60 day period extends beyond the end of growing season, until start of next growing season
- Two years of monitoring following the initial post-action monitoring event may be needed to verify lack or extent of indirect effects.
- Survey reports should be provided to NMFS and the federal action agency within 30 days of completion of each survey event

b) Eelgrass mitigation monitoring



- Mitigation should occur coincident or prior to the action
- All monitoring should be completed during the growing season
- Performance metrics for each monitoring event are compared to the 1.2:1 mitigation ratio
- Monitoring reports should be provided to NMFS and the federal action agency 30 days of completion of each monitoring event
- NMFS and action agency will evaluate if performance metrics met, and decide if supplemental mitigation or other adaptive management measures are needed

ATTACHMENT 4. Eelgrass transplant monitoring report.

In order to ensure that NMFS is aware of the status of eelgrass transplants, action agencies should provide or ensure that NMFS is provided a monitoring report summary with each monitoring report. For illustrative purposes only, an example of a monitoring report summary is provided below.

ACTION PARTY CONTACT INFORMATION:

Action Name (same as permit reference):

(a) Action party Information

Name		Address	
Contact Name		City, State, Zip	
Phone		Fax	
Email			

MITIGATION CONSULTANT

Name		Address	
Contact Name		City, State, Zip	
Phone		Fax	
Email			

PERMIT DATA:

Permit	Issuance Date	Expiration Date	Agency Contact

EELGRASS IMPACT AND MITIGATION NEEDS SUMMARY:

Permitted Eelgrass Impact Estimate (m ²):			
Actual Eelgrass Impact (m ²):		On (post-construction date):	
Eelgrass Mitigation Needs (m ²):		Mitigation Plan Reference:	
Impact Site Location:			
Impact Site Center Coordinates (actionion &			

datum):	
Mitigation Site Location:	
Mitigation Site Center Coordinates (actionion & datum):	

ACTION ACTIVITY DATA:

Activity	Start Date	End Date	Reference Information
Eelgrass Impact			
Installation of Eelgrass Mitigation			
Initiation of Mitigation Monitoring			

MITIGATION STATUS DATA:

	Mitigation Milestone	Scheduled Survey	Survey Date	Eelgrass Habitat Area (m ²)	Bottom Coverage (Percent)	Eelgrass Density (turions/m ²)	Reference Information
Month	0						
	6						
	12						
	24						
	36						
	48						
	60						

FINAL ASSESSMENT:

Was mitigation met?	
Were mitigation and monitoring performed timely?	
Were mitigation delay increases needed or were supplemental mitigation programs necessary?	

ATTACHMENT 5. Wetlands mitigation calculator formula and parameters.

Starting mitigation ratios for each region within California were calculated using “The Five-Step Wetland Mitigation Ratio Calculator” (King and Price 2004) developed for NMFS Office of Habitat Conservation. The discrete time equation this method uses to solve for the appropriate mitigation ratio is as follows:

$$R = \frac{\sum_{t=0}^{T_{\max}} (1+r)^{-t}}{(B(1-E)(1+L) - A) \left[\sum_{t=-D}^{C-D-1} \frac{(t+D)}{C(1+r)^t} + \sum_{t=D}^{T_{\max}} (1+r)^{-t} \right] + \left[\sum_{t=-D}^{T_{\max}} \frac{(1-(1-k)^{(t+D)})}{(1+r)^{(t+D)}} \right] (A(1+L))}$$

The calculator parameters in the above equation and values used to calculate starting mitigation ratios for CEMP are as follows:

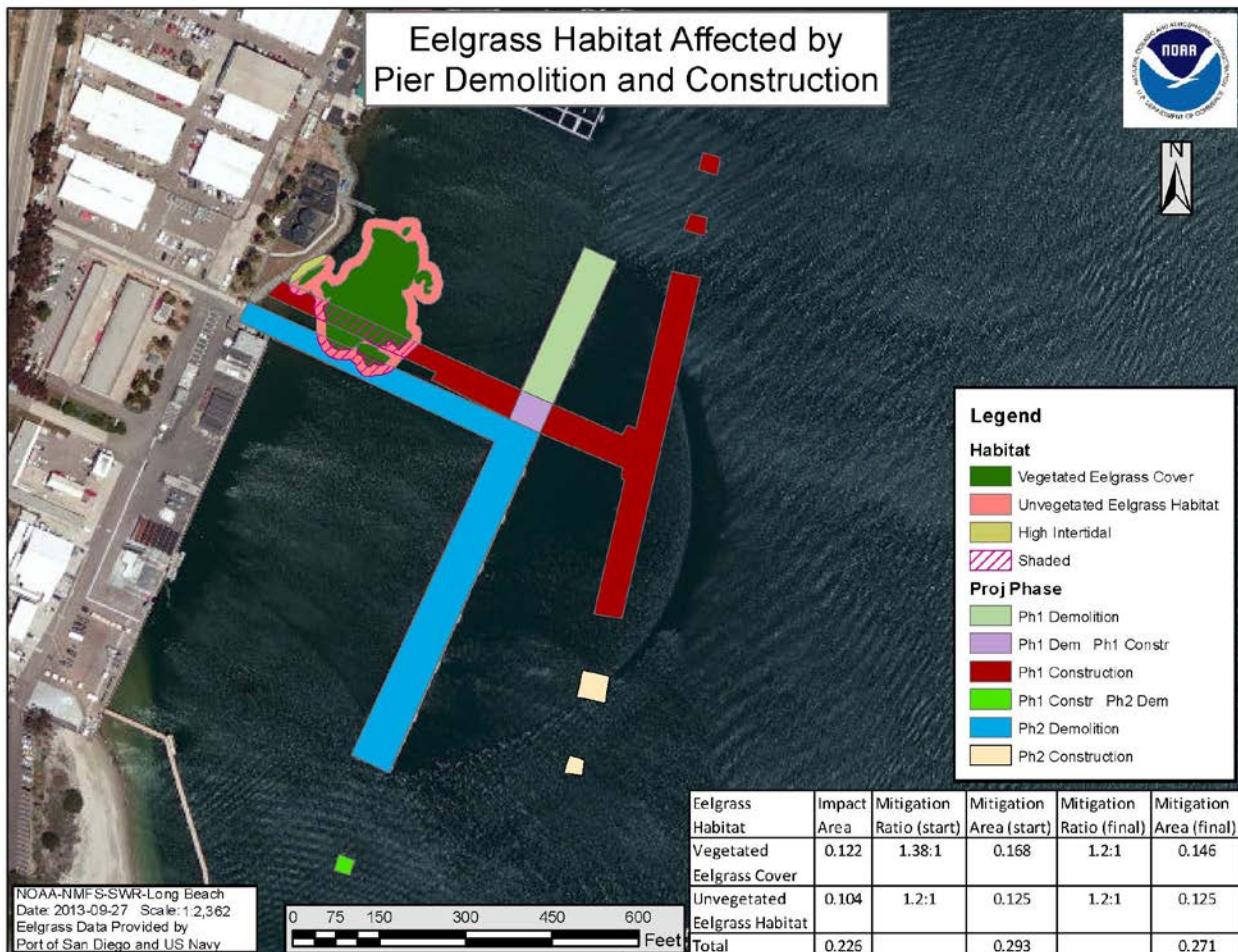
Symbol	Calculator Parameter	Value
A	The level of habitat function provided at the mitigation site prior to the mitigation project	0%
B	The maximum level of habitat function that mitigation is expected to attain, if it is successful	100%
C	The number of years after construction that the mitigation project is expected to achieve maximum function	3 yrs
D	The number of years before destruction of the impacted wetland that the mitigation project begins to generate habitat function	0 yrs
E	The percent likelihood that the mitigation project will fail and provide none of the anticipated benefits	various*
L	The percent difference in expected habitat function based on differences in landscape context of the mitigation site when compared with the impacted wetland	0%
k	The percent likelihood that the mitigation site, in the absence purchase or easement would be developed in any future year	0%
r	The discount rate used for comparing gains and losses that accrue at different times in terms of their present value	3%**
T _{max}	The time horizon used in the analysis (chosen to maintain 1.2:1 ratio at E=100% and other parameter values listed above).	13 yrs

* The value for E was based on regional history of success in eelgrass mitigation and varied between regions (see Attachment X).

** NOAA suggests the use of a 3 percent real discount rate for discounting interim service losses and restoration gains, unless a different proxy for the social rate of time preference is more appropriate. (NOAA-DARP 1999) We use this value here, because it is based on best available information and is consistent with the NOAA Damage Assessment and Restoration Program.

ATTACHMENT 6. Example calculations for application of starting and final mitigation ratios for impacts to eelgrass habitat in southern California.

In this example, a pier demolition and construction would impact 0.122 acres of vegetated eelgrass habitat (dark green) and 0.104 acres of unvegetated habitat (pink). Area of impact is indicated by purple hatch mark. Application of recommended starting mitigation ratio for southern California (1.38:1) and final mitigation ratio (1.2:1) to compute starting and final mitigation area for this example are shown in the table.



ATTACHMENT 7. Example mitigation area multipliers for delay in initiation of mitigation activities.

Delays in eelgrass transplantation result in delays in ultimate reestablishment of eelgrass habitat values, increasing the duration and magnitude of project effects to eelgrass. The delay multipliers in the table below have been generated by altering the implementation start time within “The Five-Step Wetland Mitigation Ratio Calculator” (King and Price 2004).

MONTHS POST-IMPACT	DELAY MULTIPLIER (Percent of Initial Mitigation Area Needed)
0-3 mo	100%
4-6 mo	107%
7-12 mo	117%
13-18 mo	127%
19-24 mo.	138%
25-30 mo.	150%
31-36 mo	163%
37-42 mo.	176%
43-48 mo.	190%
49-54 mo.	206%
55-60 mo.	222%



NOAA FISHERIES

ATTACHMENT 8. Summary of Eelgrass Transplant Actions in California

See table starting next page.

SUMMARY OF EELGRASS (*ZOSTERA MARINA*) TRANSPLANT PROJECTS IN CALIFORNIA

No.	Region	System	Location	Year	Size*	Type**	Consistent with Permit Conditions	Success Status***	Net Result****
Southern California Eelgrass Restoration History									
Southern	San Diego Bay	North Island		1976	<0.1	SP	yes	no	-
Southern	San Diego Bay	"Delta" Beach		1977	1.6	SP	yes	partial	-
Southern	San Diego Bay	North Island		1978	<0.1	SP	yes	yes	+
Southern	Newport Bay	Carnation Cove		1978	<0.1	SP	no	no	-
Southern	Newport Bay	West Jetty		1980	<0.1	SP	yes	partial	0
Southern	Mission Bay	multiple beaches		1982	<0.1	SP	no	partial	0
Southern	LA/LB Harbor	Cabrillo Beach		1985	<0.1	BR	yes	yes	+
Southern	Alamitos Bay	Peninsula		1985	<0.1	BR	yes	yes	+
Southern	Huntington Hbr.	Main Channel		1985	<0.1	BR	yes	no	0
Southern	Newport Bay	Upper		1985	<0.1	BR	yes	no	0
Southern	Mission Bay	Sail Bay		1986	2.7	BR	yes	yes	+
Southern	San Diego Bay	NEMS I		1987	3.8	BR	no	yes	+
Southern	San Diego Bay	Chula Vista Wildlife Reserve		1987	<0.1	BR	yes	no	+ ¹
Southern	San Diego Bay	Harbor Island		1988	0.1	BR	yes	yes	+
Southern	Huntington Harbour	Entrance Channel		1989	0.1	BR	no	yes	+
Southern	San Diego Bay	Le Meridien Hotel		1990	<0.1	BR	yes	yes	+
Southern	San Diego Bay	Embarcadero		1991	<0.1	BR	yes	yes	+ ²
Southern	Mission Bay	Sea World Lagoon		1991	<0.1	BR	yes	yes	+
Southern	San Diego Bay	Loew's Marina		1991	<0.1	BR	yes	yes	+
Southern	San Diego Bay	NEMS 2		1993	<0.1	BR	yes	yes	+
Southern	San Diego Bay	Sea Grant Study		1993	<0.1	BR	yes	yes	+
Southern	Agua Hedionda Lagoon	Outer Lagoon		1993	<0.1	BR	yes	yes	+
Southern	San Diego Bay	NEMS 5		1994	0.4	BR	yes	yes	+
Southern	Mission Bay	South Shores Basin		1994	2.9	BR	yes	yes	+
Southern	Talbert Marsh	Talbert Channel		1995	<0.1	BR	na	yes	+ ⁴
Southern	Mission Bay	various sites		1995	4.8	BR	yes	yes	+
Southern	Mission Bay	Ventura Cove ⁵		1996	0.5	BR	yes	yes	+ ⁶
Southern	Mission Bay	Santa Clara Cove		1996	<0.1	BR	yes	no	0 ¹⁰
Southern	Mission Bay	West Mission Bay Drive Bridge		1996	<0.1	BR	no	yes	0 ¹⁰
Southern	Mission Bay	De Anza Cove		1996	<0.1	BR	yes	yes	+
Southern	Batiquitos Lagoon	all basins		1997	21.6 ⁷	BR	yes	yes	+ ⁴
Southern	San Diego Bay	NEMS 5		1997	7.1	BR	yes	yes	+
Southern	San Diego Bay	Convair Lagoon		1998	2.5	BR	yes	no	- ¹²
Southern	San Diego Bay	NEMS 6		1999	0.3	BR	yes	yes	+
Southern	Aqua Hedionda	Bristol Cove		1999	0.3	BR	yes	yes	+
Southern	Aqua Hedionda	Middle Lagoon and Inner Lagoon		1999	4	BR	yes	yes	+
Southern	Newport Bay	Balboa Is. Grand Cana		1999	<0.1	BR	yes	yes	+
Southern	Mission Bay	West Ski Island		2001	0.2	BR	yes	yes	+

No.	Region	System	Location	Year	Size*	Type**	Consistent with Permit Conditions	Success Status***	Net Result****
Southern	San Diego Bay	Expanded NEMS 6		2001	0.6	BR	yes	yes	+
Southern	Newport Bay	USCG Corona del Mar		2002	<0.1	BR	yes	yes	+
Southern	Huntington Harbour	Sunset Bay		2002	<0.1	BR	yes	yes	+
Southern	San Diego Bay	Navy Enhancement Is.		2002	1	BR	yes	yes	+
Southern	San Diego Bay	Coronado Bay Bridge		2003	0.3	BR	no	no	0
Southern	LA Harbor	P300 Expansion Area		2003	5.9	BR	yes	partial	- ⁹
Southern	Newport Bay	Newport Bay Channel Dredging		2004	0.4	BR	yes	no	-
Southern	San Diego Bay	South Bay Borrow Pit		2004	4.2	BR	yes	yes	pending ⁸
Southern	San Diego Bay	USCG ATC Pier		2004	0.1	BR	yes	yes	+
Southern	San Diego Bay	South Bay Borrow Pit Sup.		2006	4.2	BR	yes	yes	pending ⁸
Southern	San Diego Bay	D Street Marsh		2006	0.3	BR	yes	pending	pending
Southern	LA Harbor	P300 Supplement		2007	0.8	BR	yes	yes	pending
Southern	San Diego Bay	Glorietta Bay Shoreline Park		2007	0.2	BR	yes	yes	pending
Southern	Bolsa Chica	Pilot Eelgrass Restoration		2007	0.5	BR	yes	yes	+ ⁴
Southern	San Diego Bay	Borrow Pit Supplement		2007	4.2	BR	yes	yes	pending ⁸
Southern	San Diego Bay	Sweetwater Silvergate Frac-out		2008	<0.1	BR	yes	yes	0 ¹¹
Southern	San Diego Bay	Harbor Drive Bridge/NTC Channel		2009	<0.1	BR	yes	pending	pending

Southern California Eelgrass Success Rate (1989-2009, Last 20 Years)

87% n=43

Central California Eelgrass Restoration History

Central	Morro Bay	Anchorage Area	1985	<0.1	BR	no	yes	+
Central	Morro Bay	Target Rock	1997	<0.1	BR	no	yes	+
Central	Morro Bay	Morro Bay Launch Ramp	2000	<0.1	BR	yes	yes	+
Central	Morro Bay	Mooring Area A1	2002	0.3	BR	yes	yes	+
Central	Morro Bay	Western Shoal	2010	0.8	BR	yes	pending	pending

Central California Eelgrass Success Rate (1985-2009, Inadequate History to Exclude Older Projects)

100% n=4

San Francisco Bay Eelgrass Restoration History

San Francisco Bay	San Francisco Bay	Richmond Training Wall	1985	<0.1	BR	NA	no	NA ⁴
San Francisco Bay	San Francisco Bay	Keil Cove and Paradise Cove	1989	0.1	Plugs	NA	partial	NA ⁴
San Francisco Bay	San Francisco Bay	Bayfarm Island/Middle Harbor Shoal	1998	0.1	BR and Plugs	NA	partial	NA ⁴
San Francisco Bay	San Francisco Bay	Bayfarm Island	1999	0.1	BR	NA	partial	NA ⁴
San Francisco Bay	San Francisco Bay	Brickyard Cove, Berkeley	2002	0.2	BR	yes	yes	+ ¹³
San Francisco Bay	San Francisco Bay	Emeryville Shoals	2002	0.1	Mixed Test	NA	no	NA ⁴
San Francisco Bay	San Francisco Bay	Marin CDay, R&GC, Audubon	2006	0.6	Seed Bouy	NA	partial	pending ⁴
San Francisco Bay	San Francisco Bay	Marin CDay, R&GC, Audubon	2006	<0.1	mod. TERFS	NA	partial	pending ⁴
San Francisco Bay	San Francisco Bay	Marin CDay, R&GC, Audubon	2006	<0.1	Seeding	NA	no	NA ⁴
San Francisco Bay	San Francisco Bay	Clipper Yacht Harbor, Sausalito	2007	<0.1	Frames	yes	pending	pending
San Francisco Bay	San Francisco Bay	Albany, Emeryville, San Rafael	2007	<0.1	BR	NA	partial	pending ⁴
San Francisco Bay	San Francisco Bay	Belvedere	2008	<0.1	Frames	yes	pending	pending

San Francisco Bay Eelgrass Success Rate (1985-2009, Inadequate History to Exclude Older Projects)

40% n=10

No.	Region	System	Location	Year	Size*	Type**	Consistent with Permit Conditions	Success Status***	Net Result****
Northern California Eelgrass Restoration History									
	Northern	Humboldt Bay	Indian Island	1982	unknown	BR	unknown	no	-
	Northern	Bodega Harbor	Spud Point Marina	1984	1.3	BR	yes	no	-
	Northern	Humboldt Bay	Indian Island	1986	<0.1	BR	yes	no	-
	Northern	Humboldt Bay		1986	0.2	unknown	unknown	no	-
	Northern	Humboldt Bay	SR255 Bridge	2004	<0.1	BR	yes	no	-
	Northern	Humboldt Bay	Maintenance Dredging Project	2005	<0.1	BR	yes	yes	+
Northern California Eelgrass Success Rate (1982-2009, Inadequate History to Exclude Older Projects)								25%	n=4

* size in hectares

SP = sediment laden plug

** BR = bare root

*** success status is measured as yes, no, partial, pending, or unknown. Success rate is reported as percentage of successful over total completed within the past 25 years.
yes = 1, partial = 0.5, no = 0, and pending or unknown are not counted in either the numerator or denominator in determining success percentage.

**** + = net increase in eelgrass coverage, 0 = no change in eelgrass coverage, - = net decrease in eelgrass coverage

1 Transplant was initially adversely impacted by an unknown source of sediment and was deemed unsuitable.

2 The transplant declined initially and later recovered from what was determined to be a one time sedimentation event.

3 Transplant was experimental due to dense beds of the exotic mussel *Musculista senhousia*

which inhibited the growth of the transplant. Replacement transplant done elsewhere.

Transplant was completed in an area deemed unsuitable. Insufficient coverage required the construction of a remedial site.

Monitoring continues at both the initial and remedial sites.

4 Transplant was experimental.

5 Multiple sites.

6 Mitigation for marina at Princess Resort, project not built

7 Amount of eelgrass present within all basins as of 2000 mapping.

8 Regional eelgrass decline has resulted in die-offs both within restoration and reference areas equally full recovery had not occurred at the time of evaluation, yet project exceeds control-corrected req.

9 Original site was constructed as a plateau that was underfilled and anticipated to fall short of objectives. A supplemental transplant was therefore completed when development began to exhibit shortfalls in area.

10 Shortfall mitigated by withdraw from established eelgrass mitigation bank.

11 Exception conditions from SCEMP requiring only replacement in place for unanticipated damage

12 Mitigated out-of-kind with non-eelgrass to satisfy permit requirements after shortfall in eelgrass mitigation.