FINAL ENVIRONMENTAL ASSESSMENT

Issuance of an Incidental Harassment Authorization
to the Washington State Department of Transportation to Take Marine Mammals
by Harassment Incidental to Manette Bridge Replacement Project
in Bremerton, Washington

May 2010

LEAD AGENCY: USDOC, National Oceanic and Atmospheric Administration
National Marine Fisheries Service, Office of Protected Resources
1315 East West Highway
Silver Spring, MD 20910

RESPONSIBLE OFFICIAL: James H. Lecky, Director, Office of Protected Resources

FOR INFORMATION CONTACT: Office of Protected Resources
National Marine Fisheries Service
1315 East West Highway
Silver Spring, MD 20910
(301) 713-2332

LOCATION: Bremerton, Washington

ABSTRACT: The National Marine Fisheries Service proposes to issue an Incidental Harassment Authorization (IHA) to the Washington State Department of Transportation (WSDOT) for the taking, by Level B harassment, of small numbers of marine mammals incidental to Manette Bridge replacement project in Bremerton, Washington. Because the proposed bridge replacement project is expected to last for three years starting from June 2010, this EA applies to the current IHA application and any future IHA applications for the bridge replacement activities during the time period of June 1 through May 31, annually, over the duration of the project.

TABLE OF CONTENTS

List of Acronyms, Abbreviations, and Initialisms

ASR	Alkali Silica Reaction
CFR	Code of Federal Regulations
CEQ	President's Council on Environmental Quality
CHART	Critical Habitat Analytical Review Team
cm	centimeter
Commission	Marine Mammal Commission
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dB	decibel
DPS	Distinct Population Segment
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FHWA	Federal Highway Administration
FL	fork length
ft	foot/feet
ft^2	square foot/feet
ft^3	cubit foot/feet
FR	*Federal Register*
GPS	global positioning system
hr	hour
hrs	hours
HUC	Hydrologic Unit Code
Hz	hertz
IHA	Incidental Harassment Authorization
in	inch
kHz	kilohertz
km	kilometer
kPa	kilopascal
m	meter
m^2	square meter
m^3	cubic meter
mi	mile
MHHW	mean higher high water
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MMO	marine mammal observer
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NWRO	NMFS Northwest Regional Office
OMB	Office of Management and Budget
OPR	Office of Protected Resources

p-p	peak-to-peak
Pa	pascal
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyls
PCE	Primary Constituent Element
POP	Persistent Organic Pollutants
PR1	NMFS OPR Permits, Conservation, and Education Division
PRD	Southwest Regional Office Protected Resources Division
psi	pound(s) per square inch
PTS	permanent threshold shift
rms	root-mean-square
RRL	range of received level
RSL	range of source level
SEL	Sound exposure level
SPL	Sound pressure level
SRKW	Southern Resident killer whale
TL	transmission loss
TS	threshold shift
TSS	total suspended solid
TTS	temporary threshold shift
TMDL	total maximum daily load
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
WDFW	Washington State Department of Fish and Wildlife
WDOT	Washington State Department of Ecology
WSDOT	Washington State Department of Transportation
ZOI	zone of influence
μPa	microPascal

CHAPTER 1 PURPOSE OF AND NEED FOR ACTION

1.1 DESCRIPTION OF ACTION

In response to a receipt of a request from the Washington State Department of Transportation (WSDOT), the National Marine Fisheries Service (NMFS) proposes to issue an Incidental Harassment Authorization (IHA) that authorizes takes by level B harassment of marine mammals in the wild pursuant to section 101(a)(5)(D) of the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1631 *et seq*.), and the regulations governing the taking and importing of marine mammals (50 Code of Federal Regulations (CFR) Part 216).

This Environmental Assessment (EA), titled "*Issuance of an Incidental Harassment Authorization to the Washington State Department of Transportation to Take Marine Mammals by Harassment Incidental to Manette Bridge Replacement Project in Bremerton, Washington,*" (hereinafter, the 2010 EA) addresses the impacts on the human environment that would result from the issuance of this IHA.

1.1.1 BACKGROUND

On December 24, 2009, NMFS received an application from the WSDOT requesting an authorization for the harassment of small numbers of marine mammals incidental to the construction and demolition work related to the Manette Bridge replacement in Bremerton, Washington, starting in early June 2010.

The proposed Manette Bridge replacement construction activities include construction of temporary work trestles; construction of new bridge piers; barge anchoring and usage; removal the existing bridge; and removal of temporary work platforms. The proposed construction work would involve steel pile installation by vibratory pile driving and possibly by impact driving methods as well; excavation of benthic material; and the potential use of dynamic positioning systems for construction vessels.

Since underwater construction noise from these activities and the increase of human activities and vessel traffic could adversely affect marine mammal species and stocks in the proposed action area, WSDOT is seeking an IHA that would allow the incidental, but not intentional, take of marine mammals by Level B behavioral harassment during the construction of the new Manette Bridge and removal of the existing bridge. The WSDOT states that small numbers of three species of marine mammals could potentially be taken by pile driving or other construction activities associated with the bridge replacement work. The marine mammals that could be affected are: California sea lion (*Zalophus californianus*), Pacific harbor seal (*Phoca vitulina richardsi*), and gray whale (*Eschrichtius robustus*).

1.1.2 PURPOSE AND NEED

In response to the receipt of an IHA application from the WSDOT, NMFS proposes to issue an IHA pursuant to the MMPA §101(a)(5)(D). The primary purpose of the IHA is to provide an exception from the take prohibitions under the MMPA to allow "takes" by "level B harassment" of marine mammals for the construction and demolition work associated with the Manette Bridge replacement project. The need for the issuance of the IHA is related to NMFS' mandates under the MMPA. Specifically the MMPA prohibits takes of marine mammals, with specific exceptions, including the incidental, but not intentional, taking of marine mammals, for periods of not more than one year, by United States citizens who engage in a specified activity (other than commercial fishing).

IHA issuance criteria require that the take of marine mammals authorized by an IHA will have a negligible impact on the species or stock(s); and will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses. In addition, the IHA must set forth the permissible methods of taking, other means of effecting the least practicable adverse impact on the species or stock and its habitat, and requirements for monitoring and reporting of such takings.

Issuance of an IHA is a federal agency action. For purposes of section 7 of the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et. seq*), NMFS must consult with itself to ensure that its action is not likely to jeopardize the continued existence of any federally-listed species or result in the destruction or adverse modification of critical habitat.

In addition, this EA is prepared in accordance with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq*.) for the analysis of the potential environmental impacts as the result of the NMFS proposed issuance of the IHA.

1.2 Scoping Summary

The purpose of scoping is to identify the issues to be addressed and the significant issues related to the proposed action, as well as identify and eliminate from detailed study the issues that are not significant or that have been covered by prior environmental review. An additional purpose of the scoping process is to identify the concerns of the affected public and Federal agencies, states, and Indian tribes.

The MMPA and its implementing regulations governing issuance of an IHA (50 CFR § 216.104) require that upon receipt of a valid and complete application for an IHA, NMFS publish a proposed IHA in the *Federal Register* (*FR*). The notice summarizes the purpose of the requested IHA, includes a statement about whether an EA or an Environmental Impact Statement (EIS) was prepared, and invites interested parties to submit written comments concerning the proposal to issue the IHA .

NOAA Administrative Order (NAO) 216-6, established agency procedures for complying with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq*.) and the implementing regulations issued by the President's Council on Environmental Quality (CEQ). NAO 216-6 specifies that the issuance of an IHA under the MMPA is among a category of actions that require further environmental review and the preparation of NEPA documentation. The CEQ regulations implementing the NEPA do not require that a draft EA be made available for public comment as part of the scoping process.

1.2.1 Comments On Application and EA

On March 22, 2010, NMFS published a notice of a proposed IHA in the *Federal Register* (75 FR 13502), which announced the availability of the application for public comment for 30 days. The public comment period for the proposed IHA afforded the public the opportunity to provide input on environmental impacts. In addition, NMFS will post the final 2010 EA on http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications.

NMFS received one comment from the Marine Mammal Commission (Commission) and one comment from a private citizen on the proposal to issue an IHA, which both recommended that NMFS issue the requested authorization for the proposed Manette Bridge replacement project (See Appendix A). Based on its review, the Commission recommended that NMFS ensure that the proposed monitoring and mitigation measures discussed in the application and *Federal Register* (75 FR 13502, March 22, 2010) notice are included in the final IHA. The Commission concurred with NMFS' initial scoping (as described in the *Federal Register* notice) and provided no additional issues or alternatives for inclusion and evaluation in the 2010 EA.

1.2.2 ISSUES WITHIN THE SCOPE OF THIS EA

The 2010 EA addresses the proposal of NMFS to issue an IHA under Section 101(a)(5)(D) of the MMPA and the alternatives to the proposed action. The IHA, if issued, would authorize the harassment of three species of marine mammals incidental to the Manette Bridge replacement project.

NMFS identified the following issues as relevant to the action and appropriate for detailed evaluation: (1) disturbance of marine mammals from construction noise; and (2) disturbance of marine mammals from the increased human presence due to construction activities.

Disturbance from Construction Noise: Because the construction and demolition activities associated with the proposed bridge replacement project will produce intense noises, NMFS expects that marine mammals in the vicinity of the project area will be affected by man-made noises from pile driving, dredging, and other construction sounds.

Disturbance from Increased Human Presence: The proposed Manette Bridge replacement project will cause increased vessel traffic and human presence in the action area, which could adversely affect marine mammals in the vicinity of the project area.

1.3 APPLICABLE LAWS AND NECESSARY FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

This section summarizes federal, state, and local permits, licenses, approvals, and consultation requirements necessary to implement the proposed action, as well as who is responsible for obtaining them. Even when it is the applicant's responsibility to obtain such permissions, NMFS is obligated under NEPA to ascertain whether the applicant is seeking other federal, state, or local approvals for their action.

1.3.1 NATIONAL ENVIRONMENTAL POLICY ACT

The NEPA, enacted in 1969, is applicable to all "major" federal actions significantly affecting the quality of the human environment. A major federal action is an activity that is fully or partially funded, regulated, conducted, or approved by a federal agency. NMFS' issuance of an IHA for incidental harassment of marine mammals represents approval and regulation of the applicant's activities. While NEPA does not dictate substantive requirements for an IHA, it requires consideration of environmental issues in federal agency planning and decision making.

The procedural provisions outlining federal agency responsibilities under NEPA are provided in the CEQ's implementing regulations (40 CFR Parts 1500-1508).

NOAA has, through NAO 216-6, established agency procedures for complying with NEPA and the implementing regulations issued by the CEQ. NAO 216-6 specifies that issuance of an IHA under the MMPA and ESA is among a category of actions that require further environmental review. When a proposed action has uncertain environmental impacts or unknown risks, establishes a precedent or decision in principle about future proposals, may result in cumulatively significant impacts, or may have an adverse effect upon endangered or threatened species or their habitats, preparation of an EA or EIS is required. The 2010 EA is prepared in accordance with NEPA, its implementing regulations, and NAO 216-6.

1.3.2 ENDANGERED SPECIES ACT

Section 7 of the ESA requires consultation with the appropriate federal agency (either NMFS or the USFWS) for federal actions that "may affect" a listed species or critical habitat. NMFS' issuance of an IHA affecting ESA-listed species or designated critical habitat, directly or indirectly, is a federal action subject to these section 7 consultation requirements. Accordingly, NMFS is required to ensure that its action is not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of critical habitat for such species. Regulations specify the requirements for these consultations (50 CFR Part 402).

The NMFS Office of Protected Resources (OPR) Permits, Conservation and Education Division (PR1) is required to consult with the NMFS Northwest Regional Office (NWRO) Protected Resources Division (PRD) on the issuance of an IHA under Section 101(a)(5)(D) of the MMPA. PR1 is required to consult with PRD because the action of issuing an IHA may affect threatened and endangered species under NMFS' jurisdiction.

1.3.3 MARINE MAMMAL PROTECTION ACT

Section 101(a)(5)(D) of the MMPA (16 U.S.C. 1371(a)(5)(D)) directs the Secretary of Commerce (Secretary) to authorize, upon request, the incidental, but not intentional, taking by harassment of small numbers of marine mammals of a species or population stock, for periods of not more than one year, by United States citizens who engage in a specified activity (other than commercial fishing) within a specific geographic region if certain findings are made and notice of a proposed authorization is provided to the public for review.

Authorization for incidental taking of small numbers of marine mammals shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), and will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses. The authorization must set forth the permissible methods of taking, other means of effecting the least practicable adverse impact on the species or stock and its habitat, and requirements pertaining to the monitoring and reporting of such takings. NMFS has defined "negligible impact" in 50 CFR 216.103 as "an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival."

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Except with respect to certain activities not pertinent here, the MMPA defines "harassment" as:

> any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild ["Level A harassment"]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering ["Level B harassment"].

Section 101(a)(5)(D) of the MMPA establishes a 45-day time limit for NMFS' review of an application followed by a 30-day public notice and comment period on any proposed authorizations for the incidental harassment of small numbers of marine mammals. Not later than 45 days after the close of the public comment period, if the Secretary makes the findings set forth in Section 101(a)(5)(D)(i) of the MMPA, the Secretary shall issue the authorization with appropriate conditions to meet the requirements of Section 101(a)(5)(D)(ii) of the MMPA.

NMFS has promulgated regulations to implement the permit provisions of the MMPA (50 CFR Part 216) and has produced Office of Management and Budget (OMB)-approved application instructions (OMB Number 0648-0151) that prescribe the procedures (including the form and manner) necessary to apply for permits. All applicants must comply with these regulations and application instructions in addition to the provisions of the MMPA. Applications for an IHA must be submitted according to regulations at 50 CFR §216.104.

1.3.4 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

Under the MSFCMA Congress defined Essential Fish Habitat (EFH) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The EFH provisions of the MSFCMA offer resource managers means to accomplish the goal of giving heightened consideration to fish habitat in resource management. NMFS Office of Protected Resources is required to consult with NMFS Office of Habitat Conservation for any action it authorizes (e.g., research permits), funds, or undertakes, or proposes to authorize, fund, or undertake that may adversely affect EFH. This includes renewals, reviews or substantial revisions of actions.

1.3.5 COASTAL ZONE MANAGEMENT ACT

Congress enacted the Coastal Zone Management Act (CZMA) (16 U.S.C. 1451 *et seq.*) to protect the coastal environment from growing demands associated with residential, recreational, commercial, and industrial uses (e.g., State and Federal offshore oil and gas development). Those coastal states with an approved Coastal Zone Management Program, which defines permissible land and water use within the state's coastal zone, can review Federal actions, licenses, or permits for "Federal consistency." "Federal consistency" is the requirement that those Federal permits and licenses likely to affect any land/water use or natural resources of the coastal zone be consistent with the Program's enforceable policies. NMFS consults with States on issuance of permits for activities that fall within the State's Coastal Zone Management Program .

2 Chapter 2 Alternatives Including The Proposed Action

The NEPA implementing regulations (40 CFR § 1502.14) and NAO 216-6 provide guidance on the consideration of alternatives to a federal proposed action and require rigorous exploration and objective evaluation of all reasonable alternatives. Each alternative must be feasible and reasonable in accordance with the President's Council on Environmental Quality (CEQ) regulations (40 CFR §§ 1500-1508). This chapter describes the range of potential actions (alternatives) determined reasonable with respect to achieving the stated objective, as well as alternatives eliminated from detailed study and also summarizes the expected outputs and any related mitigation of each alternative.

This EA evaluates the alternatives to ensure that they would fulfill the purpose and need, namely: (1) the issuance of an IHA for the take of marine mammals by level B behavioral harassment incidental to the WSDOT's conduct of Manette Bridge replacement project in Bremerton, Washington; and (2) compliance with the MMPA which sets forth specific standards (i.e., no unmitigable adverse impact and negligible impact) that must be met in order for NMFS to issue an IHA.

The Proposed Action (Preferred) alternative represents the activities proposed in the submitted application for an IHA, with standard monitoring and mitigation measures specified by NMFS. If the action will have no more than a negligible impact on the species or stocks; and will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses; then NMFS shall issue the IHA.

2.1 Project Objectives

The WSDOT intends to conduct construction and demolition activities to replace the existing Manette Bridge in the city of Bremerton, Washington. The proposed project includes construction of temporary work trestles; construction of new bridge piers; barge anchoring and usage; removal of the existing bridge; and removal of temporary work platforms. Construction work would involve steel pile installation by vibratory pile driving and possibly by impact driving methods as well; excavation of benthic material; and the potential use of dynamic positioning systems for construction vessels. The duration of the proposed bridge replacement project is expected to last for three years starting from June 2010. As such, the WSDOT will request an IHA for these activities on an annual basis.

2.2 Alternative 1: No Action Alternative – Deny Issuance of an IHA

Evaluation of the No Action Alternative is required by regulations of the CEQ as a baseline against which the impacts of the Proposed Action are compared.

Under the No Action Alternative, NMFS would not issue the proposed IHA for the activities proposed by the WSDOT. The MMPA prohibits all takings of marine mammals unless authorized by a permit or exemption under the MMPA. If authorization to take, by incidental harassment, Pacific harbor seals, California sea lions, and gray whales is denied, the WSDOT would not conduct construction and demolition activities for the bridge replacement project; marine mammals present in the vicinity of the existing Manette Bridge would not be incidentally harassed from construction activities; and the WSDOT would have to forego the project. As a result, the WSDOT would be unable to replace the current functionally obsolete Manette Bridge in Bremerton, Washington. Thus, this alternative does not meet the purpose and need.

2.3 Alternative 2: Issuance of an IHA with Mitigation (Preferred Alternative)

The Proposed Action is the Preferred Alternative. Under this alternative, NMFS would issue an IHA (valid from June 1 through May 31, annually) to the WSDOT allowing the incidental take by Level B harassment of small numbers of Pacific harbor seals, California sea lions, and gray whales during construction and demolition activities associated with the Manette Bridge replacement project in Bremerton, Washington.

NMFS will incorporate the mitigation and monitoring measures and reporting requirements described in Sections 2.3.8 and 2.3.9 into the IHA. Accordingly, this Preferred Alternative (Issuance of an IHA with Mitigation) would satisfy the purpose and need of the action—issuance of an IHA, with mitigation measures and monitoring, that would enable the agency and the WSDOT to comply with the statutory and regulatory requirements of the MMPA and ESA.

2.3.1 Construction of Work Trestles and Falsework Towers

Separate work trestles would be constructed for the new bridge construction and existing bridge removal processes. The south trestles for access to the new bridge site would be constructed prior to the installation of the north trestles for bridge removal. The work trestles and associated falsework towers would be supported on steel pilings with diameters of 0.61 to 0.91 m (24 to 36 in). The construction of the work trestles is estimated to take up to 9 months. The work trestles and falsework towers would be in place throughout the project duration, approximately 3 years.

All piles would be installed using a vibratory hammer unless an impact hammer is needed to drive a pile through consolidated material or meet bearing. Currently, pile driving is scheduled to occur July 1 to August 20, 2010, and October 6, 2010, to January 31, 2011, with an estimated 45 minutes (min) per pile and 410 total hours (hrs) of pile driving using a vibratory hammer. Pile driving activities would occur daily two hours after sunrise to two hours before sunset between April 1 and September 15, 2010. No pile driving will occur during nighttime hours.

2.3.2 Barge Anchoring and Usage

Barges would be used extensively throughout the project duration to provide access to work areas, support machinery, deliver and stage materials, and as a collection surface for spoils, construction debris, and materials from demolition. The actual number and dimensions of barges to be used would be determined by the contractor and work site conditions. However, it is estimated that up to 6 barges would be used at one time. A typical barge dimension is approximately 88.4 m (290 ft) in length and 15.2 m (50 ft) in width. Typical barge draft is 1.22 to 2.44 m (4 to 8 ft) and typical freeboard is 0.91 to 1.83 m (3 to 6 ft). Barges would be used throughout the construction period, approximately 3 years.

During working hours, barges would be attached to mooring lines, the work trestles, or to other portions of the project area, depending on the construction and access needs. Up to 6 temporary buoys may be installed to moor barges during non-working hours. These buoys would be attached to one or more anchors, which may need to be driven, or excavated, due to hard ground and strong currents in the project area. If the contractor chooses to deploy a dynamic barge positioning system, it is expected that the hours the system is in use would coincide closely with pile driving activities.

2.3.3 Construction of New Piers

Eight piers would support the new bridge, six in-water and two upland. The existing bridge has 13 piers, nine in-water and three upland. The total footprint of the piers would be 1,416 ft^2 (131.6 m^2). The footprint of the nine in-water piers supporting the existing bridge is 8,726 ft^2 (810.7 m^2). The construction of the abutment piers would occur during the bridge closure period (targeted duration of 3 months). The construction of each would include excavation of up to 3 shafts to support each pier, concrete pouring of each shaft, and construction of piers on top of new shafts. Shaft casings would be installed and the shafts will be excavated using equipment positioned on the work trestles or barges.

To create a drilled shaft, a steel casing approximately 1.8 to 3 m (6 to 10 ft) in diameter is driven into the substrate using a vibratory hammer, and the material inside the casing is excavated using an auger or a clamshell dredge. During the drilling, polymer slurry is typically placed into the hole to keep side walls of the shaft from caving.

After completion of the excavation, a steel reinforcing cage is placed into the hole to specified elevations. Concrete is then pumped into the hole using a tremie tube placed at the bottom of the excavation. As concrete is placed the tremie tube is raised but is maintained within the concrete. As the concrete is pumped into the hole, the slurry is displaced upward and removed from the top concrete using a vacuum hose.

After shafts are completed, pre-cast concrete, stay-in-place forms would be stacked on top of the shafts up to the crossbeam elevation. A steel reinforcing cage would be placed inside the concrete forms and the columns would be filled with concrete. A pre-cast concrete crossbeam or a cast-in-place crossbeam, or some combination of both would be constructed on top of the columns. Girders would be fabricated off site and would be shipped to the site on barges. The girders would then be placed on the piers and falsework towers between piers.

2.3.4 Installation of Girders and Decking

Girders and decking would be installed using the work trestles, falsework towers, and cranes deployed on work barges. The roadway deck would be made of concrete and would be poured in place. This work is expected to take 3 to 4 months. Noises from this session of work are similar to those mentioned above.

2.3.5 Reconfiguration of Abutments and Roadway Approaches

The existing bridge abutments would be removed, along with the associated retaining walls. New retaining walls and abutments would be constructed. These activities, and associated construction access would require the temporary disturbance of 0.75 acre of land, of which 0.15 acre are vegetated and permanent removal of 0.15 acre of vegetation. This work, all in upland areas, includes 2000 cubic yards of fill. Once the abutments are complete, the new bridge approach roadways will be constructed. Disturbed areas on the east shore of the Port Washington Narrows would be restored with a mix of native trees and shrubs including marine riparian vegetation and shoreline enhancement.

2.3.6 DEMOLITION OF EXISTING BRIDGE

The demolition of the existing bridge would occur in phases over a period of 18 months. After the central portion of the new bridge is constructed, the outermost spans and abutments of the existing bridge would be demolished. Once the new abutments and outer spans are constructed, the demolition of the remainder of the existing bridge will proceed.

The bridge structure above the water line would be cut into manageable sections, using conventional concrete and metal cutting tools, or a wire saw, and placed on barges for transport to approved waste or recycling sites. The portions of the piers below the water line would be cut into pieces using a wire saw. All slurry from wire cutting operations above the water line would be contained and removed. All slurry from wire cutting operations below the water line would be dispersed by the current. Piers would be cut off at the ground level except for one, Pier 4. Pier 4 was built up to encapsulate original creosote treated timbers. Complete removal of the pier is not feasible and if it is cut at the ground level, many creosote treated timbers may be exposed. To minimize the risk of contamination, Pier 4 would be cut two feet above ground level.

2.3.7 REMOVAL OF FALSEWORK TOWERS AND WORK TRESTLES

Once the demolition of the existing bridge is complete, the falsework towers and work trestles would be removed. Decking and girders would be placed on barges for transportation off-site. Piles would be removed using vibratory hammers, based on barges. The removal of the falsework towers and work trestles is expected to occur over 4 to 6 months.

Vibratory extraction is a common method for removing steel piling. The pile is unseated from the sediments by engaging the hammer and slowly lifting up on the hammer with the aid of the crane. Once unseated, the crane would continue to raise the hammer and pull the pile from the sediment. When the pile is released from the sediment, the vibratory hammer is disengaged and the pile is pulled from the water and placed on a barge for transfer upland.

2.3.8 MITIGATION MEASURES

As required under the MMPA, NMFS considered mitigation to effect the least practicable adverse impact on marine mammals and has developed a series of mitigation measures, as well as monitoring and reporting procedures (Section 2.3.9) that would be required under the IHA.

The following measures are designed to eliminate the potential for injury or mortality and to minimize Level B behavioral harassment to marine mammals found in the vicinity of the proposed project area. These measures would be required under Alternative 2 (Preferred Alternative).

In the case that NMFS should deem other mitigation measures necessary for future construction and demolition activities, NMFS would consider these and implement them after consultation and agreement with the NMFS NWRO and the WSDOT. The additional mitigation measures would appear in future IHAs for the WSDOT.

2.3.8.1 EQUIPMENT NOISE STANDARDS

To mitigate noise levels and, therefore, impacts to marine mammals, all the construction equipment would comply with applicable equipment noise standards of the U.S.

Environmental Protection Agency, and all construction equipment will have noise control devices no less effective than those provided on the original equipment.

2.3.8.2 Timing Windows

Timing restrictions are used to avoid construction activities that generate relatively intense underwater noises (i.e., pile driving, dredging, and dynamic positioning) when ESA-listed species are most likely to be present. If an ESA-listed marine mammal species is detected in the vicinity of the project area, pile driving and dredging operations will be halted and stationing construction vessels will turn off dynamic positioning systems. WSDOT states that it will comply with all in-water timing restrictions as determined through the MMPA take authorization. Pile driving activities would only be conducted during daylight hours. If the safety zone (see below) is obscured by fog or poor lighting conditions, impact pile driving will not be initiated until the entire safety zone is visible. In addition, no in-water work would be conducted between March 1 and June 14 in water below the ordinary high water line.

2.3.8.3 Establishment of Zones of Safety and Influence

For impact pile driving, the safety zones are defined as the areas where received sound pressure levels (SPLs) from noise source exceed 180 dB re 1 μPa (rms) for cetaceans (whales and dolphins) or 190 dB re 1 μPa (rms) for pinnipeds (seals and sea lions). The radii of the safety zones would be determined through empirical measurements of acoustic data. Prior to acquiring acoustic data, the safety zones shall be established based on the worst-case scenario measured from impact pile driving of 0.91 m (36-in) steel pile conducted elsewhere, such as the Anacortes or Mukiteo ferry terminals. Acoustic measurements indicate that source levels are approximately 201 dB re 1 μPa (rms) at 10 m for both pile driving activities for Anacortes and Mukiteo ferry terminal constructions when the 0.91 m (36-in) piles were hammered in (Laughlin 2007; Sexton 2007). Approximation of the received levels of 180 and 190 dB re 1 μPa (rms) by using an acoustic propagation spreading model between spherical and cylindrical propagation,

$$TL = 15\log\left(\frac{RRL}{RSL}\right),$$

where TL is the transmission loss (in dB), RRL is the range of received levels (either 180 or 190 dB), and RSL is the range (10 m) of source level (201 dB). The results show that the distances for received levels 180 and 190 dB re 1 μPa (rms) are approximately 251 m and 54 m, respectively. NMFS expects that the modeled safety zones are reasonably conservative as the propagation model does not take into consideration other transmission loss factors such as sound absorption in the water column.

Once impact pile driving begins, NMFS requires that the contractor adjust the size of the safety zones based on actual measurements of SPLs at various distances to determine the most conservative (the largest) safety zones at which the received levels are 180 and 190 dB re 1 μPa (rms).

Since the source levels for vibratory pile driving are expected to be under 180 dB re 1 μPa (rms) at 10 m, no safety zones would be established for vibratory pile driving.

In addition, WSDOT and its contractor shall establish zones of influence (ZOIs) at received levels of 160 and 120 dB re 1 μPa (rms) for impulse noise (noise from impact pile driving) and non-impulse noise (such as noise from vibratory pile driving and dynamic positioning system), respectively. These SPLs are expected to cause Level B behavioral harassment to marine mammals. The model based approximation for the distance at 160 dB received level is 5,412 m from pile driving based on the most conservative measurements from the Anacortes or Mukiteo ferry terminal construction (201 dB re 1 μPa (rms) at 10 m; Laughlin 2007; Sexton 2007), using the same spreading model discussed above. Once impact pile driving starts, the contractor shall conduct empirical acoustic measurements to determine the most conservative distance (the largest distance from the pile) where the received levels begin to fall below 160 dB re 1 μPa (rms).

As far as non-pulse noises are concerned, for which the Level B behavioral harassment is set at a received level of 120 dB re 1 μPa, no simple modeling is available to approximate the distance (though direct calculation using the spreading model puts the 120 dB received level at 100 km, this simple approximation no longer works at this long distance due to range-dependent propagation involving complex sound propagation behavior that cannot be ignored). NMFS uses the empirical underwater acoustic measurements from vibratory pile driving of 1.06 – 1.22 m (42 – 48-in) diameter piles at the San Francisco-Oakland Bay Bridge construction as a model and expects that the distance at a received level of 120 dB is less than 1,900 m from the pile (CALTRANS 2009). Likewise, WSDOT and its contractor shall conduct empirical acoustic measurements to determine the actual distance of 120 dB re 1 μPa (rms) from the pile.

All safety and influence zones shall be monitored for marine mammals prior to and during construction activities. Please refer to Section 2.3.9 for details on monitoring measures.

2.3.8.4 Shutdown Measures

No impact pile driving shall be initiated when marine mammals are detected within these safety zones (as defined in Section 2.3.8.3). In addition, during impact driving, when a marine mammal is detected within the respective safety zones or is about to enter the safety zones, impact pile driving shall be halted and shall not be resumed until the animal is seen to leave the safety zone on its own, or 30 minutes has elapsed until the animal is last seen.

WSDOT also agrees that pile driving and dredging activities would be suspended when ESA-listed marine mammals (Steller sea lion and killer whale) are detected within the zones of influence for behavioral harassment (160 dB re 1 μPa for impulse sources and 120 dB re 1 μPa for non-impulse sources) and that all vessels' dynamic positioning systems would be turned off.

Therefore, no take of ESA-listed marine mammal species or stocks is expected.

2.3.8.5 Sound Attenuation Measures

Specific to pile driving, the following mitigation measures are proposed by WSDOT to reduce impacts to marine mammals to the greatest extent practicable.

All steel piles would be installed using a vibratory hammer until an impact hammer is needed for bearing or if a pile encounters consolidated material. If vibratory installation is not possible due to the substrate, an impact pile driver would be used. An air bubble curtain(s) will be employed during impact installation of all steel piles.

WSDOT will provide bubble curtain performance criteria to the contractor, which include:

- Piling shall be completely engulfed in bubbles over the full depth of the water column at all times when an impact pile driver is in use.

- The lowest bubble ring shall be in contact with the mud line for the full circumference of the ring. The weights attached to the bottom ring shall ensure complete mud line contact. No parts of the ring or other objects shall prevent the full mud line contact.

- Bubblers shall be constructed of minimum 5.1-cm (2-in) inside diameter aluminum pipe with 0.16-cm (1/16-in) diameter bubble release holes in four rows with 1.9-cm (3/4-in) spacing in the radial and axial directions. Bubblers shall be durable enough to withstand repeated deployment during pile driving and shall be constructed to facilitate underwater setup, knockdown, and reuse on the next pile.

- One or more compressors shall be provided to supply air in sufficient volume and pressure to self-purge water from the bubblers and maintain the required bubble flux for the duration of pile driving. Compressors shall be of a type that prevents the introduction of oil or fine oil mist by the compressed air into the water. If there is presence of oil film or sheen on the water surface in the vicinity of the operating bubbler, the contractor shall immediately stop work until the source of oil film or sheen is identified and corrected.

- The system shall provide a bubble flux of 3.0 cubic meters (m^3) per minute per linear meter of pipe in each layer (32.91 ft^3, or 0.93 m^3, per minute per linear foot of pipe in each layer). The total volume of air per layer is the product of the bubble flux and the circumference of the ring:

$$V_t = 3.0\,\mathrm{m}^3/\mathrm{min}/\mathrm{m} \times \text{Circum of the aeration ring in meters.}$$

or

$$V_t = 32.91\,\mathrm{ft}^3/\mathrm{min}/\mathrm{ft} \times \text{Circum of the aeration ring in meters.}$$

- The bubble ring manifold shall incorporate a shut off valve, flow meter, and a throttling globe valve with a pressure gauge for each bubble ring supply.

- Prior to first use of the bubble curtain during pile driving, the fully-assembled system shall be test-operated to demonstrate proper function and to train personnel in the proper balancing of the air flow to the bubblers. The test shall also confirm the calculated pressures and flow rates at each manifold ring. The Contractor shall submit an inspection/performance report to WSDOT within 72 hours following the performance test.

2.3.8.6 "Soft Start" Impact Pile Driving or Ramp-up

Although marine mammals will be protected from Level A harassment by establishment of an air-bubble curtain during impact pile driving and marine mammal observers monitoring a safety zone, monitoring may not be 100 percent effective at all times in locating marine mammals. Therefore, WSDOT proposes to use a "soft-start" technique at the beginning of each day’s in-water pile driving activities or if pile driving has ceased for more than one hour to allow any marine mammal that may be in the immediate area to leave before pile driving reaches full energy.

For vibratory pile driving, the soft start requires contractors to initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a one minute waiting period. The procedure will be repeated two additional times. If an impact hammer is used on a pile greater than 10 inches in diameter, contractors will be required to provide an initial set of three strikes from the impact hammer at 40 percent energy, followed by a one minute waiting period, then two subsequent 3-strike sets. This soft start would alert any animals close to the activity and allow them time to move away, which should expose fewer animals to loud sounds, including both underwater and above water noise. This would also ensure that, although not expected, any pinnipeds and cetaceans that are missed during safety zone monitoring would move away from the activity and would not be injured.

2.3.9 MONITORING AND REPORTING

Under the Preferred Alternative (Alternative 2), NMFS would require the WSDOT to undertake the following monitoring activities for the Manette Bridge replacement project in Bremerton, Washington. The reporting requirements described in Section 2.3.9.3 would also be implemented under Alternative 2.

2.3.9.1 MARINE MAMMAL OBSERVERS

WSDOT proposes that a minimum of two qualified and NMFS-approved marine mammal observers (MMOs) would be present on site at all times during steel pile driving. In order to be considered qualified, WSDOT lists the following requirements for prospective MMOs:

- Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water’s surface with ability to estimate target size and distance. MMOs shall use binoculars to correctly identify the target.
- Advanced education in biological science, wildlife management, mammalogy or related fields (Bachelors degree or higher is preferred).
- Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience).
- Experience or training in the field identification of marine mammals (cetaceans and pinnipeds), including the identification of behaviors.
- Sufficient training, orientation or experience with the construction operation to provide for personal safety during observations.
- Writing skills sufficient to prepare a report of observations.
- Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

2.3.9.2 MARINE MAMMAL MONITORING

NMFS requires that WSDOT develop a monitoring plan that will collect sighting data for each distinct marine mammal species observed during the proposed Manette Bridge replacement construction activities that generate intense underwater noise. These activities include, but are not limited to, impact and vibratory pile driving, use of dynamic positioning system by construction and supporting vessels, and sediment dredging. Marine mammal behavior, overall numbers of individuals observed, frequency of observation, and the time corresponding to the daily tidal cycle will also be included.

In addition, for impact pile driving, WSDOT proposes the following Marine Mammal Monitoring Plan and shut down procedures:

- At least two MMOs will be on site to monitor the safety and influence zones by using a range finder or hand held global positioning system (GPS) device. The zone will be monitored by driving a boat along and within the radius while visually scanning the area, and or monitoring from shore if there is a vantage point that will allow full observation of the zone.
- If the safety zone is obscured by fog or poor lighting conditions, pile driving will not be initiated until the entire safety zone is visible.
- The safety zone will be monitored for the presence of marine mammals for 30 minutes prior to impact pile driving, during pile driving, and 20 minutes after pile driving activities.
- No impact pile driving will be started if a marine mammal is detected within the respective safety zones. Pile driving may begin if a marine mammal is seen leaving the safety zone, or 30 minutes has elapsed since the marine mammal is last seen inside the safety zone.
- If marine mammals are observed, their location in relation to the safety and influence zones, and their reaction (if any) to pile driving activities will be documented.
- Monitoring of the safety zone will continue for 20 minutes following the completion of pile driving.

2.3.9.3 Reporting Requirements

WSDOT shall submit weekly marine mammal monitoring reports from the time when in-water construction activities are commenced to NMFS Office of Protected Resources (OPR). These weekly reports would include a summary of the previous week’s monitoring activities and an estimate of the number of marine mammals that may have been disturbed as a result of in-water construction activities.

In addition, if an IHA is issued to WSDOT for the incidental take of marine mammals from the proposed Manette Bridge replacement project, WSDOT shall provide NMFS OPR with a draft final report within 90 days after the expiration of the IHA. This report should detail the monitoring protocol, summarize the data recorded during monitoring, and estimate the number of marine mammals that may have been harassed due to the construction activities. If no comments are received from NMFS OPR within 30 days, the draft final report will be considered the final report. If comments are received, a final report must be submitted within 30 days after receipt of comments.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

NMFS considered an alternative where NMFS issues an IHA without the mitigation measures described in Alternative 2–Issuance of an IHA with Mitigation (the Preferred Alternative). However, this alternative failed to meet the statutory and regulatory requirements of the MMPA for an IHA (e.g., negligible impact, effecting the least practicable adverse impact, and monitoring and reporting of such takings). Accordingly, NMFS did not consider this alternative further.

NMFS also considered an alternative where NMFS issues an IHA described in Alternative 2–Issuance of an IHA with Mitigation (the Preferred Alternative) with the requirement that the WSDOT use only vibratory pile driving so to reduce the source levels. However, this alternative may not be feasible, as some of the piles need to be impact driven due to the bottom substrate. Nevertheless, the WSDOT stated that all piles will be installed using a vibratory hammer unless an impact hammer is needed to drive a pile through consolidated material or meet bearing.

3 CHAPTER 3 AFFECTED ENVIRONMENT

This chapter presents baseline information necessary for consideration of the alternatives, and describes the resources that would be affected by the alternatives, as well as environmental components that would affect the alternatives if they were to be implemented. The effects of the alternatives on the environment are discussed in Chapter 4.

3.1 PHYSICAL ENVIRONMENT

3.1.1 GEOLOGY AND HYDROLOGY

The location of the proposed action area is around the Port Washington Narrows in Bremerton, Washington (47°34′12″N 122°39′9″W, Figure 1), which is an approximately 4.8-km (3-mi) long tidal channel connecting Sinclair Inlet with Dyes Inlet. Sinclair Inlet is located in central Puget Sound and is a relatively shallow and flat bottomed 5.6-km (3.5-mi) long estuary on the eastern Kitsap Peninsula. Mixed semi-diurnal tides typical of the Puget Sound area and winds are the primary drivers of current circulation in Sinclair Inlet. Tidal currents in Sinclair Inlet are generally weak, having a maximum velocity of 0.2 to 0.3 knots. The relatively weak tidal exchange promotes a predominantly depositional environment characterized by mud and muddy sand substrate, which accumulates at a rate of 0.5 to 2 cm per year (URS Greiner 1999). Sinclair Inlet has a generally flat bottomed bathymetry, with depths averaging 9 to 12 m (30 to 40 ft) at mean lower low water (MLLW), including the portion of the inlet within the action area.

The Port Washington Narrows is different in character from Sinclair Inlet. The portion of the Port Washington Narrows within the action area is approximately 350 and 370 m (1,150 and 1,200 ft) wide at MLLW, with typical mid-channel depths ranging to 12 m (40 ft) at MLLW. The Port Washington Narrows' constricted width accelerates tidal currents to as high as 2.2 knots within the project footprint and even higher at the limits of the action area (NOAA 2008). High tidal current velocities efficiently transport fine sediments. As a consequence, the bed of the Port Washington Narrows is characterized by coarser sand, gravel, and cobble sized substrates and clear bathymetric indications of sediment transport (Shannon and Wilson 2007).

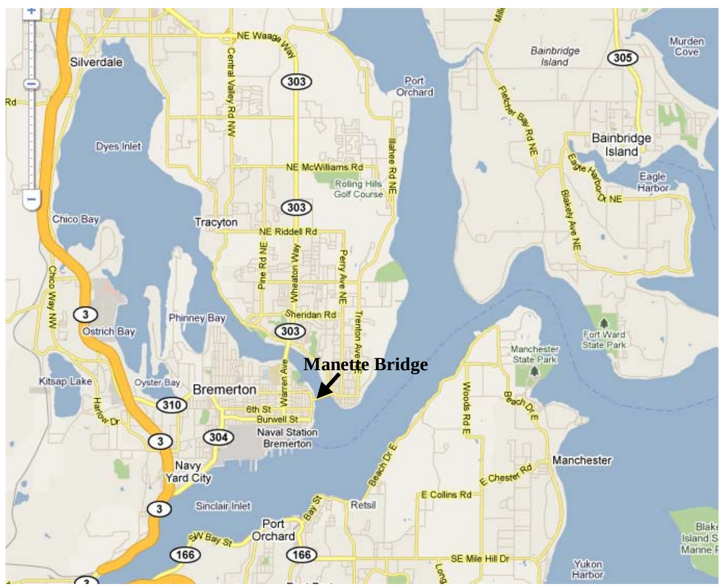

Figure 1. Location of the proposed action area.

Much of the shoreline of Sinclair Inlet and portions of the Port Washington Narrows has been armored with quay-wall and riprap. Shoreline armoring is typically steep, creating an abrupt vertical transition from uplands to the beach, in many cases down to approximately MLLW.

Shoreline armoring efficiently reflects wave energy, promoting offshore transport of sand and gravel sized substrates that form intertidal beaches while preventing recruitment of new substrates from bluff erosion. Over time, this tends to create an abrupt vertical transition between uplands and the subtidal environment, replacing gradually sloped beaches with flat bottomed subtidal environments characterized by cobble and boulder sized substrates (Finlayson 2006). Shoreline armoring has extensively modified or even eliminated shallow intertidal zoneation in many areas throughout Puget Sound (Finlayson 2006). It is effectively continuous around the majority of Sinclair Inlet, and extensive but discontinuous within the Port Washington Narrows.

Sinclair Inlet and the Port Washington Narrows are defined as a Class “A” waters according to the Washington Department State of Ecology (WDOE) Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A) (FHWA 2008). However, these water bodies have been and continue to be affected by many point and non-point pollution sources including wastewater treatment plant effluent, septic tank drain fields, stormwater runoff, combined sewer overflows, and fuel spills (URS Greiner 1999). Industrial activities conducted at the Puget Sound Naval Shipyard and other facilities in Sinclair inlet have contributed to contamination of benthic sediments with a mixture of toxic materials, including high molecular weight polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), other organic contaminants, and metals (URS Greiner 1999). Sinclair Inlet was listed on the 1998 303(d) list for impaired water bodies. A total maximum daily load allowance (TMDL) for fecal coliform is currently in development for Dyes Inlet, Sinclair Inlet, and the Port Washington Narrows (KCHD 2008). Ambient total suspended solid (TSS) in the Port Washington Narrows varies seasonally within narrow limits. Monitoring conducted at selected locations just north of the proposed bridge location found relatively low TSS levels in winter months (e.g., 1.47 to 1.62 mg/L in March) and higher levels during summer months (e.g., as high as 2.55 mg/L in July to 2.36 mg/L in September) (WDOE 2009). Higher TSS levels during summer months are consistent with seasonal highs in primary productivity.

May and Peterson (2003) classified the streams and marine shorelines of Kitsap County according to their value to salmonids as “refugia.” The authors defined refugia as “habitats or environmental factors that provide spatial and temporal resistance and/or resilience to aquatic communities impacted by natural and anthropogenic disturbances.” Areas that qualify as refugia typically have habitat features such as intact streamside forests, undeveloped floodplains, wetlands, and natural shorelines. Refugia are used intensively by salmon compared to non-refugia areas and are therefore considered biological “hot-spots.” Sinclair Inlet, Dyes Inlet, and connecting waters were classified as category “D” refugia, or a “potential refugia with altered ecological integrity.” Despite the fact that these habitats are functioning below historic levels of productivity, they still provide important habitat functions for juvenile salmon and have potential for restoration (May and Peterson 2003).

3.1.2 ACOUSTIC ENVIRONMENT

3.1.2.1 AMBIENT SOUND

The need to understand the marine acoustic environment is critical when assessing the effects of anthropogenic noise on marine wildlife. Sounds generated by coastal construction such as pile driving and dredging within the marine environment can affect its inhabitants’ behavior (e.g., deflection from loud sounds) or ability to effectively live in the marine environment (e.g., masking of sounds that could otherwise be heard). Understanding of the existing environment is necessary to evaluate what the potential effects of oil and gas exploration and development may be.

Ambient sound levels are the result of numerous natural and anthropogenic sounds that can propagate over large distances and vary greatly on a seasonal and spatial scale. These ambient sounds occupy all frequencies and contributions in ocean soundscape from a few hundred Hz to 200 kHz (NRC 2003). In typical urban coastal waters such as the one at the proposed action area, the main sources of underwater ambient sound would be associated with:

- Wind and wave action
- Precipitation
- Vessel and industrial activities
- Biological sounds (fish, snapping shrimp)

The contribution of these sources to the background sound levels differs with their spectral components and local propagation characteristics (e.g., water depth, temperature, salinity, and ocean bottom conditions). In deep water, low-frequency ambient sound from 1–10 Hz mainly comprises turbulent pressure fluctuations from surface waves and the motion of water at the air-water interfaces. At these infrasonic frequencies, sound levels depend only slightly on wind speed. Between 20–300 Hz, distant anthropogenic sound (ship transiting, etc.) dominates wind-related sounds. Above 300 Hz, the ambient sound level depends on weather conditions, with wind- and wave-related effects mostly dominating sounds. Biological sounds arise from a variety of sources (e.g., marine mammals, fish, and shellfish) and range from approximately 12 Hz to over 100 kHz. The relative strength of biological sounds varies greatly; depending on the situation, biological sound can be nearly absent to dominant over narrow or even broad frequency ranges (Richardson *et al.* 1995).

There are no area specific measurements on ambient sound levels at the proposed action area. However, the ambient noise is expected to be high due its proximity to downtown Bremerton, especially in the Port Washington Narrows where the Manette Bridge crosses.

3.1.2.2 Underwater Acoustic Propagation

Underwater acoustic propagation has several mechanisms for loss in the amplitude of the signal. First, the water itself acts as an absorber of the acoustic wave. As the frequency of the wave increases the absorption also increases, resulting in high frequency sound not propagating as far as low frequency sound. Second, since the sound source is limited to a very small point in space relative to the large volume of the underwater environment, the sound that emanates from the source spreads out as it travels underwater. Even if there was no absorption by the water, the spherical spreading of the sound decreases the sound amplitude by a factor of the radius squared. This drastically reduces the received levels of the acoustic pulses at any significant distances from the sound source. Finally, the underwater environment of the ocean itself is not a simple environment. Stratification of the water leads to a phenomenon known as ray-bending, which means that the sound does not propagate on a straight path due to variations in sound velocity from the surface of the ocean to the bottom. The sound velocity also varies as a function of temperature, pressure, and composition of the water (e.g., salinity). Consequently, as the water depth increases, the velocity of the acoustic signal changes. Ray-bending often causes sound to bend towards the bottom, which further limits the propagation distance of the sound.

As sound propagates it interacts with both the ocean bottom and surface of the water. Consequently, the bottom composition and profile become important in determining how far sound will propagate. If the bottom is smooth, sound can reflect off the bottom and continue to propagate beyond the immediate area of the source. However, when the bottom or surface is rough, then the reflected sound will be scattered over a range of angles, increasing the loss of sound and decreasing the distance it is propagated. One consequence of this is that it is rare for sound to propagate around points of land or past islands. If the bottom is muddy, then instead of sound reflecting off of it, it is absorbed into the mud and consequently these surfaces do not typically produce echoes.

The proposed action area at the Port Washington Narrows is a shallow inland water area within the Kitsap Peninsular. Its average depth is about 12 m (40 ft) in mid-channel at MLLW. It is effectively bounded by Manette Peninsular to the north and east, downtown Bremerton to the west, and Port Orchard across Sinclair Inlet to the south (Figure 1). The only water channels from the Port Washington Narrows Site to the greater Puget Sound region involve narrow passages of water via Sinclair Inlet. Consequently, there is no direct path for sound to get from the action area to anywhere else in Puget Sound. However, the bottom type of the Port Washington Narrows, which is characterized by coarser sand, gravel, and cobble sized substrates and the steep, armored shoreline, may provide some reflectivity for acoustic energy, thus causing multipath propagation within this effectively enclosed body of water.

3.1.3 MANETTE BRIDGE

The Manette Bridge is a steel truss bridge that spans the Port Washington Narrows in Bremerton, Washington. It connects the community of Manette, Washington to downtown Bremerton. The bridge is 25 m (82 ft) above the water, and has a horizontal clearance of 98 m (321 ft) between the piers.

The Manette Bridge was originally built in 1930. The bridge was constructed with five steel truss main spans on six concrete piers, elements which are still part of today's bridge. A 1949 contract replaced the original wooden deck and timber trusses in the outer spans with concrete and steel. The primary areas of structural deficiencies are in the concrete piers and the structural steel trusses, which are nearing 80 years old. The concrete in the foundations is in varying states of deterioration. Testing and analysis of concrete taken from the main piers from 1976 thru 2003 determined that deterioration in the concrete has resulted from a process called Alkali Silica Reaction (ASR).

ASR causes deterioration of mortars and concretes due to the swelling of gel formed by the reaction of alkali in cement-based materials with reactive silica in aggregates in the presence of water. The swelling of the gel generates tensile stresses in the specimen resulting in expansion and cracks. There is no known way to mitigate and fully address the ASR problem in the concrete foundations of the six piers supporting the steel truss spans.

In 1993, the WSDOT Bridge Engineer identified that the bridge superstructure (trusses and deck) could be rehabilitated to provide 20 or more years of additional service life. The cost to totally rehabilitate this bridge by: encasing and repairing all the concrete main piers; replacing corroded steel including rivets and connections; repainting the entire bridge and replacing the bridge deck could exceed 50-75% of the replacement costs. However, there are no practical means to restore or prevent further deterioration in the column and footing concrete. The condition of the reinforcing steel in the highly fractured substructure concrete is an added unknown. As a result of this assessment, it was determined that replacement of the bridge is warranted and necessary. The Legislature and the Governor have provided approximately $65 million for the replacement of the Manette Bridge over the next 8 years with construction of the new bridge scheduled to begin in 2010.

3.1.4 ESSENTIAL FISH HABITAT

The action area is located within the estuarine Essential Fish Habitat (EFH) composite, which includes EFH for three species of Pacific salmon (PFMC 2000), 17 species of west coast groundfishes (PFMC 2005), and four coastal pelagic species (PFMC 1998).

3.1.5 DESIGNATED CRITICAL HABITAT

Marine components of designated critical habitat for Puget Sound Chinook salmon occur within the action area. NMFS designated critical habitat for Puget Sound Chinook salmon on September 2, 2005 (70 FR 52630). NMFS has identified Primary Constituent Elements (PCEs) as the physical and biological features essential to the conservation of Puget Sound Chinook salmon. The Critical Habitat Analytical Review Team (CHART) concluded that all of the areas occupied by this species contained at least one of the PCEs necessary for the conservation of this Evolutionarily Significant Unit (ESU; NMFS, 2005b). The critical habitat PCEs are:

- PCE 1 - Freshwater spawning sites with water quantity and quality conditions and substrate that support spawning, incubation, and larval development;

- PCE 2 - Freshwater rearing sites with (1) water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility, (2) water quality and forage that support juvenile development, and (3) natural cover such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;

- PCE 3 - Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks that support juvenile and adult mobility and survival;

- PCE 4 - Estuarine areas free of obstruction and excessive predation with (1) water quality, water quantity, and salinity conditions that support juvenile and adult physiological transitions between fresh water and salt water, (2) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and (3) juvenile and adult foraging opportunities, including aquatic invertebrates and prey fish, supporting growth and maturation;

- PCE 5 - Nearshore marine areas free of obstruction and excessive predation with (1) water quality and quantity conditions and foraging opportunities, including aquatic invertebrates and fishes, supporting growth and maturation, and (2) natural cover including submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels;

- PCE 6 - Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

The CHART evaluated the existing habitat conditions and determined a conservation priority for all critical habitat PCEs within each Fifth Field Hydrologic Unit in the ESU (NMFS 2005b). Critical habitat for Puget Sound Chinook salmon has 61 freshwater and 19 marine areas. To determine the conservation value of each watershed to ESU viability, the CHART evaluated the quantity and quality of habitat features (for example, spawning gravels, wood and water condition, side channels), the relationship of the area compared to other areas within the ESU, and the significance to the ESU of the population occupying that area. Thus, even a location that has poor quality of habitat could be ranked at high conservation value if that location was essential due to factors such as limited availability (e.g., one of a very few spawning areas), the unique contribution of the population it served (e.g., a population at the extreme end of geographic distribution), or other important role (e.g., obligate area for migration to upstream spawning areas).

Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and 8 received a medium rating. Freshwater PCEs in many streams and rivers throughout designated critical habitat have been degraded by channel simplification, removal of riparian vegetation, stormwater and other sources of pollutants, in many cases limiting productivity of salmonids. Of the marine areas, all 19 are ranked with high conservation value.

Only PCE 5, nearshore marine areas, occurs within the action area, therefore the current condition of this PCE is most relevant to this consultation. Marine critical habitat PCEs throughout Puget Sound has been degraded by shoreline development, hydromodification of rivers and estuaries (leading to changes in the routing and delivery of sediments and organic materials), point source and non-point source pollution, and sediment contamination. Degradation of PCE 5 is implicated as an important contributing factor in the decline of the Puget Sound Chinook salmon ESU. Gradual and persistent degradation of habitat function and conservation value has occurred over many years as shoreline development expanded across the region. In particular, widespread shoreline armoring has significantly altered and fragmented many formerly productive shoreline habitats, reducing overall habitat suitability for juvenile Chinook salmon throughout much of Puget Sound. Many formerly productive intertidal beaches have been transformed from gradually sloping shallow water habitats with fine substrates, to seawalls fronting an abrupt transition to relatively deep water habitats. Shoreline armoring promotes offshore transport of fine grained material that forms gradually sloping beaches and restricts the recruitment of new materials from upland areas. In addition to the direct loss of suitable juvenile habitats this also degrades and often eliminates forage fish spawning habitat, reducing the forage base available for subadult and adult salmon. This form of degradation is pervasive and persistent (Downing 1983). The recovery of Puget Sound Chinook salmon will be dependent, in part, on the successful restoration or rehabilitation of the physical processes and ecological connectivity that form and maintain desirable nearshore habitats.

Land use activities contributing to the existing condition of PCE 5 in the action area and vicinity include shoreline development for commercial, industrial, military, and residential uses, and shoreline armoring to protect properties, buildings, and transportation infrastructure. Water quality and sediment within the ESU is degraded due to effects associated with urbanization and military and industrial activity (NMFS 2005b).

3.2 Biological Environment

3.2.1 Marine Flora

Marine flora consist of floating algae (phytoplankton) and attached plants which include both algae and vascular plants such as eelgrass. As described by Gustafson *et al.* (2000), phytoplankton productivity in the open waters of the central basin of Puget Sound is dominated by intense blooms of microalgae beginning in late April or May and recurring through the summer. Annual primary productivity in the central basin of the Sound is about 465 grams of carbon per square meter. This high productivity is due to intensive upward transport of nitrate by the estuarine mechanism and tidal mixing.

Substrates for attached plants in the action areas consists of riprap along the shorelines of Port Washington Narrows, Sinclair and Dyes Inlets as well as tide flats, marshes, and a shallow lagoon. The subtidal and intertidal habitat in and around the action area consists mostly of sand with a little mixed mud, clay, and wood substrates. The subtidal and intertidal areas of these waters are dominated by brown and green algae as well as eelgrass beds. Eelgrass grows in the muddy or sandy substrate of the shallow subtidal zone, down to a depth of approximately 7 m (22 ft), and forms a complex and highly productive ecosystem that is an important component of nearshore habitat in estuaries and bays throughout Puget Sound. Eelgrass meadows are biologically rich habitats, sheltering a diverse group of fish and invertebrate species that are dependent on eelgrass beds for food resources and cover (Phillips 1984). Gammarid amphipods are dependent on ingesting eelgrass particles for their growth and development and are preferred prey items of juvenile salmon. Epibenthic harpacticoid copepods are an important food resource for juvenile chum salmon and were reported to be four times more prevalent in a stand of eelgrass compared to a neighboring habitat without eelgrass (Simenstad and Kenney 1978). Pacific herring, another commercially important species, utilize eelgrass beds as a spawning substratum to deposit their eggs and as a nursery ground for young herring. Apart from Pacific herring and juvenile salmon, numerous other commercially and non-commercially important fish are associated with eelgrass meadows. In addition to supporting fish fishery resources, eelgrass beds also support many invertebrate fishery resources like clams, oysters, shrimps, crabs, etc.

3.2.2 MARINE INVERTEBRATES

3.2.2.1 PELAGIC INVERTEBRATES

Pelagic habitat comprises the water column and is defined by the depth to which light can penetrate, or the photic zone, allowing photosynthesis to occur with existing marine flora. Depth of this layer varies seasonally and locally, generally ranging to depths of 20 to 80 m (66 to 262 ft) (NOAA 1993). Light, temperature, and nutrients all determine the occurrence and succession of zooplankton species (Gustafson *et al.* 2000). Zooplankton exhibit daily vertical migration patterns and will go deeper than the photic zone. However, during the high phytoplankton production months of spring and summer, zooplankton tend to stay near their food source.

Zooplankton such as ciliates, copepods, euphausiids, and pelagic tunicates as well as larval stages of crabs, worms, mollusks, and barnacles occur in the pelagic habitat of the action area in and around the Port Washington Narrows and Sinclair and Dyes Inlets. The most dominant zooplankton species in Puget Sound are calanoid copepods as well as cnidarians and polychaetes that thrive throughout the year (Gustafson *et al.* 2000).

3.2.2.2 SUBTIDAL BENTHIC INVERTEBRATES

Subtidal benthic or bottom habitat is defined as depths not uncovered by the tides (i.e., below the level of the extreme-low-spring tide at a given location). The most abundant (in terms of biomass) bivalve in the subtidal benthic habitat is the Pacific geoduck. Geoducks occur in soft bottom habitat from the intertidal zone to the deep subtidal zone. In Puget Sound they have been found as deep as 110 m (360 ft). Although a highly productive and popular fishery, geoduck associated with eelgrass beds are not harvested out to a 1-m (2-ft) buffer zone around rooted eelgrass to protect the eelgrass beds (Bradbury *et al.* 2000).

Other marine invertebrate species utilizing the sand/mud habitat in and around the Port Washington Narrows action area and surrounding waters include cockles and horse mussel. Other bivalves found in the area include numerous species of hardshell clams such as piddocks, littleneck clam, butter clam, and horse clam (WDFW 2004). Dungeness crab occurs throughout Puget Sound, both intertidally and subtidally on a variety of substrates; juveniles and subadults are often associated with eelgrass (Fisher and Velasquez 2008).

3.2.2.3 INTERTIDAL BENTHIC INVERTEBRATES

In addition to their utilization of subtidal habitat, clams and cockles inhabit the intertidal areas within the vicinity of the action area. Other invertebrates found in the intertidal and subtidal areas include shrimp, tunicates, crab, barnacles, sun star, sea cucumber, and sea anemones. Clams and cockles as well as crab, oyster, sea anemones, and barnacles are most associated with a hard substrate bottom. Sea anemones and barnacles adhere to rocks and other hard structures found in the intertidal areas.

3.2.3 FISH SPECIES

3.2.3.1 NON-ESA-LISTED FISH SPECIES

3.2.3.1A Coastal Pelagic and Forage Fish Species

Pelagic fishes inhabit the open, upper portion of marine waters rather than waters adjacent to land or near the sea floor. Some pelagic fish rear in intertidal or freshwater environments for periods of time, but move into marine waters for two to five years until they are sexually mature. When ready to spawn, these fish move to waters closer to shore. Predominant pelagic fish species found in marine waters adjacent to Washington include: Pacific herring, Pacific sand lance, surf smelt, Pacific sardine, northern anchovy, and eulachon. These species are considered "forage fish" and are important prey for various fish, marine mammals, and seabirds and are also harvested in commercial, recreational, and Tribal usual and accustomed fisheries. Although technically anadromous, eulachon are discussed under the pelagic fish section because of their extensive pelagic life stage and their role as forage fish for other marine animals.

Pacific Herring Most Washington State herring stocks spawn in intertidal and shallow subtidal areas on hard bottom, algae, and other substrates from late January through early April, and hatching of larvae occurs 10 to 14 days later. The larvae become part of the pelagic community and drift with the ocean currents. Puget Sound herring stocks spend their first year in Puget Sound (Bargmann 1998). Some herring stocks spend their entire lives within Puget Sound ("resident stocks") while other stocks ("migratory stocks") summer in the coastal areas of Washington and southern British Columbia (Trumble 1983).

Herring stocks are defined by spawning grounds. At least 18 stocks spawn inside Puget Sound and one stock spawns on the Washington coast in central Willapa Bay. The Washington State Department of Fish and Wildlife's (WDFW's) ongoing annual assessment survey results (which indicate stock specific age structures and strong site specificity, spawn timing, and prespawner holding area characteristics) support the assumption of stock autonomy for Puget Sound herring. Therefore, conservation of herring spawning habitat and minimizing disturbance in the prespawning holding areas is key to the preservation of the herring stocks inside Puget Sound. Herring stock assessment data are very useful for localized habitat management and planning. The Pacific herring is of considerable interest in the Puget Sound region because of the species' value as forage for other fish, seabirds, and marine mammals; its popularity as recreational fishing bait; its significance to local commercial and Tribal usual and accustomed fisheries; and its importance as an indicator of the general "health and productivity" of Puget Sound (WDFW 1997).

Sand Lance The Pacific sand lance is widespread and can be found from California to Alaska and across the Bering Sea to Japan. Sand lance are found from the intertidal zone to approximately 200 m (656 ft) deep and feed in the upper water column during the day and bury in the sand substrate during the night (Hobson 1986). Puget Sound sand lance populations appear to be obligatory upper intertidal spawners, depositing their eggs in sand-gravel substrates between the mean high-tide line and about 2 m (5 ft) in tidal elevation (WDFW 1997). Spawning takes place annually from approximately the beginning of November through mid-February. Individual broods of eggs incubate in the beach substrate for about 1 month, after which time the larvae are a common component of the nearshore plankton in many parts of Puget Sound.

Several spawnings may occur at any given site during the November to February spawning season (Bargmann 1998). Sand lance spawning activity appears to be distributed throughout the shorelines of the Puget Sound basin.

Sand lance are an important part of the trophic link between zooplankton and larger predators in the local marine ecosystem. Like all forage fish, sand lance are a significant component in the diet of many economically important resources in Washington. On average, 35 percent of juvenile salmon diets are composed of sand lance. In particular, 60 percent of the diet of juvenile Chinook are composed of sand lance. Other economically important species, such as Pacific cod, Pacific hake, and dogfish feed heavily on juvenile and adult sand lance (WDFW 1997).

Sand lance populations are widespread within Puget Sound, the Strait of Juan de Fuca, and the coastal estuaries of Washington. They are most commonly noted in more localized areas, such as the eastern Strait and Admiralty Inlet. However, WDFW plankton surveys and ongoing spawning habitat surveys suggest that there are very few if any bays and inlets in the Puget Sound basin that do not support sand lance spawning activity. Sand lance are not regularly harvested for bait or human consumption in Washington and when harvested are commonly dip netted for salmon sport bait. The stock status of sand lance within Washington is unknown (WDFW 1997).

Surf Smelt Surf smelt occur from Southern California to central Alaska and have an entirely marine/estuarine life history. Surf smelt are very widespread in Washington, occurring in the outer coastal estuaries, the shores of the Olympic Peninsula, and the greater Puget Sound basin from Olympia to the U.S.-Canada border (Bargmann 1998).

Surf smelt within the Puget Sound basin are somewhat unusual in having an extended spawning season, with some areas receiving several months of spawning activity centered in either the summer months or a fall-winter period. Surf smelt deposit adhesive, semitransparent eggs on beaches, which have a specific mixture of coarse sand and pea gravel. Larvae emerge after approximately 11 to 16 days in the summer months and 27 to 56 days in the winter months. After emerging, they are planktonic for a period of time before settling in estuaries and nearshore waters for several months. Juvenile surf smelt rear in the nearshore waters throughout Puget Sound. Spawning maturity may be reached during their first year of life, although the majority reach spawning maturity during their second year. Surf smelt do not die after spawning and may spawn during successive seasons (WDFW 1997).

Surf smelt are harvested in commercial, recreational and Tribal usual and accustomed fisheries in Washington and are currently “passively managed” by the WDFW. Stock status of surf smelt within Washington is unknown (WDFW 1997).

3.2.3.1B Groundfish

Groundfish are marine fish species that live near or on the bottom of marine waters for most of their adult lives. These include groundfish species such as rockfish, flatfish (flounder, sole, halibut), roundfish (greenlings, ling cod, Pacific cod, sablefish, walleye pollock, Pacific hake), sharks, and skates. There are over 90 species of groundfish on the Pacific coast of the U.S. managed under the Pacific Coast Groundfish Fishery Management Plan (PFMC 2004), many of which support important commercial, recreational and Tribal usual and accustomed fisheries. There are at least 150 species of groundfish in Puget Sound (Palsson *et al.* 1998).

While the majority of groundfish on the west coast of Washington are harvested in the commercial trawl fishery, both recreational and Tribal usual and accustomed fisheries also harvest groundfish. Washington coastal treaty Indian tribes (Hoh, Makah, Quileute and the Quinault Indian Nation) hold formal allocations in their usual and accustomed fishing areas for sablefish, Pacific hake, and black rockfish.

A preliminary 2002 assessment of groundfish stocks has shown that over half of key groundfish stocks in South Puget Sound are at or below average abundance (Puget Sound Water Quality Action Team [PSWQAT] 2002). Some of the species that once dominated the catches of recreational and commercial fishers are now at depressed or critical abundances, resulting in historic low catches and reduced fisheries (Palsson *et al.* 1998). Additionally, eight species of West Coast groundfish have recently been declared overfished including widow rockfish, canary rockfish, yelloweye rockfish, darkblotched rockfish, bocaccio, Pacific ocean perch, lingcod, and cowcod.

Cod, Sablefish, and Lingcod Pacific cod are found in continental shelf and upper continental slope waters and are widely distributed in the coastal North Pacific, from the Bering Sea and Alaska south to Santa Monica, California in the east and the Sea of Japan in the west (Hart 1973; Department of Fisheries and Oceans Canada [DFOC] 2001).

Garrison and Miller (1982) reported that all Pacific cod life stages are found in various bays in Puget Sound and in the Strait of Juan de Fuca. Adults occur as deep as 875 m (2,871 ft), but the majority occurs from 50 to 300 m (164 to 984 ft). They are typically associated with mixed-coarse and mixed-fine sand substrata on the bottom of Puget Sound (Matthews 1987). Pacific cod migrate from shallow waters in spring and summer to deeper waters in fall and winter. Sexual maturity is reached by 2 to 3 years of age (DFOC 2001) and spawning occurs at depths of 40 to 265 m (131 to 869 ft) from late fall to early spring in Puget Sound (Garrison and Miller 1982). Eggs and larvae are found over the continental shelf between Washington and central California from winter through summer (Dunn and Matarese 1987; Palsson 1990). Small juveniles usually settle into intertidal and subtidal habitats, commonly associated with sand and eel grass, and gradually move into deeper water with increasing age (Miller *et al.* 1976; NOAA 1990).

The status of Pacific cod in Puget Sound is based primarily on recreational and commercial fishery statistics since 1970 and bottom trawl surveys that were conducted throughout Puget Sound in 1987, 1989, and 1991. A biological review identified several concerns: 1) the apparent loss of the major, known spawning locations in Puget Sound; 2) general synchronicity in declining trends in cod abundance from Puget Sound to Southeast Alaska; and 3) relatively little quantitative information or understanding about the effects of potential risk factors (Gustafson *et al.* 2000).

Sablefish inhabit shelf and slope waters to depths greater than 1,494 m (4,900 ft) from central Baja California to Japan and the Bering Sea. Spawning occurs from January to March along the continental shelf at depths greater than 1,000 m (3,281 ft). Larval sablefish are found in surface waters over the shelf and slope from April to May. Juveniles are commonly encountered in shallower waters, including Puget Sound (Hart 1973).

Lingcod are demersal fish that range from Baja California to Kodiak Island in the Gulf of Alaska (Hart 1973). In Puget Sound, adult lingcod live on and adjacent to rocky bottoms and reefs while juveniles are found on sandy bottom areas adjacent to rocky reefs (Matthews 1987). Spawning occurs between December and March with eggs laid in rocky crevices in shallow areas with strong water motion. After dispersing from their nests, larvae spend two months in pelagic habitat. In late spring-early summer, juveniles move to demersal habitats and settle in shallow-water vegetated habitats (Cass *et al.* 1990; West 1997). It is likely that juveniles use nearshore habitats for shelter and feeding.

Flatfish At least 13 species of flatfish occur in Washington waters and include the Pacific halibut, butter sole, rock sole, curlfin sole, Dover sole, flathead sole, English sole, petrale sole, sand sole, rex sole, starry flounder, and Pacific sanddab. Most flatfish are demersal species associated with shallow, soft-bottom (sand and mud) habitats in Puget Sound and Washington coast waters (Emmett *et al.* 1991). They spawn offshore between September and April (Kruse and Tyler 1983). Larvae are found in nearshore habitats between March and May. Juveniles are found throughout the year in gravel, sand-eelgrass, and mud-eelgrass habitats. English sole is the most numerous flatfish in Puget Sound.

Sharks and Skates Species of sharks and skates that are known to occur in Washington waters include the spiny dogfish, big skate, and longnose skate. The spiny dogfish occurs worldwide in temperate seas and on the Pacific Coast occurs from the Aleutian Islands to central Baja. It is frequently encountered over rocky reefs up to 900 m (2,953 ft) deep and is known to inhabit estuarine, coastal, and offshore waters. Tagging studies have indicated that they are capable of long migrations and have been documented to travel 7,000 km (4,350 mi) from British Columbia to Japan. The spiny dogfish is ovoviviparous (eggs or embryos develop inside the maternal body, but do not receive nutritive or other metabolic aids from the parent; offspring are released as miniature adults). They have a slow maturity rate (around 12 years) which makes them highly vulnerable to overfishing (Elasmodiver 2006).

The big skate is found in temperate waters of the eastern Pacific Ocean including the eastern Bering Sea and Aleutian Islands, west to Unalaska Island and south to Baja, California. It inhabits waters from the intertidal to depths of 120 m (394 ft) and can be found along the coast in estuaries, bays, and over the continental shelf (Florida Museum of Natural History 2006).

The longnose skate was once frequently encountered in British Columbia and Washington but are now uncommon from Alaska to Southern California. The longnose skate is generally found on gently sloping sand and mud bottoms at depths of 20 to 600 m (66 to 1,968 ft) and inhabits coastal areas, estuaries, bays, and continental shelves (Elasmodiver 2006).

Sharks and skates form part of the demersal and near-bottom fish communities in Puget Sound and are not classified as food fish. These species are often caught as bycatch in groundfish fisheries. Stock status of these species in Washington is unknown.

3.2.3.1C Non-ESA-Listed Salmonids

Non ESA-listed salmonid species that are known to inhabit streams flowing into Port Orchard Reach near the action area include chum and Coho salmon (WDFW 2004).

Chum salmon within the vicinity of the action area are considered to be part of the Dyes Inlet/Liberty Bay fall chum stock and are found in Big Scandia, Little Scandia, and Crouch creeks, as well as in an unnamed stream located north of the action area. Other stocks of chum might be present in the action area during their migrations to and from natal streams. The Dyes Inlet/Liberty Bay fall chum stock is considered to be healthy. Escapement estimates based on live spawner counts in Chico, Barker, Dogfish, Clear, Steele, and Scandia creeks have ranged from 5,266 in 1997 to 75,920 in 2003 (WDFW 2003).

Puget Sound fall-run chum enter their natal streams in October and November and spawn from November through January. Out-migrating juvenile fall-run chum are found in nearshore marine waters from January through the end of July. Adult Coho return from the marine environment from early August to the end of December, with spawning occurring from late October to late December. Juvenile Coho out-migration to estuarine areas occurs from mid-February through September, with a few individuals remaining as late as November (Williams *et al.* 1975; WDFW 2003; Dorn and Best 2005; May *et al.* 2005; Fresh *et al.* 2006).

Coho salmon near the action area are considered to be part of the East Kitsap Coho stock due to their distinct spawning distribution and common history of hatchery releases, mainly from Minter Creek Hatchery (WDFW 2003). Coho populations are found in Big Scandia, Little Scandia, and Crouch creeks and in two unnamed streams on Bainbridge Island. Other Coho stocks are also likely to move through the action area. Escapement estimates for the East Kitsap Coho stock have ranged from 800 in 1992 to 18,000 in 2000. This stock is considered to be healthy.

No known populations of anadromous cutthroat or bull trout/Dolly Varden are present within the action area, although resident populations of cutthroat trout are found in two unnamed streams north of the Keyport action area (WDFW 2003, 2004; PSMFC 2006).

The status of the East Kitsap winter steelhead stock is unknown (WDFW 2003).

3.2.3.2 ESA-Listed Fish Species

Two ESA-listed salmonid and three ESA-listed rockfish species potentially occur within the Keyport action area: Puget Sound Chinook Salmon ESU, Puget Sound Steelhead Trout Distinct Population Segment (DPS), Puget Sound/Georgia Basin yelloweye rockfish DPS, Puget Sound/Georgia Basin canary rockfish DPS, and Puget Sound/Georgia Basin bocaccio DPS.

Puget Sound Chinook Salmon ESU Chinook salmon occur in the action area as both adults and as juveniles. Chinook salmon spawning has been documented in Chico Creek, Clear Creek and other tributary streams to Dyes Inlet, and Blackjack Creek and Gorst Creek, tributaries to Sinclair Inlet (WDFW 2008). These spawning subpopulations are considered part of the South Puget Sound Chinook salmon stock defined by the WDFW and Western Washington Treaty Tribes (Tribes). This stock is classified as being of hatchery origin and not self-sustaining based on the typical habitat conditions present in these tributary habitats (WDFW 2002). It is nonetheless considered part of the ESU because individual spawning populations are supported in part by natural production. Spawning typically occurs from late September through October (WDFW 2002), but staging adult Chinook salmon are likely to be present in the action area as early as the last week of August. The Kitsap Pogie Club hosts an annual salmon fishing derby in mid-August targeting hatchery reared Chinook salmon staging in Sinclair Inlet before returning to spawn in Gorst Creek.

Juvenile Chinook salmon are known to utilize both nearshore and mid-water habitats throughout Sinclair Inlet, Dyes Inlet, and the PWN. Fresh *et al.* (2006) studied marine habitat utilization weekly between February and September in 2001 and 2002 using beach seines, mid-water seines, and mid-water tow nets. They found juvenile Chinook salmon at sampling sites located within the action area as early as March and as late as September, with peak abundance in May and June. The majority of these fish are of hatchery origin from outplants in local streams. However, tagged hatchery origin fish from other rivers in the region including the Nisqually, Puyallup, Skykomish, and Samish River systems, tributaries to the Strait of Juan de Fuca, and even the Fraser River were also captured during sampling. Assuming that wild origin fish display similar habitat use, the action area is likely to be utilized by juvenile Chinook salmon from several populations distributed throughout the ESU.

Puget Sound Steelhead Trout DPS Puget Sound steelhead occur in the action area as adults migrating to spawning habitats and as outmigrant juveniles. Steelhead are known to spawn in several tributary streams in the vicinity, including Gorst, Ross, Anderson, and Blackjack Creeks in Sinclair Inlet; and Chico, Clear, and Barker Creeks in Dyes Inlet. The WDFW considers these discrete spawning subpopulations to be part of the South Sound - East Kitsap Winter Steelhead stock (WDFW 2002). This stock is of native origin and supported entirely by wild production. These populations are not routinely monitored for abundance and productivity and their status is rated as unknown (WDFW 2002). Spawning typically occurs from February through mid-April, meaning that adult fish will be migrating through the action area from late January through early April.

The majority of juvenile Puget Sound steelhead migrate to marine waters from early April through mid-May as two-year old smolts, typically 140 to 160 mm in length (NMFS 2005a). The inshore migration patterns of steelhead in Puget Sound are not well understood (NMFS 2005a); however, an increasing body of evidence indicates that juveniles migrate rapidly to offshore marine habitats upon exiting freshwater. For example, Welch *et al.* (2004) and Melnychuk *et al.* (2007) found that tagged Keogh River steelhead smolts migrated rapidly from freshwater release areas to open marine waters, the majority moving into open water habitats within one week. Oregon Coast steelhead have also been shown to migrate rapidly to offshore environments (Pearcy 1992).

Studies of Puget Sound steelhead populations have demonstrated similar behavior. Berger and Ladley (2006) studied the migratory patterns of juvenile Puyallup River steelhead using acoustic telemetry. They found that steelhead smolts spent little time in estuarine and nearshore habitats, migrating rapidly towards the open ocean upon leaving their home river. The majority of tagged fish were detected at distant receiver arrays (i.e., West Point, Dalco Passage, Admiralty Inlet, and the Strait of Juan de Fuca) within 6 to 30 days of release near the mouth of the White River. Given the similarity in behavior demonstrated by steelhead populations throughout the Pacific Northwest, it is reasonable to conclude that juvenile steelhead are unlikely to be present in the action area beyond mid-June. Data on juvenile steelhead utilization of nearshore and midwater habitats in Sinclair Inlet are consistent with these observations. Fresh *et al.* (2006) conducted beach and midwater surveys in Sinclair Inlet using a variety of capture techniques. Only four of the over 20,000 juvenile salmonids captured in two years of effort were steelhead, indicating that offshore migration is rapid and nearshore habitat use by this species is limited at best.

Rockfish Rockfish on the Pacific coast typically inhabit the continental shelf and upper slope regions and consequently are sometimes described as nearshore, shelf, or slope rockfish. As adults, rockfish inhabit rocky reef habitats, slopes, pinnacles, pilings, or submerged debris and typically remain within 31 to 50 m (100 to 164 ft) of their preferred habitat (Matthews 1990). Rockfish are long-lived and sexual maturity is attained between 5 and 20 years of age. Spawning for most species generally takes place in the early spring (April) or late fall. Once hatched (late winter to mid-summer) the juvenile larvae form part of the pelagic community for up to 3 years and use nearshore habitats. Due to their long lives and late sexual maturity, rockfish are extremely susceptible to over harvest and stock depletion. The spawning potential of rockfish in Puget Sound has declined by approximately 75 percent since the historic peak levels observed during the 1970s (PSWQAT 2002).

On April 28, 2010, NMFS listed the Puget Sound/Georgia Basin DPSs of yelloweye rockfish and canary rockfish as threatened, and listed the Puget Sound/Georgia Basin DPS of bocaccio as endangered under the ESA (72 FR 2276; April 28, 2010). The listing of each species will become effective on July 27, 2010. These DPSs include all yelloweye rockfish, canary rockfish, and bocaccio found in waters of the Puget Sound, the Strait of Georgia, and the Strait of Juan de Fuca east of Victoria Sill.

Yelloweye rockfish within the Puget Sound/Georgia Basin (in U.S. waters) are very likely the most abundant within the San Juan Islands region of the DPS. Though there is a lack of a reliable population-census within the regions of Puget Sound Proper, the San Juan region has the most suitable rocky benthic habitat (Palsson *et al.* 2009) and historically was the area of greatest angler catches (Moulton and Miller 1987). Productivity for yelloweye rockfish is influenced by long generation times that reflect intrinsically low annual reproductive success. Natural mortality rates have been estimated from 2 - 4.6% (Yamanaka and Kronlund 1997). Productivity may also be particularly impacted by Allee effects. As adults have been removed by fishing, the density and proximity of mature fish is decreased. Adult yelloweye typically occupy relatively small ranges (Love *et al.* 2002), and may not move to find suitable mates. Maternal effects on yelloweye rockfish productivity within the DPS are similar to those previously described for rockfish generally.

Historically the South Puget Sound was thought to be a population stronghold for the canary rockfish within the DPS, but it appears to be greatly depleted (Drake *et al.* 2010). Natural annual mortality ranges from six to nine percent (Methot and Stewart 2005; Stewart 2007). Life history traits suggest intrinsically slow growth rate and low rates of productivity for this species, specifically its age at maturity, long generation time and its maximum age (84 years) (Love *et al.* 2002). Past commercial and recreational fishing removals may have depressed the DPS to a threshold beyond which optimal productivity is unattainable (Drake *et al.* 2010). Maternal effects on canary rockfish productivity within the DPS are similar to those previously described for rockfish.

Bocaccio within the Puget Sound/Georgia Basin were historically most common within the South Sound and Central Sound regions (Drake *et al.* 2010), with just several documented occurrences within Hood Canal and none within the San Juan region. Though bocaccio were never a predominant segment of the multi-species rockfish population within the Puget Sound/Georgia Basin (Drake *et al.* 2010), their present-day abundance is likely a fraction of their pre-contemporary fishery abundance. Bocaccio may be absent in significant segments of their formerly-occupied habitat; from 1998 to 2008 fish were reported by anglers in only one region of the DPS. Productivity is driven by high fecundity and episodic recruitment events, largely correlated with environmental conditions, thus bocaccio populations do not follow consistent growth trajectories and sporadic recruitment drives population structure (Drake *et al.* 2010). Natural annual mortality is approximately 15% (Tolimeri and Levin 2005). Demographically, this species demonstrates some of the highest recruitment variability among rockfish species, with many years of failed recruitment being the norm (Tolimieri and Levin 2005). Given their severely reduced abundance, Allee effects may be particularly acute for bocaccio, even considering the propensity of some individuals to move long distances and potentially find mates.

Relevance of the Environmental Baseline Condition to Species and Critical Habitat Status
The degraded condition of habitat in the action area undermines function in support of the Puget Sound Chinook salmon or Puget Sound steelhead life histories expressed in the Port Washington Narrows. In general, the status of Puget Sound Chinook salmon and Puget Sound steelhead as threatened species is, in part, a function of declining conditions across the range of key habitats. With regard to nearshore marine habitats, various anthropogenic features, such as modified shorelines, modified bathymetry, overwater structures, disruption of hydrologic and sediment transport processes, habitat fragmentation, and degraded water

quality have negatively influenced the biotic features necessary to support healthy populations of these species. While other factors, such as ocean conditions, harvest levels, and natural mortality from predation and disease also influence species status, the baseline conditions within the action area contribute to the net effect of depressing population viability. This effect is primarily realized through depressed juvenile survival during early marine rearing, which in turn is reflected in population productivity.

These factors also contribute to the degraded condition of Puget Sound Chinook salmon PCE 5 in the vicinity of the action area. Specifically, numerous overwater structures and shoreline development have degraded habitat suitability for juvenile Chinook salmon. Shallow water nearshore habitats have been eliminated in many areas, and numerous overwater structures pose a partial migration barrier through physical and shading effects. Shoreline development has resulted in the removal of submerged and overhanging vegetation and woody debris in many areas. Degraded water quality causes behavioral and sublethal injury responses that reduce individual fitness of Chinook salmon for their present and subsequent life histories. Additionally, these conditions effect the productivity of the salmonid prey base, decreasing the availability of food, having further, indirect effects on individual fitness. Despite these limiting factors, the action area and vicinity still provide important habitat functions. The action area is characterized by contiguous shallow water habitat and abundant forage fish and other prey resources, creating important transitional and migratory habitat for juvenile salmonids.

Critical habitat has not yet been designated for the listed yelloweye rockfish, canary rockfish, or bocaccio DPSs.

3.2.4 Marine Mammals

Six marine mammal species/stocks occur in the area where the proposed Manette Bridge replacement work is planned. These six species/stocks are: Pacific harbor seal (*Phoca vitulina richardsi*), California sea lion (*Zalophus californianus*), Steller sea lion (*Eumetopias ubatus*), transient and Southern Resident killer whales (*Orcinus orca*), and gray whale (*Eschrichtius robustus*). All these marine mammals have been observed in southern Puget Sound during certain periods of the year and may occur in Sinclair Inlet, Port Washington Narrows and Dyes Inlet, although direct observation in the vicinity of the Manette Bridge may not be documented.

To further gather information on the occurrence of these marine mammal species in the vicinity of the proposed project area, the WSDOT contracted ten surveys between the months of July 2006 and January 2007. This time period was chosen for sampling because it represents the time period when most in-water work activities would occur. Two pinniped species and zero cetaceans were observed. Thirty four harbor seals, one California sea lion and one unidentified pinniped, likely a California sea lion, were observed over the six month period. In general, cetacean observations are infrequent in the Puget Sound (Calambokidis and Baird 1994, Jefferies 1985). During ten surveys for marine mammals in Sinclair Inlet and Port Washington Narrows between July 2006 and January 2007, no cetaceans were observed. No marine mammals were observed during two of the ten surveys. Detailed results of the surveys are provided in a final report, which is included in Appendix E of the WSDOT IHA application (WSDOT 2009).

Additional information on these species, particularly in relation to their occurrence in the proposed project area, is provided below.

3.2.4.1 HARBOR SEAL

Three distinct harbor seal stocks occur along the west coast of the continental U.S., the Washington inland waters stock, Oregon/Washington coastal stock, and California stock (Caretta *et al.* 2010). The Washington inland waters stock of the Pacific harbor seal is distributed in inland waters including Hood Canal, Puget Sound, and the Strait of Juan de Fuca out to Cape Flattery (Caretta *et al.* 2010), and is expected to occur in the proposed project area.

Harbor seal is the most common pinniped and the only marine mammal species that breeds in the inland marine waters of Washington (Calambokidis and Baird 1994). Pupping and molting typically occurs between April and August.

Individual harbor seals are frequently observed in the Port Washington Narrows, Sinclair Inlet and Dyes Inlet. Harbor seals were observed during eight of ten surveys between July 2006 and January 2007. No more than six individuals were observed during any one survey period. There are no documented harbor seal haul-out areas within 4.8 km (3 mi) of the Manette Bridge. One harbor seal haul-out estimated at less than 100 animals is documented in Dyes Inlet west of the Manette Bridge. These animals must pass through the Port Washington Narrows to gain access to Sinclair Inlet and the greater Puget Sound basin.

In 1999, Jefferies *et al.* (2003) recorded a mean count of 9,550 harbor seals in Washington's inland marine waters. The estimated population for this stock is approximately 14,612 harbor seals with a correction factor to account for animals in the water which were missed during the aerial surveys (Calambokidis and Baird 1994; Carretta *et al.* 2010). From 1991 to 1996, counts of harbor seals in Washington State have increased at an annual rate of 10% (Jefferies *et al.* 2000). Harbor seals are not considered to be "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act (ESA).

3.2.4.2 CALIFORNIA SEA LION

California sea lions occur throughout the Pacific Rim and are separated into three subspecies, of which only one occurs in western North America (Caretta *et al.* 2010). The subspecies is further separated into three stocks, the United States (US) stock, the Western Baja California stock and the Gulf of California stock (Caretta et al. 2010).

The US stock of California sea lion is expected to occur in the vicinity of the proposed project area. They breed in California and southern Oregon between May and July, but not in Washington. Pupping occurs on the breeding ground, typically one month prior to mating. Sea lions are typically observed in Washington between August and April, after they have dispersed from breeding colonies.

There are no documented California sea lion haul outs within 4.8 km (3 mi) of the Manette Bridge. Two California sea lion haul-outs estimated at less than 10 animals are documented on bouys in Rich Passage approximately 6.4 km (4 mi) to the east. Individuals are infrequently observed in the Port Washington Narrows, Sinclair Inlet and Dyes Inlet. One California sea lion was observed during one of ten surveys between July 2006 and January 2007. An unidentified pinniped was also recorded during one survey and is believed to be a California sea lion, although positive identification was not possible.

Population estimates are calculated by conducting pup counts. Because California sea lions do not breed in Washington, accurate estimates of the non-breeding population in Washington do not exist. Estimates from the 1980s suggest the population size was just under 3,000 by the mid-1980s (Bigg 1985; Gearin *et al.* 1986). In the 1990s, the number of sea lions in Washington appears to have either stabilized or decreased (Gearin *et al.* 1986; Calambokidis and Baird 1994). The entire population of the US stock of California sea lion is estimated to be approximately 238,000 (Carretta *et al.* 2010). The California sea lions are not considered to be "depleted" under the MMPA or listed as "threatened" or "endangered" under the ESA.

3.2.4.3 STELLER SEA LION

Steller sea lion occur along the north Pacific Rim with the population center in the Gulf of Alaska and the Aleutian Island chain. This species is separated into two stocks, the eastern and western stocks. The Eastern stock ranges from southeast Alaska south to California (Loughlin *et al.* 1984). The Eastern stock breeds in Alaska, British Columbia, Oregon and California, but does not have breeding rookeries in Washington. Breeding typically occurs from May to July. Pupping occurs within days of returning to the breeding colony.

Individuals, especially adult males and juveniles, disperse widely and travel great distances outside of the breeding season, including waters off and within Washington State. Individual Steller sea lions typically return to breeding grounds in May, although in 2007 and 2008 two to six individual Steller sea lions remained all summer near Nisqually (southern Puget Sound near Olympia) on the Toliva Shoals and Nisqually buoys. There was also one Steller sea lion observed at Point Defiance (near Tacoma, Washington) in July 2008. Furthermore, reports of Steller sea lions on the North Vashon, Manchester and Bainbridge Island bouys increased in winter 2007 - 2008 and spring 2008 although there are no estimates of individual numbers for these reports (WSDOT 2009). According to WSDOT (2009: communication between WSDOT and Jefferies in 2008) there are also records from the 1990's of 200 - 300 Steller sea lions using Navy floats at the Fox Island Acoustic Range. The majority of Steller sea lions are observed in the north Puget Sound and Strait of Juan de Fuca, although Steller sea lions are regularly observed at three haulout sites in central and southern Puget Sound. The nearest site, Shilshole Bay, is on the east side of the Puget Sound, adjacent to the city of Seattle approximately 19.3 km (12 mi) from the Manette Bridge.

Population estimates are calculated by conducting pup counts. Because Steller sea lions do not breed in Washington, accurate estimates of the non-breeding population in Washington do not exist. Using the most recent 2005 pup counts from aerial surveys across the range of the eastern stock, the total population of the eastern stock of Steller sea lion is estimated to be between 46,000 and 58,000 (Pitcher *et al.* 2007; Allen and Angliss 2010). The eastern stock of Steller sea lion is listed as "threatened" under the ESA, and is designated as a "depleted" stock under the MMPA.

3.2.4.4 Gray Whale

The North Pacific gray whale stock is divided into two distinct stocks: the eastern North Pacific and western North Pacific stocks (Rice *et al.* 1984; Allen and Angliss 2010). The eastern North Pacific stock ranges from Alaska, where they summer, to Baja California, where they migrate to calve in the winter.

Gray whales occur frequently off the coast of Washington during their southerly migration in November and December, and northern migration from March through May (Rugh *et al.* 2001, Rice *et al.* 1984). Gray whales are observed in Washington inland waters regularly between the months of January and September, with peaks between March and May. The average tenure within Washington inland waters is 47 days and the longest stay was 112 days (Cascadia Research Collective, unpub. report). Gray whales are reported in Sinclair Inlet, Port Washington Narrows or Dyes Inlet during migration. Between 2001 and 2007, gray whale sightings were reported during three of the years (Orca Network 2008). Reports occurred in April 2002, February, March and May 2005, and March and April 2007. The May 2005 observation was a stranding mortality at the Kitsap Naval Base in Bremerton (Orca Network 2008).

Systematic counts of the eastern North Pacific gray whales have been conducted by shore-based observers during their southbound migration along the central California coast. The most recent abundance estimate is based on counts made during the 2001-02 seasons. Based on the data, the abundance estimate for this stock of gray whale is 18,178 individuals (Allen and Angliss 2010). The eastern North Pacific gray whale was removed from the ESA-list in 1994, due to steady increases in population abundance. Therefore, it is not considered "endangered" or "threatened" under the ESA.

3.2.4.5 Killer Whale

Two distinct forms, or ecotypes, of killer whales – "residents" and "transients" – are found in the greater Puget Sound. These two ecotypes are different populations of killer whales that vary in morphology, ecology, behavior, and genetics. Both ecotypes of killer whales are not known to intermix with one another.

Resident Killer Whales are noticeably different from both transient and offshore forms. The dorsal fin is rounded at the tip and falcate (curved and tapering). Resident whales have a variety of saddle patch pigmentations with five different patterns recognized. They have been sighted from California to Alaska. Resident whales primarily eat fish.

The "resident" population that could occur in the proposed project area is the Southern Resident killer whale (SRKW). This population contains three pods (or stable family-related groups) – J pod, K pod, and L pod – and is considered a stock under the MMPA. Their range during the spring, summer, and fall includes the inland waterways of Puget Sound, Strait of Juan de Fuca, and Southern Georgia Strait. Their occurrence in the coastal waters off Oregon, Washington, Vancouver Island, and more recently off the coast of central California in the south and off the Queen Charlotte Islands to the north has been documented. Little is known about the winter movements and range of the Southern Resident stock. Resident killer whales feed exclusively on fish such as salmon (Calambokidis and Baird 1994).

Southern resident killer whale presence is possible but unlikely in the proposed project area. They were last seen in the vicinity of the proposed project area in 1997. Nineteen members of L pod (subpod L-25) arrived on October 21, 1997 and stayed in Dyes Inlet for 30 days (WSDOT 2009). A fall chum run has been suggested as the reason for the extended stay. The only access to Sinclair Inlet is to the north (Agate Passage) or south (Rich Passage) of Bainbridge Island.

The Southern Resident killer whale population is currently estimated at about 86 whales (Carretta *et al.* 2010), a decline from its estimated historical level of about 200 during the mid- to late 1800s. Beginning in about 1967, the live-capture fishery for oceanarium display removed an estimated 47 whales and caused an immediate decline in SRKW numbers. The population fell an estimated 30% to about 67 whales by 1971. By 2003, the population increased to 83 whales. Due to its small population size, NMFS listed this segment of the population as endangered under the ESA. This population is also listed as depleted under the MMPA.

Transient killer whales occur throughout the eastern North Pacific, primarily in coastal waters. Individual transient killer whales have been documented as traveling great distances, reflecting a large home range. The dorsal fin of transient whales tends to be more erect (straighter at the tip) than those of resident whales. Saddle patch pigmentation of transient killer whales is restricted to two patterns. Pod structure is small (e.g., fewer than 10 whales) and dynamic in nature. Transient killer whales feed exclusively on other marine mammals such as dolphins, sea lions, and seals.

The transient killer whale population that could occur in the proposed project area is the West Coast transient stock. It is a trans-boundary stock, which includes killer whales from British Columbia. The presence of this killer whale population in the south Puget Sound is considered rare. In 2008, there were only two reports of transient orca whales in the south Puget Sound. One of these reports occurred in January just east of Maury Island and the other report of transients occurred in August in the Tacoma narrows (WSDOT 2009).

Preliminary analysis of photographic data results in a minimum of 314 killer whales belonging to the West Coast transient stock (Allen and Angliss 2010). This number is also considered the minimum population estimate of the population since no correction factor is available to provide a best estimate of the population. At present, reliable data on trends in population abundance for the West Coast transient stock of killer whales are unavailable (Allen and Angliss 2010). This stock of killer whale is not designated as "depleted" under the MMPA nor is it listed under the ESA.

4 CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

This chapter represents the scientific and analytic basis for comparison of the direct, indirect, and cumulative effects of the alternatives. Regulations for implementing the provisions of NEPA require consideration of both the context and intensity of a proposed action (40 CFR Parts 1500-1508).

4.1 EFFECTS OF ALTERNATIVE 1: DENY ISSUANCE OF AN IHA (NO ACTION)

Under the No Action Alternative, NMFS would not issue the proposed IHA for the activities proposed by the WSDOT. Accordingly, any takes of marine mammals resulting from the proposed construction and demolition associated with the Manette Bridge replacement project would not be authorized and any incidental take of marine mammals would be a violation of the MMPA. As a result, the WSDOT would abandon the proposed bridge replacement project. As a result, the WSDOT would be unable to replace the current functionally obsolete Manette Bridge in Bremerton, Washington. Thus, this alternative does not meet the purpose and need. If the WSDOT is prohibited from the proposed Manette Bridge replacement project, the impacts to the human environment at the proposed action area would remain the status quo.

4.2 EFFECTS OF ALTERNATIVE 2: ISSUANCE OF AN IHA WITH MITIGATION (PREFERRED)

4.2.1 IMPACTS ON THE PHYSICAL ENVIRONMENT

Geology and Hydrology: Based on a review of the data, the impacts on geology and hydrology of the proposed action area are small. The proposed bridge replacement activities would only occur in a confined area. It is estimated that the construction and demolition work trestles would cover up to 5,193 m^2 (55,900 ft^2) of the Port Washington Narrows throughout the construction period, a duration of approximately three years although neither trestle would be in place for that entire period. The project would replace the existing bridge, which was originally built on site in 1930, therefore, no addition of new structure is expected to be placed.

Though the construction and demolition activities may cause short-term water turbidity, only a small portion of the action is expected to be affected at a time. Overall, water quality conditions will generally improve as a result of the construction of stormwater treatment facilities associated with the project. Currently, stormwater from the existing roadway and bridge is discharged, untreated into the Port Washington Narrows. Post project, all stormwater leaving the bridge will receive treatment by the city of Bremerton (WSDOT 2009).

Therefore, the proposed action is not expected to disturb the geology nor the water in the vicinity of the action area.

Acoustical Environment*:* The construction and demolition activities are expected to raise the overall ambient noise at the proposed action area, especially around the work site near the bridge in the Port Washington Narrows. The level of increase would largely depend on the machinery/vessels and the distance from the noise source(s). However, not all construction activities produce intense noises. The types of construction and demolition work that produce noise levels that are most likely to be detected above ambient sound levels at long distances (>1 km) are those limited to pile driving, dredging, dynamic positioning, and perhaps vessel traffic. The majority of the noise increase would be in the low frequencies (below 1,000 Hz; Richardson *et al.* 1995) and would occur during the daylight hours. However, due to the shallow water in the proposed action area (averaging to 12 m, or 40 ft, at MLLW in the mid-channel of Port Washington Narrows), propagation of low-frequency sound is limited due to low frequency cutoff in a waveguide-like environment (Etter 2003). Using the theory of radio propagation in ground-based radio ducts and values of sound speed and sound-speed gradient appropriate for sound propagation in the mixed layer, Etter (2003) derived the maximum wavelength in surface duct:

$$\lambda_{max} = \frac{8.51}{1000}\sqrt{H^3},$$

where λ_{max} is the maximum wavelength in meters trapped in a mixed-layer duct of depth H in meters. For the proposed action area where water depth is 12 m (40 ft) at the mid-channel of the Port Washington Narrows, the maximum wavelength is 0.35 m (1.16 ft), corresponding to a cutoff frequency 4,240 Hz (assuming that the sound speed is 1,500 m/s). Although this does not represent a sharp cutoff, wavelengths much longer (or frequencies much lower) than this are strongly attenuated.

In addition, the proposed mitigation measures discussed above, such as limiting the use of impact pile driving and dynamic position thruster for vessels, and the establishment of a sound attenuation device such as the bubble curtain system will reduce some impacts from construction noises.

Finally, the proposed Manette Bridge replacement project is of limited duration for three years, and the long-term underwater acoustic ecology in the proposed action area is not expected to be altered.

Essential Fish Habitat: Based on the Biological Opinion for the proposed Manette Bridge replacement project (NMFS 2009), the proposed action will result in temporary disturbance including elevated sound pressure levels (SPLs) of sufficient magnitude to cause injury to fish occurring within 540 m (1,775 ft) of pile driving. Pile driving noise may affect the behavior of fish as far as 3,380 m (11,090 ft) from the source. In addition to potential direct effects on EFH species, elevated SPLs are also likely to lead to a localized decrease in the abundance of forage fish species for an intermediate-term period. As primary prey species, forage fish constitute a significant feature of EFH for Pacific salmon, west coast ground fish, and some of the coastal pelagic species.

The proposed action will result in the intermediate-term modification of benthic habitats within the Port Washington Narrows. These impacts will occur in the form of 358 m^2 (3,850 ft^2) of temporary pilings, which will remain in place for up to 2.5 years, and residual holes in the Port Washington Narrows channel bed that remain after the temporary pilings are removed. Natural sediment transport is expected to refill these depressions, leading to complete habitat recovery within one year after the project is completed. The action will also result in an intermediate-term reduction in the habitat functions provided by 607 m^2 (6,530 ft^2) of marine riparian and 283 m^2 (3,050 ft^2) of adjacent upland vegetation. However, riparian and upland vegetation function is expected to be significantly improved once the planned vegetation enhancements implemented on these sites are sufficiently mature.

Collectively, these impacts are likely to adversely affect EFH for an intermediate-term period. Over the long-term, the net effects of the proposed action on EFH will be beneficial. The new bridge will have a smaller in-water footprint than the existing structure, increasing benthic habitat area in the Port Washington Narrows available for EFH by up to 679 m^2 (7,310 ft^2). This increase may be as much as 30 percent smaller if the bases of two existing piers are left in place. It may be necessary to cut these piers off three feet above the substrate to keep creosote treated piles used in the original foundation fully encased in concrete. The proposed action will also produce long-term beneficial effects on water quality. Stormwater from the existing structure currently drains directly to surface waters. The new structure will route stormwater to Bremerton's stormwater treatment system. This will result in a net decrease in the annual loading of stormwater pollutants to surface waters.

Designated Critical Habitat*:* The action area is located entirely within and considered part of Puget Sound Chinook salmon critical habitat PCE 5. The relevant habitat characteristics provided by PCE 5 are nearshore habitats that provide juvenile refuge, feeding and migratory corridors, and returning adult migration corridors. The CHART rated PCE 5 in Kitsap Hydrologic Unit Code (HUC) 5 as having high conservation value, despite the fact that existing habitat conditions are degraded as described in Chapter 3 "Existing Environment."

Functioning nearshore and intertidal areas provide forage and foraging habitat, refuge from predation, suitable areas for the physiological transition between salt and fresh water, and migratory corridors. This PCE is currently functioning below optimal conditions within the action area. Despite these limitations, the action area and the surrounding marine area have high conservation value because they play a key role in supporting early marine rearing in this section of critical habitat. The proposed action will not appreciably reduce, and is likely to improve the conservation value of this habitat over the long-term. However, it is likely to result in a localized, two to three years of adverse effect on PCE 5 in the action area as the result of the presence of temporary structures and reduction in foraging fish abundance.

Placement of 542 pilings will temporarily alter the suitability of 356 m^2 (3,830 ft^2) of aquatic habitat in the pile footprint, including habitats that directly and indirectly support salmonids. The construction trestle pilings will affect up to 235 m^2 (2,530 ft^2) for a period of 2.5 years. The demolition trestle will impact the remaining 121 m^2 (1,300 ft^2) for anywhere from 12 months to 2.5 years. The pilings and the shading effect of the trestles will present a physical and visual obstruction that could impede and alter fish migration behavior. The trestles are located waterward of about 6.1 m (20 ft) MLLW, therefore they are not expected to interfere significantly with the movements of smaller juvenile salmon. Larger juveniles and adults are more likely to utilize offshore habitats and are therefore more likely to be directly affected by these structures. As noted, the trestles and supporting structures may provide temporary habitat for species that prey on both juvenile and adult salmon and steelhead, including prey fish, birds, and marine mammals.

The proposed action will result in the intermediate-term degradation of nearshore and benthic habitat in the action area. Construction access and pier foundations will require the removal of natural cover along the shoreline and upland bluffs. Marine riparian vegetation contributes many important functions that support the overall productivity of salmonid rearing habitat (Brenna 2004. Brennan and Culverwell 2004; Brennan *et al.* 2004). For example, shade from overhanging riparian vegetation has been shown to significantly increase the survival of surf smelt spawn (Pentilla 2001; Rice 2006), which in turn support the forage base for juvenile and adult Chinook salmon. These adverse effects will eventually be offset when planned riparian vegetation enhancement matures, resulting in improved conditions relative to the environmental baseline.

The majority of holes created in the bed of the Port Washington Narrows by temporary piles are expected to collapse when the piles are removed. Some holes in exposed till may not immediately collapse however, remaining in an altered condition until they are refilled by natural sediment transport. This is expected to occur over a period of several months.

The proposed action is also likely to result in a two to three year, localized reduction in forage fish abundance. The action area contains forage fish spawning and pre-spawn staging and migratory habitat, as well as additional undocumented but otherwise suitable spawning habitat. Documented spawning habitat occurs within and immediately adjacent to the bridge construction site. Given this proximity, it is likely that large numbers of larval, juvenile, and adult forage fish will be unavoidably exposed to underwater noise levels sufficient to cause injury or death. Barring other environmental factors, forage fish abundance would be expected to recover within one to two years after project construction is completed. The resulting intermediate-term reduction in forage fish abundance will affect prey availability for both adult and juvenile salmonids. This represents an adverse effect on the abundant of forage element of PCE 5.

On balance, with the exception of marine riparian vegetation impacts, the adverse effects of the proposed action on critical habitat will last from two to three years. Intermediate-term impacts from project construction are not expected to appreciably degrade the conservation value of PCE 5 as a whole, because the area affected by construction is highly localized and represents a small percentage of available critical habitat within Kitsap HUC 5. Effects on forage fish, while potentially more extensive, are not expected to appreciably reduce the conservation value of critical habitat PCE 5 because the overall effect on forage fish abundance within HUC 5 is expected to be within the natural range of variability for these species.

Over the long-term, the proposed action will result in a beneficial improvement in the conservation value of PCE 5 in the action area. The action will eliminate the direct discharge of stormwater runoff from the existing bridge to surface waters, producing a beneficial improvement in water quality, and will reduce the amount of in-water structures and artificial fill in the action area. Finally, planned habitat enhancement activities are expected to produce a modest improvement in local shoreline and riparian habitat conditions.

4.2.2 IMPACTS ON THE SOCIAL AND ECONOMIC ENVIRONMENT

***Commercial Fishing**:* None of the activities would be directed at commercial fishing or would likely have any impact on commercial fishing in the action area. No significant direct impacts are expected from the action of issuing an IHA for the incidental take, by Level B harassment only, of small numbers of marine mammals to the WSDOT. No significant indirect impacts are expected from the WSDOT conducting the Manette Bridge replacement project.

Recreational Fishing*:* Local anglers may charter commercial passenger fishing vessels, or use private boats or rental boats to transit to fishing areas around the proposed action area in Dyes and Sinclair Inlets. However, none of the proposed activities are directed at recreational fishing. No significant direct impacts are expected from the action of issuing an IHA for the incidental take, by Level B harassment only, of small numbers of marine mammals to the WSDOT. No significant indirect impacts are expected from the WSDOT conducting the Manette Bridge replacement project.

Tourism and Recreation*:* The Manette Bridge replacement project would have little effect on existing public recreation activities occurring near the proposed action area, which is in the vicinity of Bremerton, WA. No significant direct impacts are expected from the action of issuing an IHA for the incidental take, by Level B harassment only, of small numbers of marine mammals to the WSDOT. No significant indirect impacts are expected from the WSDOT conducting construction and demolition activities for the bridge replacement.

Local Ecnonoy*:* The Manette Bridge replacement project is expected to benefit the local economy in the Bremerton, WA, area with increased job opportunities related to the bridge construction and demolition. The construction of a new bridge will provide a safer passage between downtown Bremerton and the Manette area of Bremerton metropolitan. No significant direct impacts are expected from the action of issuing an IHA for the incidental take, by Level B harassment only, of small numbers of marine mammals to the WSDOT.

Subsistence Use*:* Subsistence hunts of marine mammals do not occur in the area. No significant direct impacts are expected from the action of issuing an IHA for the incidental take, by Level B harassment only, of small numbers of marine mammals to the WSDOT. No significant indirect impacts are expected from the WSDOT conducting construction and demolition activities for the bridge replacement.

4.2.3 IMPACTS ON THE BIOLOGICAL ENVIRONMENT

4.2.3.1 MARINE MAMMALS

Anticipated impacts resulting from the Manette Bridge replacement project include disturbance from increased human presence and marine traffic if marine mammals are in the vicinity of the proposed project area and Level B harassment by noises generated from the construction work such as pile driving and dredging activities.

4.2.3.1.1 IMPACTS FROM ANTHROPOGENIC NOISE

Marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Kastak *et al.* 1999; Schlundt *et al.* 2000; Finneran *et al.* 2002; 2005). TS can be permanent (PTS), in which case the loss of hearing sensitivity is unrecoverable, or temporary (TTS), in which case the animal’s hearing threshold will recover over time (Southall *et al.* 2007). Since marine mammals depend on acoustic cues for vital biological functions, such as orientation, communication, finding prey, and avoiding predators, marine mammals that suffer from PTS or TTS will have reduced fitness in survival and reproduction, either permanently or temporarily. Repeated noise exposure that leads to TTS could cause PTS.

Measured source levels from impact pile driving can be as high as 214 dB re 1 μPa @ 1 m. Although no marine mammals have been shown to experience TTS or PTS as a result of being exposed to pile driving activities, experiments on a bottlenose dolphin (*Tursiops truncates*) and beluga whale (*Delphinapterus leucas*) showed that exposure to a single watergun impulse at a received level of 207 kPa (or 30 psi) peak-to-peak (p-p), which is equivalent to 228 dB re 1 μPa (p-p), resulted in a 7 and 6 dB TTS in the beluga whale at 0.4 and 30 kHz, respectively. Thresholds returned to within 2 dB of the pre-exposure level within 4 minutes of the exposure (Finneran *et al.* 2002). No TTS was observed in the bottlenose dolphin. Although the source level of pile driving from one hammer strike is expected to be much lower than the single watergun impulse cited here, animals being exposed for a prolonged period to repeated hammer strikes could received more noise exposure in terms of SEL than from the single watergun impulse (estimated at 188 dB re 1 μPa^2-s) in the aforementioned experiment (Finneran *et al.* 2002).

However, in order for marine mammals to experience TTS or PTS, the animals have to be close enough to be exposed to high intensity noise levels for prolonged period of time. Current NMFS standards for preventing injury from PTS and TTS is to require shutdown or power-down of noise sources when an individual cetacean is detected within the isopleths corresponding to SPL at received levels equal to or higher than 180 dB re 1 μPa (rms); for an individual pinniped the current standard for preventing injury corresponds to SPL at received levels equal to or higher than 190 dB re 1 μPa (rms). Based on the best scientific information available, these SPLs are far below the threshold that could cause TTS or the onset of PTS. Certain mitigation measures proposed by the WSDOT, discussed below, can effectively prevent the onset of TS in marine mammals, by either reducing the source levels (using an air bubble curtain system) and by shut-down and power down procedures for pile driving.

In addition, chronic exposure to excessive, though not high-intensity, noise could cause masking at particular frequencies for marine mammals that utilize sound for vital biological functions. Masking can interfere with detection of acoustic signals such as communication calls, echolocation sounds, and environmental sounds important to marine mammals. Therefore, like TS, marine mammals whose acoustical sensors or environment are being masked are also impaired from maximizing their performance fitness in survival and reproduction.

Masking occurs at the frequency band which the animals utilize. Therefore, since noise generated from the proposed bridge replacement activities, such as pile driving, vessel traffic, and dredging, is mostly concentrated at low frequency ranges, it may have less effect on high frequency echolocation sounds by killer whales. However, lower frequency man-made noises are more likely to affect detection of communication calls and other potentially important natural sounds such as surf and prey noise. It may also affect communication signals when they occur near the noise band and thus reduce the communication space of animals (e.g., Clark *et al.* 2009) and cause increased stress levels (e.g., Foote *et al.* 2004; Holt *et al.* 2009).

Unlike TS that affects individual animals, masking may have impacts to some marine mammal species at population, community, or even ecosystem levels. Masking affects both senders and receivers of the signals and has long-term chronic effects on marine mammal species and populations. Recent science suggests that low frequency ambient sound levels have increased by as much as 20 dB (more than 3 times in terms of SPL) in the world's ocean from pre-industrial periods, and most of these increases are from distant shipping (Hildebrand 2009). All anthropogenic noise sources, such as those from vessels traffic, pile driving, and dredging activities, contribute to the elevated ambient noise levels, thus contributing to masking.

Nevertheless, the sum of noise from the proposed bridge replacement is confined in an area of inland waters that is bounded by landmass, therefore, the noise generated is not expected to contribute to increased ocean ambient noise.

Finally, exposure of marine mammals to certain sounds could lead to behavioral disturbance (Richardson *et al.* 1995), such as: changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities, changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping), avoidance of areas where noise sources are located, and/or flight responses (e.g., pinnipeds flushing into water from haulouts or rookeries).

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

- Drastic change in diving/surfacing patterns (such as those that may be related to beaked whale stranding due to exposure to military mid-frequency tactical sonar);

- Habitat abandonment due to loss of desirable acoustic environment; and

- Cessation of feeding or social interaction.

For example, at the Guerreo Negro Lagoon in Baja California, Mexico, which is one of the important breeding grounds for Pacific gray whales, shipping and dredging associated with a salt works may have induced gray whales to abandon the area through most of the 1960s (Bryant *et al.* 1984). After these activities stopped, the lagoon was reoccupied, first by single whales and later by cow-calf pairs.

The onset of behavioral disturbance from anthropogenic noise depends on both external factors (characteristics of noise sources and their paths) and the receiving animals (hearing, motivation, experience, demography) and is also difficult to predict (Southall *et al.* 2007).

The proposed project area is not believed to be a prime habitat for marine mammals, nor is it considered an area frequented by marine mammals. Therefore, behavioral disturbances that could result from anthropogenic construction noise associated with bridge replacement are expected to affect only a small number of marine mammals on an infrequent basis.

Currently NMFS uses 160 dB re 1 μPa at received level for impulse noises (such as impact pile driving) as the onset of marine mammal behavioral harassment, and 120 dB re 1 μPa for continued noises (vibratory pile driving and dredging).

Regarding airborne noise affects on marine mammals, as mentioned before, the nearest pinniped haulout (harbor seal) is in Dyes Inlet, which is approximately 3 miles (4.8 km) west of the proposed project area. NMFS does not expect that airborne noise from pile driving would reach harassment levels at this distance.

4.2.3.1.2 Impacts from Presence of Human Activities

In addition to noise induced disturbances and harassment, the increased human presence and vessel traffic associated with the bridge replacement construction is also expected to have adverse impacts to marine mammals in the vicinity of the proposed project.

Some of the expected impacts could result from work trestles and barge anchoring. The construction and demolition work trestles would cover up to 5,193 m^2 (55,900 ft^2) of the Port Washington Narrows throughout the construction period, a duration of approximately three years, although neither trestle would be in place for that entire period. The size of these trestles has been reduced to the greatest extent practicable according to WSDOT. The demolition trestle would be installed during the in-water work window immediately prior to initiation of bridge demolition activities occurring from this trestle and both trestles would be removed as soon as practicable following the completion of construction and demolition activities. Barge anchoring would occur adjacent to the construction and demolition work trestles creating a passage the width of the shipping channel between the Port Washington Narrows and Sinclair Inlet. Killer whales, if they happen to be present in the vicinity of the area, could become confined by psychological barriers such as nets or low walls that they can physically cross, but for unknown reasons do not. Such was the case in 1994 in Barnes Lake near Ketchikan, Alaska, when 10 killer whales entered following salmon but then refused to leave until human intervention chased them out of the lake (Anonymous 1995). In 1997, 19 members of the L pod of the Southern Resident killer whales entered Dyes Inlet near Bremerton, Washington, which is approximately 4.8 km (3 mi) west of the proposed project area and is surrounded by urban and residential development, and stayed there for nearly 30 days (Wiles 2004; NMFS 2008). The long length of residence of killer whales in this area was highly unusual and the reason is unclear, but may have been related to food abundance since it was coincident to a strong run of chum salmon into Chico Creek between late October and November, or a reluctance by the whales to depart the inlet because of the physical presence of a bridge crossing the Port Washington Narrows and associated road noise (Wiles 2004; NMFS 2008). The work trestles and barges may present a similar situation that would discourage or prevent killer whales from exiting Dyes Inlet or Port Washington Narrows and returning to more open water if the whales happen to enter the inlet. However, as mentioned before, the occurrence of killer whales in the vicinity of proposed project area is not frequent.

4.2.3.2 FISH SPECIES

High levels of underwater sound have been shown to have negative physiological and neurological effects on a wide variety of fish species (Yelverton *et al.* 1973; Yelverton and Richmond 1981; Hastings and Popper 2005). High intensity sounds can injure and/or kill exposed individuals, temporarily stun them, and/or cause behavioral alterations (Popper 2003; Hastings and Popper 2005). There have been few directed experimental studies to date on fish response to elevated SPLs generated during pile driving. The information that is available has been derived from opportunistic studies of previously planned pile driving activities, the majority examining effects on caged fishes placed at varying distances from the noise source. These studies have produced variable results. For example, two studies in California (Abbott and Bing-Sawyer 2002; CALTRANS 2003) demonstrated significant injury in caged fishes exposed to approximately 4,000 pile strikes at peak pressures as low as 198 dB re: 1 μPa. The cages were located as far as 311 m (1,020 ft) from pile driving, indicating that injury level effects can occur at distance. In contrast, Ruggerone *et al.* (2008) found no evidence of injury in juvenile coho salmon (*Oncorhynchus kisutch*) exposed to driving of small steel piles at relatively close proximity. It is difficult to generalize from these findings, however, because of the opportunistic nature of the studies and the fact that several important environmental factors were largely uncontrolled.

Broadly, the effects of organism exposure to elevated underwater noise can vary from no observable response, to behavioral alteration, to temporary impairment, to permanent injury, to delayed or immediate death. Over this continuum of effect, there is no easily identifiable point at which behavioral responses begin, or where these responses transition to physical injury. While specific thresholds are unclear, noise from impact pile driving has clearly been implicated in fish injury and mortality, with sensitivity varying dependent on species specific physiology (Stotz and Colby 2001; Fordjour 2003; Gaspin 1975; Hastings and Popper 2005; Abbott *et al.* 2005).

The primary mechanism of injury from impulsive sounds (sounds of very short duration with a rapid rise in pressure) is the effect of rapid, high amplitude pressure changes on body tissues. The injuries resulting from this type of exposure are referred to as barotraumas (Turnpenny *et al.* 1994). Gas-filled organs, such as swim bladders, are particularly sensitive to this type of injury because they resonate (i.e., vibrate at a frequency determined by the physical parameters of the affected object) to a greater degree than most other tissues. When a sound pressure wave strikes the swim bladder, the gas-filled space vibrates (rapidly expands and contracts) at the resonant frequency of that organ. When the amplitude of this vibration is sufficiently high, the pulsing swim bladder can rapidly compress adjacent organs, such as the liver and kidney. This pneumatic compression causes demonstrable injury, in the form of ruptured capillaries, internal bleeding, and maceration of highly vascular tissues (CALTRANS 2002). Hastings and Popper (2005) also noted that sound waves can cause non-gas-filled tissues to vibrate at different frequencies, leading to tearing of mesenteries and other sensitive connective tissues. Exposure to impulsive sounds can also induce "rectified diffusion." Rectified diffusion describes the process by which rapid pressure changes draw dissolved gasses out of solution, creating bubbles. When these bubbles form in body tissues they can cause inflammation, cellular damage, and blockage or rupture of capillaries, arteries, and veins (Stroetz *et al.* 2001; Vlahakis and Hubmayr 2000), leading to overt injury or even mortality. Death from barotrauma and rectified diffusion injuries can be instantaneous, or delayed for minutes, hours, or even days following exposure.

Regardless of species, smaller fish appear to be far more sensitive to injury of non-auditory tissues (Yelverton *et al.* 1975). For example, NMFS biologists observed that approximately 100 surf perch from three different species (Cymatogaster aggregata, *Brachyistius frenatus*, and *Embiotoca lateralis*) were killed during impact pile driving of 30-inch diameter steel pilings at Bremerton, Washington (NMFS 2009). Dissections revealed complete swim bladder destruction across all species in the smallest fish (80 mm fork length (FL)), while swim bladders in the largest fish (170 mm FL) were nearly intact. However, swim bladder damage was typically more extensive in *C. aggregata* when compared to *B. frenatus* of similar size. Comparable size specific results have been demonstrated in other species. Due to their large size, adult salmon can tolerate higher noise levels and are generally less sensitive to injury of non-auditory tissues than juveniles (Hubbs and Rechnitzer 1952). However, no information is available to determine whether or not the risk of auditory tissue damage decreases with increasing size of the fish.

Gravid female salmon, specifically ovarian tissues and egg masses, may face elevated injury risk relative to immature adults and sub-adults of comparable size. Eggs and supporting mesenteries are highly vascular tissues located in close proximity to the swim bladder, suggesting elevated sensitivity to barotrauma. These risks could include direct injury to individual eggs, tearing of the mesenteries that hold the eggs in place (resulting in the eggs being extruded prematurely), and loss of blood flow leading to developmental abnormalities or death. While this form of barotrauma has not been the subject of directed study, some inferences can be drawn from studies of other species. For example, Banner and Hyatt (1973) demonstrated increased mortality of sheepshead minnow eggs and embryos when exposed to continuous broadband noise (100 to 1,000 Hz) approximately 15 dB above ambient. Hatched sheepshead minnow fry were unaffected by the same exposure, as were the eggs and fry of the longnose killifish (*Fundulus similis*). However, it must be noted that the sounds produced by impact driving of steel piles are very different in character than the sounds in this study, and the eggs were free floating and not contained within the ovaries of the mother. As such, extrapolations from this study to eggs in a gravid female salmon are tenuous, at best.

However, WSDOT plans to use vibratory pile driving instead of impact hammer to the largest extent possible and the use of bubble curtain systems during impact pile driving would reduce much of the fish mortality that could result from impact piling. In addition, WSDOT indicated that no in-water work would be conducted between March 1 and June 14 which would also prevent any adverse impact to juvenile fish species.

4.3 Compliance With Applicable Laws / Necessary Federal Permits

NMFS has determined that its proposed IHA is consistent with the applicable requirements of the MMPA, ESA, and NMFS' regulations. The applicant has secured or applied for necessary permits from the Federal Highway Administration (FHWA).

4.3.1 Endangered Species Act

This section summarizes conclusions resulting from consultation required under section 7 of the ESA. The consultation process was concluded before the proposed IHA was published in the *FR* notice (75 FR 13502; March 22, 2010).

As discussed above in this document, there are two marine mammal species and five fish species that are listed as endangered or threatened under the ESA with confirmed or possible occurrence in the study area: Eastern North Pacific Southern Resident killer whale, Eastern U.S. Steller sea lion, Chinook salmon, steelhead trout, yelloweye rockfish, canary rockfish, and bocaccio. Under section 7 of the ESA, the FHWA and WSDOT have consulted with the NMFS Northwest Regional Office (NWRO) on the proposed Manette Bridge replacement project. In a memo issued with its August 3, 2009, Biological Opinion, NMFS NWRO stated that the proposed bridge replacement may affect, but is not likely to adversely affect the listed marine mammal species and stocks. On May 28, 2010, FHWA requested the reinitiation of section 7 consultation with NMFS NWRO on the newly ESA-listed three Puget Sound rockfish species. The consultation is expected to be completed in July 2010.

The proposed issuance of an IHA to WSDOT constitutes an agency action that authorizes an activity that may affect ESA-listed species and, therefore, is subject to section 7 of the ESA. As the effects of the activities on listed marine mammals were analyzed during a formal consultation between the FHWA and NMFS, and as the underlying action has not changed from that considered in the consultation, the discussion of effects that are contained in the Biological Opinion and accompanying memo issued to the FHWA on August 3, 2009, pertains also to this action. Therefore, NMFS has determined that issuance of an IHA for this activity would not lead to any effects to listed marine mammal species apart from those that were considered in the consultation on FHWA's action. Although the reinitiation of section 7 consultation by FHWA on three Puget Sound rockfish species is still on-going, NMFS does not expect that the outcome would affect NMFS' action in issuing an IHA for the incidental take of marine mammals.

4.3.2 Marine Mammal Protection Act

The applicant submitted an application which included responses to all applicable questions in the regulations. The requested activities are consistent with applicable issuance criteria in the MMPA and NMFS' implementing regulations. NMFS considered the views and opinions of the Marine Mammal Commission, scientists, or other persons or organizations knowledgeable about the marine mammals that were the subject of the application. These views, and other matters germane to the application, supported NMFS' initial determination that the action would have a negligible impact on the species or stocks and would not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, to support issuance of the proposed IHA.

The IHA would contain standard terms and conditions stipulated in the MMPA and NMFS' regulations. The IHA would specify: (1) the effective date of the permit; (2) the number and kinds (species and stock) of marine mammals that may be taken; (3) the location and manner in which they may be taken; and (4) other terms and conditions deemed appropriate.

4.3.3 COASTAL ZONE MANAGEMENT ACT

On June 4, 2009, WSDOT submitted a Federal Consistency determination stating that the proposed Manette Bridge replacement project is consistent with the Washington State Coastal Zone Management Program (CZMP). Pursuing to Section 307(c)(3) of the CZMA, the Washington State Department of Ecology concurred with WSDOT's determination on October 6, 2009.

4.3.4 ESSENTIAL FISH HABITAT

The FHWA and WSDOT consulted with NMFS NWRO on EFH. NMFS NWRO made the determination that the proposed project is not likely to adversely affect EFH in its Biological Opinion dated August 3, 2009.

4.4 UNAVOIDABLE ADVERSE EFFECTS

NMFS does not expect WSDOT's requested activities to have adverse consequences on the viability of the species and populations of marine mammals in the vicinity of the proposed action area. Further, NMFS does not expect there would be take of ESA-listed marine mammals given the mitigation and monitoring measures prescribed in the proposed IHA. Given this and the likely response by marine mammals to the proposed bridge replacement project, individual animals are likely to be adversely affected by construction and demolition noise and possibly by human presence during proposed project activities, but as mentioned throughout this EA, the project would have a negligible impact on the affected species or stocks of marine mammals.

4.5 CUMULATIVE EFFECTS

Cumulative effects are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions" (40 CFR §1508.7). Cumulative impacts can result from individually minor but collectively significant actions that take place over a period of time.

The proposed Manette Bridge replacement project is located near an urban development between downtown Bremerton and the Manette Neighborhood in the City of Bremerton, WA. The Downtown Regional Center, on the west side of the bridge, is the retail center of the city. Retail businesses are at street level with residences and offices on upper floors. Washington State Ferries operates passenger and vehicle ferry service from a terminal south of the bridge in the Downtown Regional Center. The Puget Sound Naval Shipyard is adjacent to the Downtown Regional Center and has been in operation since 1891. The primary activities at the shipyard involve decommissioning nuclear submarines and storing inactive vessels, including several aircraft carriers.

4.5.1 COASTAL DEVELOPMENT

Between 2000 and 2008, the population of Kitsap County increased by roughly 15,000. Thus, NMFS assumes that future public and private actions will continue within the action area, increasing as the population density rises. NMFS does not expect that areas already set-aside as limited and public open space will be converted to intensive land uses. Furthermore, much of the area that may be redeveloped in future years is already under uses that impair or reduce ecological function.

4.5.2 SHORELINE CLEANUP AND RESTORATION

Historic military and industrial activities have contributed to persistent degradation of water and sediment quality in the action area and vicinity. Federal and state led cleanup actions have been planned for a variety of sites, and one non-Federal action will take place within the action area. The City of Bremerton, in cooperation with WDOE under an Agreed Order, has developed a contaminant remediation plan for a former Chevron bulk fuel distribution facility adjacent to Evergreen Park. This site is near the northern limit of the action area, within the range of underwater noise effects but outside the limits of construction related bed disturbance. The scope of the cleanup action includes contaminated soils and groundwater in the upland portion of the site, and contaminated sediments in adjacent offshore areas. A conceptual plan for shoreline restoration has been developed in conjunction with the cleanup action. This plan includes removal of shoreline armoring, overwater structures and treated wood piles and restoration of the shoreline to a natural condition. This action is expected to improve water and sediment quality and enhance nearshore habitat conditions for salmonid rearing and forage fish spawning.

This shoreline restoration project is a component of the broader Bremerton Boardwalk project, a planned 3,400-foot-long over-water structure paralleling the western shore of the Port Washington Narrows. The boardwalk will pass directly under the Manette Bridge waterward of MLLW. The Boardwalk is intended to provide a recreational waterfront amenity and access for maintenance of underperforming sewer outfalls on the adjacent beach. Project construction will require impact pile driving, and the creation of a permanent overwater structure adjacent to the nearshore. These impacts will be offset by the planned removal of concrete rubble and debris, several hundred creosote-treated wood piles, and the removal of derelict nearshore and overwater structures. The net effect of the proposed action and the boardwalk project on the nearshore environment is expected to be neutral to beneficial over the long term, provided that the mitigation actions associated with the boardwalk project are implemented in full.

4.5.3 MARINE POLLUTION

Marine mammals are exposed to contaminants via the food they consume, the water in which they swim, and the air they breathe. Point and non-point source pollutants from coastal runoff, offshore mineral and gravel mining, at-sea disposal of dredged materials and sewage effluent, marine debris, and organic compounds from aquaculture are all lasting threats to marine mammals in the project area. The impacts of these pollutants are difficult to measure.

The persistent organic pollutants (POPs) tend to bioaccumulate through the food chain; therefore, the chronic exposure of POPs in the environment is perhaps of the most concern to high trophic level predators such as Southern Resident killer whales, Eastern Pacific gray whales, California sea lions, Pacific harbor seals, and Steller sea lions.

The WSDOT's construction and demolition activities associated with the Manette Bridge replacement project are not expected to cause increased exposure of POPs to marine mammals in the project vicinity due to the small scale and localized nature of the activities. Additionally, the WSDOT will use barges to carry out all construction debris and demolition material for proper disposal.

4.5.4 DISEASE

Disease is common in many marine mammal populations and has been responsible for major die-offs worldwide, but such events are usually relatively short-lived.

As recent as April 2010, five gray whales were found dead in Puget Sound. The die-off raised concerns among researchers who monitor gray whales and the health of marine mammals in the region (Calambokidis and Huggins 2010). The total number of recent mortalities remains well below the peak numbers documented in big mortality year and the 5 that have died so far in 2010 is still under the average for an entire year. Current, scientists from the Northwest Marine Mammal Stranding Network including NMFS, Cascadia Research, Central Puget Sound Marine Mammal Stranding Network, and Washington Department of Fish and Wildlife are investing these mortalities.

4.5.5 COMMERCIAL AND PRIVATE MARINE MAMMAL WATCHING

Although marine mammal watching is considered by many to be a non-consumptive use of marine mammals with economic, recreational, educational and scientific benefits, it is not without potential negative impacts. One concern is that animals may become more vulnerable to vessel strikes once they habituate to vessel traffic (Swingle *et al.* 1993; Wiley *et al.* 1995). Another concern is that preferred habitats may be abandoned if disturbance levels are too high. Several recent research efforts have monitored and evaluated the impacts of people closely approaching, swimming, touching and feeding marine mammals and has suggested that marine mammals are at risk of being disturbed ("harassed"), displaced or injured by such close interactions. Researchers investigating the adverse impacts of marine mammal viewing activities have reported boat strikes, disturbance of vital behaviors and social groups, separation of mothers and young, abandonment of resting areas, and habituation to humans (Kovacs and Innes 1990, Kruse 1991, Wells and Scott 1997, Bejder *et al.* 1999, Colborn 1999, Cope *et al.* 1999, Mann *et al.* 2000, Samuels *et al.* 2000, Boren *et al.* 2001, Constantine 2001, Nowacek *et al.* 2001).

Although there are no known marine mammal watching operations based in the vicinity of the proposed action area, marine mammal watching, especially killer whale watching, in the Greater Puget Sound area is a popular recreational activities among many tourists and the local population, and marine mammals occurring the in action area could use Puget Sound and thus be adversely affected.

4.5.6 MARINE MAMMAL RESEARCH

Research activities permitted under the MMPA and ESA are highly regulated and closely monitored, and may include the incidental taking or harassment of marine mammals in the course of research activities. Many of these permits only allow the incidental harassment of

California sea lions, Pacific harbor seals, Steller sea lions, gray whales, and killer whales during studies of other marine mammal species in the vicinity. Most marine mammal surveys introduce no more than increased vessel traffic impacts to the environment.

Currently, there are at least seven active research permits within the Greater Puget Sound region that allow activities that have the potential to result in either Level A or Level B harassment (*e.g.*, vessel/aerial surveys, photo-identification, collection of sloughed skin, tagging, capture and handling, etc.) of marine mammals. Mortalities may occasionally occur incidental to marine mammal research activities authorized under MMPA permits issued to a variety of government, academic, and other research organizations. Between 2002-2006, there were a total of 12 reported incidental mortalities resulting from research on the eastern stock of Steller sea lions, which resulted in an annual average of 2.4 mortalities per year from this stock (Allen and Angliss 2010).

4.5.7 SUMMARY OF CUMULATIVE EFFECTS

All of the issues noted above are likely to have some level of impact on marine mammal populations in the area. Although commercial harvest no longer takes place and existing subsistence harvest is set by quotas, scientific research activities, whale watching, coastal construction and development, marine pollution, and disease continue to result in some level of impact to marine mammal populations in the area. Nonetheless, the proposed Manette Briege replacement project would only add negligible additional impacts to marine mammals in the project area due to the limited project footprint and limited duration within the action area.

The construction and demolition activities associated with the bridge replacement project are well planned to minimize impacts to the biological and physical environment of the areas by implementing mitigation and monitoring protocols. Therefore, NMFS has determined that the WSDOT's Manette Bridge replacement project would not have a significant cumulative effect on the human environment, provided that the mitigation and monitoring measures described in Sections 2.3.8 and 2.3.9 are implemented.

5 LIST OF PREPARERS

Shane Guan
Fishery Biologist
Office of Protected Resources
NOAA/National Marine Fisheries Service
Silver Spring, MD

6 LITERATURE CITED

Abbott, R., and E. Bing-Sawyer. 2002. Assessment of pile driving impacts on the Sacramento blackfish (*Othodon microlepidotus*). Draft report prepared for Caltrans District 4. October 10, 2002.

Abbott, R.R., J.A. Reyff and G. Marty. 2005. Monitoring the Effects of Conventional Pile Driving on Three Species of Fish. Final Report, submitted to Manson Construction Company, Richmond, California (April 8, 2005). 131 p.

Allen. B. M., and R. P. Angliss. 2010. Alaska Marine Mammal Stock Assessments, 2009. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. NMFSAFSC-206, 276 p.

Anonymous. 1995. Rescue in Alaska. The Blackfish Sounder - The Newsletter of the Vancouver Aquarium's Killer Whale Adoption Program. No. 3.

Banner, A., and M. Hyatt. 1973. Effects of Noise on Eggs and Larvae of Two Estuarine Fishes. Transaction of the American Fisheries Society 102: 134-136.

Bargmann, G. 1998. Forage Fish Management Plan: A Plan for Managing the Forage Fish Resources and Fisheries of Washington. Washington Department of Fish and Wildlife, Olympia, WA. September.

Bejder, L., S.M. Dawson and J.A. Harraway. 1999. Responses by Hector's dolphins to boats and swimmers in Porpoise bay, New Zealand. Marine Mammal Science 15(32):738-750.

Berger, A. and R. Ladley. 2006. Acoustic tagging of winter steelhead in the Puyallup River: 2006. Puyallup Tribe of Indians, Fisheries Department.

Bigg, M.A. 1985. Status of the Steller sea lion (*Eumetopias jubatus*) and California sea lion (*Zalophus californianus*) in British Columbia. Canadian Special Pububublication Fisheries and Aquatic Science 77. 20 p.

Boren, L.J., N.J. Gemmell and K. Barton. 2001. Controlled approaches as an indicator of tourist disturbance on New Zealand Fur Seals (*Arctocephalus forsteri*). Page 23 in Abstracts of the Southern Hemisphere Marine Mammal Conference 2001, Victoria, Australia, May 29-June 1, 2001.

Bradbury, A., B. Sizemore, D. Rothaus and M. Ulrich. 2000. Stock Assessment of Subtidal Geoduck Clams (*Panopea abrupta*) in Washington. Marine Resources Unit, Fish Management Division, Fish Program, Olympia, WA. January.

Brennan, J. 2004. Riparian functions and the development of management actions in marine nearshore ecosystems. In Proceedings of the DFO/PSAT Sponsored Marine Riparian Experts Workshop, Tsawwassen, BC, February 17-18, 2004, edited by J.P. Lemieux, J.S. Brennan, M. Farrell, C.D. Levings and D. Myers. Canadian Manuscript Report of the Fisheries and Aquatic Sciences No. 2680.

Brennan, J.S., and H. Culverwell. 2004. Marine Riparian: An assessment of riparian functions in marine ecosystems. Seattle, Washington: Washington Sea Grant Program.

Brennan, J.S., K.F. Higgins, J.R. Cordell and V.A. Stamatiou. 2004. Juvenile salmon composition, timing distribution, and diet in marine nearshore waters of central Puget Sound in 2001-2002. King County, Department of Natural Resources and Parks, Seattle WA. 164 pp.

Bryant, P.J., C.M. Lafferty, and S.K. Lafferty. 1984. Reoccupation of Laguna Guerrero Negro, Baja California, Mexico, by gray whales. pp. 375-87. *In:* M. L. Jones, S. L. Swartz and S. Leatherwood (*eds.*) The Gray Whale, Eschrichtius robustus. Academic Press, Inc., Orlando, Florida. xxiv+600pp.

Calambokidis, J., and R.W. Baird. 1994. Status of marine mammals in the Strait of Georgia, Puget Sound and the Juan de Fuca Strait and potential human impacts. Canadian Technical Report of Fisheries and Aquatic Sciences.

CALTRANS. 2002. Biological Assessment for the Benicia Martinez New Bridge Project for NMFS. Prepared by Caltrans for U.S. Department of Transportation, (October 2002). 37 p.

CALTRANS. 2003. Pile driving impacts on the splittail. Administrative draft report. November 13, 2003.

CALTRANS. 2009. Marine Mammal Observations Memo: Observations during East Span Project Pile Driving at Tower F on December 1, 2, 9, and 11, 2008. California Department of Transportation. January 2009.

Carretta, J.V., K.A. Forney, M.S. Lowry, J. Barlow, J. Baker, D. Johnston, B. Hanson, R.L. Brownell Jr., J. Robbins, D.K. Mattila, K. Ralls, M.M. Muto, D. Lynch and L. Carswell. 2010. U.S. Pacific Marine Mammal Stock Assessments: 2009. NOAA-TM-NMFS-SWFSC-453. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA.

Cass, A.J., R.J. Beamish and G.A. McFarlane. 1990. Lingcod (*Ophiodon elongatus*). Canadian Special Publication of Fish and Aquatic Science No. 109.

Clark, C.W., W.T. Ellison, B.L. Southall, L. Hatch, S.M. Van Parijs, A. Frankel, D. Ponirakis. 2009. Acoustic masking in marine ecosystems: intuitions, analysis, and implication. Marine Ecology Progress Series 395:201-222.

Colborn, K. 1999. Interactions between humans and bottlenose dolphins, Tursiops truncates, near Panama City, Florida. Master's Thesis, Duke University, Durham, N.C. 45pp.

Constantine, R. 2001. Increased avoidance of swimmers by wild bottlenose dolphins (*Tursiops truncates*) due to long-term exposure to swim-with-dolphin tourism. Marine Mammal Science 17(4):689-702.

Cope, M., D. St. Aubain and J. Thomas. 1999. the effect of boat activity on the behavior of bottlenose dolphins (*Tursiops truncates*) in the nearshore waters of Hilton Head, South Carolina. Page 37 in Abstracts of the 13th Biennial Conference on the Biology of Marine Mammals, Wailea, Hawaii, November 38-December 3, 1999.

DFOC (Department of Fisheries and Ocean Canada). 2001. Fish Stocks of the Pacific Coast. Pacific Region, Vancouver, BC. Department of Fisheries and Ocean Canada (DFOC).

Dorn, P., and P.N. Best. 2005. Integration of Joint City of Bainbridge Island/Suquamish Tribal Beach Seining Results into Shoreline Management and Salmon Recovery Efforts in Kitsap County, Washington. *In* Proceedings of the 2005 Puget Sound Georgia Basin Research Conference. Online at http://www.engr.washington.edu/epp/psgb/2005psgb/2005proceedings/index.html.

Downing, J. 1983. The Coast of Puget Sound, its Processes and Development. Washington Sea Grant. University of Washington Press, Seattle and London. ISBN 0-295-95944-4. 128pp.

Drake, J., and nine co-authors. 2010. Preliminary Scientific Conclusions of the Review of the Status of 5 Species of Rockfish: Bocaccio (*Sebastes paucispinis*), Canary Rockfish (*Sebastes pinniger*), Yelloweye Rockfish (*Sebastes ruberrimus*), Greenstriped Rockfish (*Sebastes elongatus*) and Redstripe Rockfish (*Sebastes proriger*) in Puget Sound, Washington National Marine Fisheries Service, Northwest Fisheries Science Center. Seattle, WA. 225p

Dunn, J. R. and A. C. Matarese. 1987. A review of the early life history of Northeast Pacific gadoid fishes. Fish Research (Amst.) 5:163-184.

Elasmodiver. 2006. The Elasmodiver Shark and Ray Field Guide. http://www.elasmodiver.com/.

Emmett, R. L., S. A. Hinton, S. L. Stone and M. E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries, Volume II: Species life history summaries. ELMR Report No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD.

Etter, P. 2003. Underwater Acoustic Modeling and Simulation. 3rd Edition. Spon Press, New York.

FHWA (Federal Highway Administration). 2008. Biological Assessment, Endangered Species Act of 1973 Section 7: Manette Bridge Replacement, Bremerton, Kitsap County.

Finlayson, D., 2006. The geomorphology of Puget Sound beaches. Puget Sound Nearshore Partnership Report No. 2006-02. Washington Sea Grant Program, University of Washington. Available at http://pugetsoundnearshore.org.

Finneran, J.J., D.A. Carder, C.E. Schlundt and S.H. Ridgway. 2005. Temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*) exposed to mid-frequency tones. Journal of the Acoustical Society of America 118:2696-2705.

Finneran, J.J., C.E. Schlundt, R. Dear, D.A. Carder and S.H. Ridgway. 2002. Temporary shift in masked hearing thresholds (MTTS) in odontocetes after exposure to single underwater impulses from a seismic watergun. Journal of the Acoustical Society of America 111:2929-2940.

Fisher, W. and D. Velasquez. 2008. Management Recommendations for Washington's Priority Habitats and Species: Dungeness Crab, *Cancer magister*. WDFW. December.

Florida Museum of Natural History. 2006. Ichyology: Biological Profiles. http://www.flmnh.ufl.edu/fish/Gallery/Descript/BigSkate/BigSkate.html.

Foote, A.D., R.W. Osborne and A.R. Hoelzel. 2004. Whale-call response to masking boat noise. Nature 428:910.

Fordjour, K. 2003. Bremerton Dolphin Replacement - Report of Fish Kill. Washington State Department of Transportation, Seattle.

Fresh, K. L., D. J. Small, H. Kim, C. Waldbilling, M. Mizell, M. L. Carr and L. Stamatiou. 2006. Juvenile Salmon Use of Sinclair Inlet, Washington in 2001 and 2002. WDFW Report FPT-05-08. March.

Gaspin, J.B. 1975. Experimental investigations of the effects of underwater explosions on swimbladder fish, 1: 1973 Chesapeake Bay Tests. Naval Surface Weapons Center, White Oak Laboratory, Publication NSWC/WOL/TR 75-58, Silver Springs, Maryland (June 20, 1975). 76 p.

Calambokidis, J., and J. Huggins. 2010. Gray whale deaths - April 2010. http://www.cascadiaresearch.org/Gray%20Whale%20Deaths-April%202010.htm

Gassison, K. J. and B. S. Miller. 1982. Review of the early life history of Puget Sound fishes. Fisheries Research Institute. University of Washington, Seattle, WA.

Gearin, P., B. Pfeifer and S. Jeffries. 1986. Control of California Sea Lion Predation of Winter-run Steelhead at the Hiram M. Chittenden Locks, Seattle, December 1985 - April 1986 with Observations on Sea Lion Abundance and Distribution in Puget Sound. Washington Department of Game , Fishery Management Report: 86-20. Olympia, WA.

Gustafson, R. G., W. H. Lenarz, B. B. McCain, C. C. Schmitt, W. S. Grant, T. L. Builder and R. D. Methot. 2000. Status Review of Pacific Hake, Pacific Cod, and Walleye Pollock from Puget Sound, Washington. NOAA Technical Memorandum NMFS-NWFSC-44. NMFS, Northwest Fisheries Science Center, Seattle WA.

Hart, J. L. 1973. Pacific Fishes of Canada. Bulletin of the Fisheries Research Board of Canada 180.

Hastings, M.C. and A.N. Popper. 2005. Effects of Sound on Fish. Prepared by Jones and Stokes for the California Department of Transportation, Sacramento, California (August 23, 2005). 82 p.

Hildebrand, J. A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Marine Ecology Progress Series 309:5-20.

Hobson, E. S. 1986. Predation on the Pacific sand lance, *Ammodytes hexapterus* (Pices: Ammodytidae), during the transition between day and night in southeastern Alaska. Copeia 1986:223-226.

Holt, M.M., D.P. Noren, V. Veirs, C.K. Emmons and S. Veirs. 2009. Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise. Journal of the Acoustical Society of America 125:27–32.

Hubbs, C. L., and A. B. Rechnitzer. 1952. Report on experiments designed to determine effects of underwater explosions on fish life. California Fish and Game 38: 333-365.

Jeffries.S. J. 1985. Occurrence and distribution patterns of marine mammals in the Columbia River and Adjacent coastal waters of northern Oregon and Washington. In: Marine mammals their interactions with fisheries of the Columbia River and adjacent waters 1980-1982 (Beach *et al.*). Third Annual Report to National Marine Fisheries Service, Seattle, WA. 315 p.

Jeffries, S. J., P. J. Gearin, H. R. Huber, D. L. Saul and D. A. Pruett. 2000. Atlas of seal and sea lion haulout sites in Washington. Washington Department of Fish and Wildlife, Wildlife Science Division, 600 Capitol Way North, Olympia, WA. 150pp.

Jeffries, S., H. Huber, J. Calambokidis and J. Laake. 2003. Trends and status of harbor seals in Washington State: 1978-1999. Journal of Wildlife Management: 67: 208-219.

KCHD (Kitsap County Health District). 2008. 2008 Priority Area Work List for the Pollution Identification and Prevention Program. Funded by Kitsap County Surface And Storm Water Management, Port Orchard, WA.

Kovacs, K. M., and S. Innes. 1990. The impact of tourism on harp seals (*Phoca groenlandica*) in the gulf of St. Lawrence, Canada. Applied Animal Behaviour Science, 26:15-26.

Kruse, G. H., and A. V. Tyler. 1983. Simulation of temperature and upwelling effects on the English sole (*Parophrys ventulus*) spawning season. Canadian Journal of Fisheries and Aquatic Science 40:230-237.

Kruse, S. 1991. the interactions between killer whales and boats in Johnstone Strait, B.C. pages 149-159 in K. Pryor and K.S. Norris, eds. *Dolphin Societies – Discoveries and Puzzles*. University of California Press, Berkeley, CA.

Kastak, D., R.J. Schusterman, B.L. Southall and C.J. Reichmuth. 1999. Underwater temporary threshold shift induced by octave-band noise in three species of pinniped. Journal of the Acoustical Society of America 106:1142-1148.

Laughlin, J., 2007. Underwater Sound Levels Associated with Driving Steel and Concrete Piles near the Mukilteo Ferry Terminal. WSDOT monitoring report.

Loughlin, T. R., D. J. Rugh and C. H. Fiscus. 1984. Northern sea lion distribution and abundance: 1956-80. Journal of Wildlife Management 48:729-740.

Love, M.S., M.M. Yoklavich and L. Thorsteinson. 2002. The rockfishes of the Northeast Pacific. University of California Press, Berkeley, California.

Mann, J., R. C. Connor, L. M. Barre and M.R. Heithaus. 2000. Female reproductive success in wild bottlenose dolphins (*Tursiops* sp.): Life history, habitat, provisioning, and group size effects. Behavioral Ecology 11:210-219.

Mattews, K. 1987. Habitat utilization by recreationally-important bottomfish in Puget Sound: An assessment of current knowledge and future needs. Washington Department of Fisheries Progress Report 264.

Mattews, K. 1990. A comparative study of habitat use by young-of-the-year, subadult, and adult rockfishes on four habitat types in central Puget Sound. Fishery Bulletin 88:223-239.

May, C.W., and G. Peterson. 2003. Kitsap Salmonid Refugia Report. Appendix B In: Shared Strategy for Puget Sound, East Kitsap watershed chapter, Draft, June 29, 2004. 80 p. + appendices.

May, C.W., K. Byrme-Barrantes and L. Barrantes. 2005. Liberty Bay Nearshore Habitat Evaluation and Enhancement Project. Final Report. Liberty Bay Foundation and Lemolo Citizens Club. June 30. Onlien at www.libertybayfoundation.com.

Melnychuk, M.C., D.W. Welch, C.J. Walters, and V. Christensen. 2007. Riverine and early ocean migration and mortality patterns of juvenile steelhead trout (*Oncorhynchus mykiss*) from the Cheakamus River, British Columbia. Hydrobiologia 582(1):55-65.

Methot, R., and I.J. Stewart. 2005. Status of U.S. canary rockfish resource in 2005. Pacific Fishery Management Council, Portland, OR.

Miller, B.S., C. A. Simenstal and L. L. Moulton. 1976. Puget Sound baseline: nearshore fish survey. Fisheries Research Institute. University of Washington, Seattle, WA.

NMFS. 2005a. Status Review Update for Puget Sound Steelhead. 2005 Puget Sound Steelhead Biological Review Team. National Marine Fisheries Service, Northwest Fisheries Science Center. Available at: http://www.nwr.noaa.gov/Publications/Biological-Status-Reviews/loader.cfm?csModule=security/getfile&pageid=35827

NMFS. 2005b. Final Assessment of NOAA Fisheries' Critical Habitat Analytical Review Teams for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead. U.S. Department of Commerce, NOAA Fisheries Protected Resources Division, NMFS Northwest Region, Portland, Oregon (August 2005). http://www.nwr.noaa.gov/Salmon-Habitat/Critical-Habitat/2005-Biological-Teams-Report.cfm.

NMFS. 2008. Recovery Plan for Southern Resident Killer Whales (*Orcinus orca*). Prepared by NOAA/NMFS Northwest Regional Office. Seattle, WA.

NMFS. 2009. Endangered Species Act - Section 7 Consultation Biological Opinion and Magnuson-Stevens Fisheries Conservation and Management Act Essential Fish Habitat Consultation for the Manette Bridge Replacement, Bremerton, Kitsap County, Washington Sixth Field HUC 1711001901. NOAA/NMFS Northwest Regional Office, Seattle, WA. August.

Moulton, L.L., and B.S. Miller. 1987. Characterization of Puget Sound marine fishes: survey of available data. Fisheries Research Institute, School of Fisheries, University of Washington. FRI-UW 8716.

NOAA (National Oceanic and Atmospheric Administration). 1990. West Coast of North America Coastal and Ocean Zones Strategic Assessment: Data Atlas. Vol. 3: Invertebrates and Fish. National Oceanic and Atmospheric Administration, Ocean Assessments Division, Strategic Assessment Branch.

NOAA (National Oceanic and Atmospheric Administration). 1993. Olympic Coast National Marine Sanctuary Final Environmental Impact Statement/Management Plan, Volume 1. Sanctuaries and Reserves Division, Washington, DC. November.

NOAA (National Oceanic and Atmospheric Administration). 2008. Tide and current predictions for the ‘Port Washington Narrows, south entrance’ tidal current station for year 2008. Data accessed on October 8, 2008. Available at: http://tidesandcurrents.noaa.gov/currents08/tab2pc2.html.

Nowacek, S. M., R. S. Wells and A. R. Solow. 2001. Short-term effects of boat traffic on bottlenose dolphins, *Tursiops truncates*, in Sarasota Bay, FL. Marine Mammal Science 17(4):673-688.

NRC (National Research Council). 2003. Ocean Noise and Marine Mammals, Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals. The National Academies Press.

Orca Network. 2008. Gray whale sightings from the vicinity of Manette bridge, Port Washington Narrows Bridge, Dyes Inlet, and Sinclair Inlet. http://www.orcanetwork.org/.

Palsson, W.A. 1990. Pacific cod (*Gadus macrocephalus*) in Puget Sound and adjacent water: biology and stock assessment. Washington Department of Fisheries Technical Report 112.

Palsson, W.A., T.J. Northup and M.W. Barker. 1998. Puget Sound Groundfish Management Plan. WDFW, Olympia, WA. December.

Palsson, W.A., T.-S. Tsou, G.G. Barbman, R.M. Buckley, J.E. West, M.L. Mills, Y.W. Cheng and R.E. Pacunski. 2009. The biology and assessment of rockfishes in Puget Sound. Washington Department of Fish and Wildlife, Olympia WA.

Pearcy, W.G. 1992. Ocean Ecology of North Pacific Salmonids. University of Washington Press, Seattle, WA. 179 p.

Penttila, D.E. 2001. Effects of Overhanging Shading Vegetation on Egg Survival for Summer-Spawning Surf Smelt on Upper Intertidal Beaches in Northern Puget Sound, Washington, Draft. WDFW, Marine Resources Division.

PFMC (Pacific Fisheries Management Council). 2004. Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery as Amended through Amendment 17. Portland, OR.

Phillips, R. C. 1984. The ecology of eelgrass meadows in the Pacific Northwest: A community profile. U.S. Fish and Wildlife Service Report No. FWS/OBS-84/24. September.

Pitcher, K. W., P. F. Olesiuk, R. F. Brown, M. S. Lowry, S. J. Jeffries, J. L. Sease, W. L. Perryman, C. E. Stinchcomb and L. F. Lowry. 2007. Status and trends in abundance and distribution of the eastern Steller sea lion (*Eumetopias jubatus*) population. Fishery Bulletin 107(1):102-115.

Popper, A.N. 2003. Effects of anthropogenic sounds on fishes. Fisheries 28(10): 24-31.

PSWQAT (Puget Sound Water Quality Action Team). 2002. Puget Sound Update 2002: Eighth Report of the Puget Sound Ambient Monitoring Program. Olympia, WA. Puget Sound Water Quality Action Team.

Rice, C. A. 2006. Effects of shoreline modification on a northern Puget Sound beach: microclimate and embryo mortality in surf smelt. Estuaries and Coasts 29(1): 63-71.

Rice, D. W., A. A. Wolman and H. W. Braham. 1984. The gray whale, *Eschrichtius robustus*. Marine Fisheries Review 46(4):7-14.

Richardson, W. J., Greene, C. R., Malme, C. I., & Thomson, D. H. 1995. *Marine Mammals and Noise*. San Diego, California: Academic Press.

Ruggerone, G.T., S. Goodman, and R. Miner. 2008. Behavioral response and survival of juvenile coho salmon exposed to pile driving sounds. Report to Port of Seattle. February. 16 pp. + figs.

Rugh, D. J., K. E. W. Shelden and A. Schulman-Janiger. 2001. Timing of the southbound migration of gray whales. Journal of Cetacean Research and Management 3(1):31-39.

Samuels, A. and L. Bejder. 1998. Habitual interactions between humans and wild bottlenose dolphins (*Tursiops truncates*) near Panama City Beach, Florida. Report to the Marine Mammal Commission, Silver Spring, MD. 13 pp.

Schlundt, C.E., J.J. Finneran, D.A. Carder and S.H. Ridgway. 2000. Temporary shift in masked hearing thresholds (MTTS) of bottlenose dolphins and white whales after exposure to intense tones. Journal of the Acoustical Society of America 107:3496-3508.

Sexton, T., Underwater Sound Levels Associated with Pile Driving during the Anacortes Ferry Terminal Dolphin Replacement Project. WSDOT monitoring report

Shannon and Wilson. 2007. Bremerton Sewer Replacement and Public Access Subsurface Investigation and Preliminary Geotechnical Engineering. Prepared for Parametrix, Inc. and the City of Bremerton, Public Works Department by Shannon and Wilson, Inc.

Simenstad, C.A., and W.J. Kenney. 1978. Trophic relationships of outmigrating chum salmon in Hood Canal, 1977. Final Report FRI-UW-7810. University of Washington, Fisheries Reserch Institute, Seattle, WA.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas and P.L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33(4):411-522.

Stewart, I.J. 2007. Status of the U.S. canary rockfish resource in 2007. Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, 2130 SW Fifth Ave., Suite 224, Portland OR. 362 p.

Stotz, T., and J. Colby. 2001. January 2001 Dive Report for Mukilteo Wingwall Replacement Project. Washington State Department of Transportation, Washington State Ferries Memorandum, Seattle, Washington (April 30, 2001). 19 p.

Stroetz, R.W., N.E. Vlahakis, B.J. Walters, M.A. Schroeder, and R.D. Hubmayr. 2001. Validation of a new live cell strain system: Characterization of plasma membrane stress failure. Journal of Applied Physiology 90: 2361-2370.

Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. McLellan and D.A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. Marine Mammal Science 9:309-315.

Tolimieri, N., and P.S. Levin. 2005. The roles of fishing and climate in the population dynamics of bocaccio rockfish. Ecological Applications 15:458-468.

Trumble, R. 1983. management Plan for Baitfish Species in Washington State. Department of Fisheries Progress Report No. 195.

Turnpenny, A.W.H., K.P. Thatcher and J.R. Nedwell. 1994. The effects on fish and other marine animals of high-level underwater sound. Fawley Aquatic Research Laboratory, Ltd., Report FRR 127/94, United Kingdom (October 1994). 79 p.

URS Greiner. 1999. Sinclair Inlet Existing Conditions Data Compilation. Prepared for the U.S. Navy, Naval Facilities Engineering Command, Engineering Field Activity, Northwest.

Vlahakis, N.E., and R.D. Hubmayr. 2000. Plasma membrane stress failure in alveolar epithelial cells. Journal of Applied Physiology 89: 2490-2496.

WDFW. 1997. Forage Fish. http://www.wdfw.wa.gov/fish/forage/forage.htm.

WDFW. 2002. Washington State Salmonid Stock Inventory. Species stock status and distribution data for WRIA 15. Washington Department of Fish and Wildlife, Olympia, Washington. Website viewed October 17, 2008. Last updated 2002. Available at: <http://wdfw.wa.gov/fish/sasi/>.

WDFW. 2003. Salmonscape. http://www.wdfw.wa.gov/mapping/salmonscape.
WDFW. 2004. Priority Habitats and Species GIS Maps and Reports for the following Quadrangles: Brinnon, Eldon, Holly, Lofall, Poulsbo, Quilcene, Seabeck, Suquamish, Taholah, and Tunnel Island. 16 June.
WDFW. 2008. Salmonscape Database. Washington Department of Fish and Wildlife. Salmonid distribution data for Sinclair Inlet, Dyes Inlet, and vicinity. Website viewed April 1 4, 2008. Available at: <http://wdfw.wa.gov/mapping/salmonscape/index.html>.
WDOE (Washington Department of Ecology). 2009. Washington Department of Ecology Environmental Information Management System, water quality monitoring data for sampling locations PS-16-07-R, PS-01-07-R, PS-10-07-R, PS-17-02-R, and PS-07-03-R. Data downloaded on June 2, 2009. Available at: http://apps.ecy.wa.gov/eimreporting/Search.asp.
Welch, D.W., B.R. Ward and S.D. Batten . 2004. Early ocean survival and marine movements of hatchery and wild steelhead trout (*Oncorhynchus mykiss*) determined by an acoustic array: Queen Charlotte Strait, British Columbia. Deep Sea Research Part II: Topical Studies in Oceanography 51(6-9):897-909. Oceanography of the Eastern Pacific, Volume III.
Wells, R.S., and M.D. Scott. 1997. seasonal incidence of boat strikes on bottlenose dolphins near Sarasota, Florida. Marine Mammal Science, 13(3):475-480.
West, J. 1997. Protection and restoration of marine life in the inland waters of Washington State. Puget Sound/Georgia Basin Envirnmental Report Series No. 6. Prepared for the Puget Sound/Georgia Basin International Task Force.
Wiles, G.J. 2004. Washington State status report for the killer whale. Washington Department Fish and Wildlife, Olympia, Washington.
Wiley, D.N., R.A. Asmutis, T.D. Pitchford and D.P. Gannon. 1995. Stranding and mortality of humpback whales, *Megaptera novaeangliae*, in the mid-Atlantic and southeast United States, 1985-1992. Fishery Bulletin 93:196-205.
Williams, R.W., R.M. Laramie and J.J. Ames. 1975. A catalog of Washington strems and salmon utilization. Volume 1: Puget Sound Region. Washington Department of Fisheries, Olympia, WA. November.
WSDOT. 2009. Request for an Incidental Harassment Authorization under the Marine Mammal Protection Act. Prepared by Tara Chestnut and Hans Purdom, Washington State Department of Transportation Olympic Region, Environmental and Hydraulic Services, Olympia, WA.
Yamanaka, K.L., and A.R. Kronlund. 1997. Inshore rockfish stock assessment for the west coast of Canada in 1996 and recommended yields for 1997. Can. Tech. Rep. Fish. Aquat. Sci. 2175.
Yelverton, J.T., and D.R. Richmond. 1981. Underwater explosion damage risk criteria for fish, birds, and mammals. 102nd Meeting of the Acoustical Society of America, November 30 - December 4, Miami Beach, Florida. Department of Biodynamics, Lovelace Biomedical and Environmental Research Institute, Alberquerque, New Mexico.
Yelverton, J.T., D.R. Richmond, R.E. Fletcher and R.K. Jones. 1973. Safe Distance from Underwater Explosions for Mammals and Birds. Lovelace Foundation for Medical Education and Research, Albuquerque, New Mexico. 64 p.

7 APPENDIX A - COMMENTS RECEIVED ON THE APPLICATION

MARINE MAMMAL COMMISSION

21 April 2010

Mr. P. Michael Payne, Chief
Permits, Conservation, and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway, Room 13635
Silver Spring, Maryland 20910

Dear Mr. Payne:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the application submitted by the Washington State Department of Transportation under section 101(a)(5)(D) of the Marine Mammal Protection Act. The agency is seeking authorization to take small numbers of Pacific harbor seals, California sea lions, and gray whales incidental to replacing the Manette Bridge in Bremerton, Washington. The principal means of taking would be by disturbance resulting from construction activity and noise, primarily from pile driving. The Commission also has reviewed the National Marine Fisheries Service's 22 March 2010 *Federal Register* notice (75 Fed. Reg. 13513), announcing receipt of the application and requesting comments on its proposal to issue the authorization, subject to certain conditions.

The Service has preliminarily determined that, taking into consideration implementation of the proposed mitigation and monitoring measures (e.g., limited use of impact hammers for pile driving, the use of an air-bubble curtain during impact pile driving, safety zones and shutdown requirements, and visual and acoustic monitoring of safety zones), the Manette Bridge replacement project will result in the incidental take of small numbers of Pacific harbor seals, California sea lions, and gray whales by Level B harassment only, and that the total taking from the activity will have a negligible impact on the affected species or stocks.

RECOMMENDATION

Based on the information provided, the Marine Mammal Commission concurs with the Service's preliminary determination and recommends that the National Marine Fisheries Service issue the requested authorization, provided that the monitoring and mitigation activities proposed in the *Federal Register* notice are carried out as described.

Please contact me if you have any questions concerning this recommendation.

Sincerely,

Timothy J. Ragen

Timothy J. Ragen, Ph.D.
Executive Director

RECEIVED 04-27-10 PR1

4340 East-West Highway • Room 700 • Bethesda, MD 20814-4498 • T: 301.504.0087 • F: 301.504.0099
www.mmc.gov

Subject:
Proposed incidental harassment authorization for Manette Bridge Replacement in Bremerton, Washington
From:
Robin <Robinh940138@comcast.net>
Date:
Tue, 23 Mar 2010 10:21:05 -0700
To:
0648-XU03@noaa.gov

I believe the state has a good plan to mitigate any disturbance to wildlife during the proposed construction of the new Manette Bridge and would hope that the they would be given any authorizations in a timely manner so as not to increase costs to the taxpayers.

Sincerely,

Robin Henderson
2704 E 13th st
Bremerton, Wa. 98310