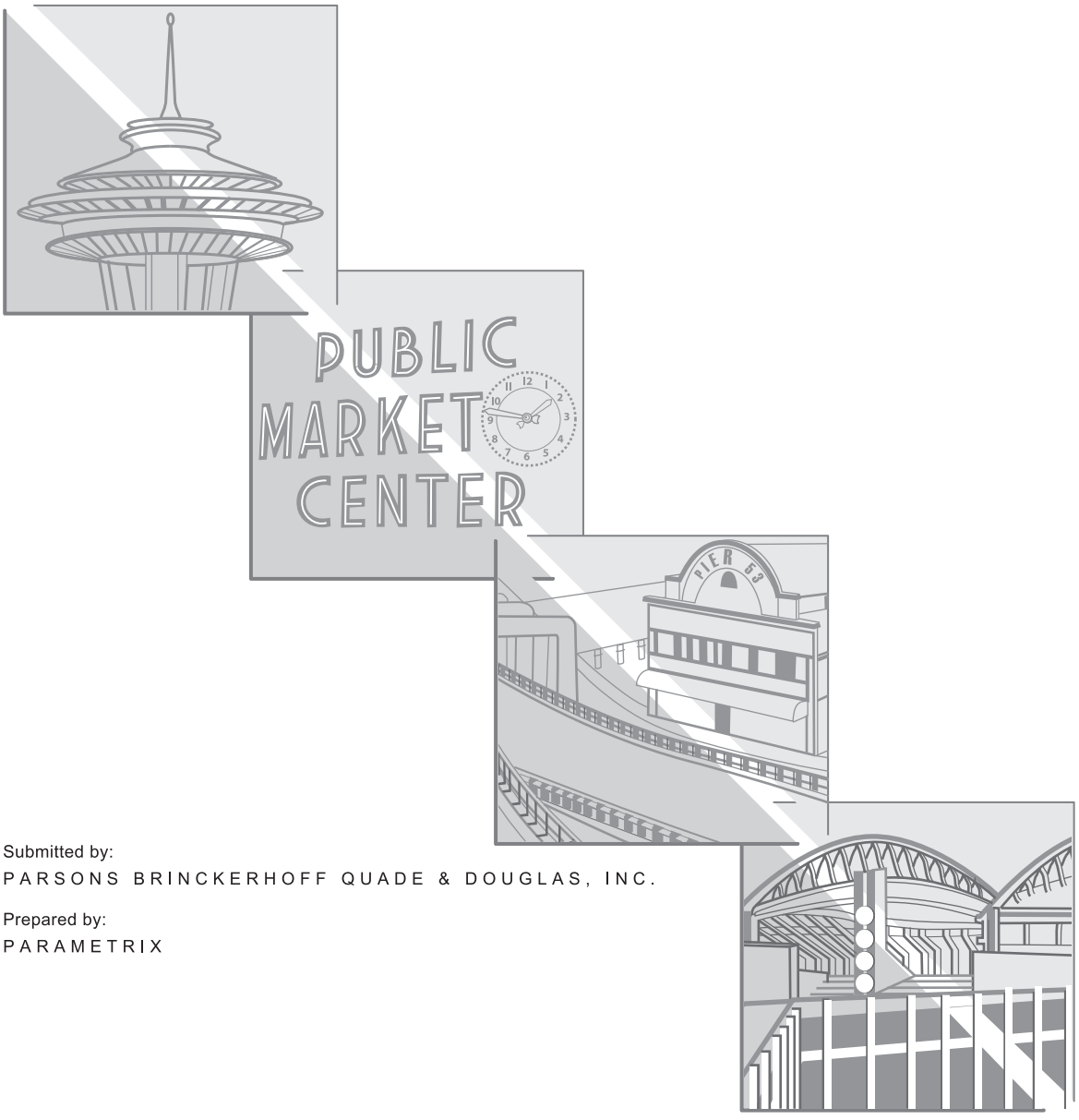
SR 99: ALASKAN WAY VIADUCT & SEAWALL REPLACEMENT PROJECT

Supplemental Draft Environmental Impact Statement

APPENDIX R

Fisheries, Wildlife, and Habitat Discipline Report



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U.S. Department of Transportation
Federal Highway Administration

Washington State
Department of Transportation

City of
Seattle

SR 99: ALASKAN WAY VIADUCT & SEAWALL REPLACEMENT PROJECT

Supplemental Draft EIS
Fisheries, Wildlife, and Habitat Discipline Report

AGREEMENT NO. Y-7888

FHWA-WA-EIS-04-01-DS

Submitted to:

Washington State Department of Transportation
Alaskan Way Viaduct and Seawall Replacement Project Office
999 Third Avenue, Suite 2424
Seattle, WA 98104

The SR 99: Alaskan Way Viaduct & Seawall Replacement Project is a joint effort between the Washington State Department of Transportation (WSDOT), the City of Seattle, and the Federal Highway Administration (FHWA). To conduct this project, WSDOT contracted with:

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Tom Warne and Associates, LLC
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LIST OF EXHIBITS

ACRONYMS

AWV	Alaskan Way Viaduct and Seawall Replacement
BMP	best management practice
dB (re 1 μPa)	decibels with reference to one micropascal
DPS	distinct population segment
EFH	essential fish habitat
EIS	environmental impact statement
ESA	Endangered Species Act
FHWA	Federal Highway Administration
ft^2	square feet
ft^3	cubic feet
m	meters
MHHW	mean higher high water
NMFS	National Marine Fisheries Service
SEL	sound exposure level
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

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PREFACE

The technical appendices present the detailed analyses of existing conditions and predicted effects of each alternative. The results of these analyses are summarized and presented in the main text of the Supplemental Draft Environmental Impact Statement (EIS).

The Supplemental Draft EIS appendices are intended to add new information and updated analyses to those provided in the Draft EIS, published in March 2004. Information that has not changed since then is not repeated in these appendices. Therefore, to get a complete understanding of the project area conditions and projected effects, you may wish to refer to the appendices that were published with the Draft EIS. These are included on a CD in the Supplemental Draft EIS. To make it easier to understand where there is new information or analyses, the supplemental appendices present information in the same order as it was presented in the Draft EIS appendices.

The Supplemental Draft EIS and the technical appendices evaluate the effects of three construction plans: the shorter plan, the intermediate plan, and the longer plan. These plans vary in how long SR 99 would be completely closed, in how long the periodic closures may be, and in the total construction duration. For the purposes of the analyses in the technical appendices, two construction plans are evaluated with the Tunnel Alternative and one plan is evaluated with the Elevated Structure Alternative. However, each alternative could be built with any of the three plans. The construction durations and the sequencing would not be the same for a particular construction plan if paired with a different alternative; however, the effects would be within the ranges presented by the analyses.

There are several differences in how the information is presented between the main text of the Supplemental Draft EIS and how it is presented in these appendices. The Supplemental Draft EIS text refers to possible variations within the alternatives as "choices" while these appendices use the term "options." (For example, Reconfigured Whatcom Railyard versus Relocated Whatcom Railyard is referred to as a design choice in the Supplemental Draft EIS and as an option in the appendices.) In either case, the intent is to describe the various configurations that could be selected and the effects for each design.

One design choice in particular is handled very differently between the Supplemental Draft EIS text and the technical appendices. For the Tunnel Alternative in the central waterfront area, there is a choice between a stacked tunnel alignment and a side-by-side tunnel alignment. In the appendices, to simplify the discussion, these two alignments, as well as the Elevated Structure

Alternative, are each paired with a different set of options throughout the corridor and presented as complete sets that are evaluated separately. The Supplemental Draft EIS text communicates this information differently by describing one Tunnel Alternative and one Elevated Structure Alternative and evaluating the effects of the different design choices (or mix-and-match components) separately. While it may appear that there are three alternatives analyzed in the appendices and two in the Supplemental Draft EIS text, there are in fact only two alternatives. Each alternative has many potential components or design choices that can be made throughout the corridor.

The organization of the analysis of the alternatives is also a little different between the main body of the Supplemental Draft EIS and the appendices. In the Supplemental Draft EIS text, we identify two alternatives: a Tunnel Alternative and an Elevated Structure Alternative. The Supplemental Draft EIS text compares these alternatives directly by comparing effects (for example, the effects of both alternatives on water quality are presented together). The appendices present the effects of each alternative separately (for example, all of the effects of the Tunnel Alternative are presented first, followed by all of the effects of the Elevated Structure Alternative). The substance of both discussions is the same. The organization of the Supplemental Draft EIS technical appendices mirrors that of the Draft EIS appendices, allowing you to more easily find comparable information in the Draft EIS appendices.

Chapter 1 SUMMARY

This discipline report supports the analyses in the Supplemental Draft Environmental Impact Statement (EIS) for the Alaskan Way Viaduct and Seawall Replacement (AWV) Project. The proposed alternatives have been updated for the replacement of the Alaskan Way Viaduct and Seawall. This report uses the information currently available to assess and describe the potential impacts to the fish, wildlife, and habitat potentially affected. For detailed information on the updated alternatives, see the 2006 Supplemental Draft EIS Appendix B, Alternatives Description and Construction Methods Technical Memorandum.

The Draft EIS (WSDOT et al. 2004) evaluated five Build Alternatives and a No Build Alternative. In December 2004, the lead agencies narrowed the five alternatives down to two—Tunnel and Rebuild. They identified the Tunnel Alternative as the Preferred Alternative and carried the Rebuild Alternative forward for analysis as well. Since that time, the engineering and design have been updated and refined for the Tunnel and Rebuild Alternatives. Due to the magnitude of the changes in the design of the Rebuild Alternative, it has been renamed the Elevated Structure Alternative. The Elevated Structure Alternative combines elements of the Aerial and Rebuild Alternatives that were evaluated in the Draft EIS.

The fish, wildlife, and habitat resources potentially affected by these alternatives are still within the estuarine habitat along the Seattle waterfront. Most of the biological and habitat conditions along this area have not changed since the Draft EIS was prepared. This discipline report focuses only on the changes to the project that have occurred since the Draft EIS was issued and the resulting biological and habitat effects of these changes.

1.1 Existing Environment

The fish, wildlife, and vegetation resources potentially affected by replacement of the Alaskan Way Seawall and the viaduct are primarily those associated with the shallow water environment along Seattle's Elliott Bay. The biological resources of this area occur in previously altered habitat that resulted from the original construction of the seawall at a location seaward of the natural shoreline, filling of intertidal and shallow subtidal areas, and construction of piers over much of the remaining shallow water area. This shoreline is the transition zone between the natural subtidal and open-water habitat of Elliott Bay and the highly urbanized habitat of Seattle.

The following key changes in the list of species protected under the federal Endangered Species Act (ESA) have occurred since publication of the Draft EIS:

- The southern resident killer whale (*Orcinus orca*) is now listed under the ESA and as an endangered species by Washington State.
- The marbled murrelet (*Brachyramphus marmoratus*) is listed as a threatened species under the ESA and by Washington State. Potential effects of pile driving on the marbled murrelet have been added to this evaluation.
- The Puget Sound steelhead distinct population segment (DPS) (*Oncorhynchus mykiss*) is proposed for listing under the ESA as a threatened species.

No other additional species have been identified as occurring within the area potentially affected by the AWV Project since publication of the Draft EIS, and no changes have been identified to essential fish habitat (EFH) (as defined by the Magnuson-Stevens Act) for species likely to occur within the project area. However, final critical habitat has been designated for Chinook salmon and bull trout since the Draft EIS was published. Critical habitat for Chinook salmon includes the nearshore areas of Elliott Bay, from the extreme high tide mark to a depth of about 98 feet (ft) (30 meters [m]). The critical habitat for bull trout also includes the nearshore areas of Elliott Bay, from mean higher high water (MHHW) to a depth of 33 ft (10 m).

1.2 Proposed Project

This report focuses on the seawall portion of the project along the edge of Elliott Bay because the only fish, wildlife, and vegetation resources that occur within the project area are those associated with Elliott Bay and the shoreline habitat. The following key changes in the proposed project have occurred since the Draft EIS was issued:

- The Tunnel Alternative options have changed, moving the new seawall closer to the existing shoreline in the Pier 48 to Colman Dock area.
- The Elevated Structure Alternative now places the new seawall farther into Elliott Bay at some locations than the Rebuild Alternative described in the Draft EIS.

The conditions of the aquatic portion of the project area have not changed substantially since the Draft EIS. The project still involves the Seattle waterfront from the mouth of the Duwamish River East Waterway to Broad Street (Township 24N, Range 4E, Section 32). The existing Seattle waterfront was filled and had bulkheads constructed from the late 1800s through the early 1900s. Upland portions of the project extend from S. Spokane Street at

the southern end through the Battery Street Tunnel up to Comstock Street on the north.

The Tunnel and Elevated Structure Alternatives would both replace the existing seawall. The new seawall would be within the plane or landward of the existing seawall except in the area from Pier 48 to Colman Dock. Replacing the seawall would require some in-water work between Pier 48 and Colman Dock. Both tunnel alignments and the Elevated Structure Alternative evaluated in this report would fill a portion of the shallow water habitat. This fill would decrease the bottom surface area by 6,060 to 13,880 square feet (ft^2) and the water volume by 80,996 to 193,410 cubic feet (ft^3).

Subsequent removal of the existing seawall would return a narrow strip of previously filled area to Elliott Bay's aquatic habitat along 5,750 ft of shoreline. This change would include an increase of 14,620 to 20,565 ft^2 of bottom surface and 195,272 to 265,574 ft^3 of water volume between Colman Dock and Broad Street.

The seawall north of Broad Street was included as part of the AWV Project described in the Draft EIS. That section is now part of the Olympic Sculpture Park project and is currently under construction.

1.3 Environmental Changes

North of Colman Dock, portions of the new seawall would be built in the same plane as or slightly upland of the existing seawall, with a total of 6,670 ft of construction behind the existing seawall. Several of the waterfront areas north of Colman Dock have existing fill on the seaward side of the seawall.

The Tunnel Alternative would decrease the area and volume of aquatic habitat within Elliott Bay and would eliminate all intertidal riprap and gravel habitat between Pier 48 and Colman Dock, as well as some shallow subtidal habitat (-4 to -30 ft mean lower low water [MLLW]). From Colman Dock to about Broad Street (Pier 70), the Tunnel Alternative would replace the existing vertical seawall with a new vertical seawall.

Between Pier 48 and Colman Dock, the stacked tunnel alignment would decrease shallow subtidal habitat by about 10,000 ft^2. The total volume of open-water habitat would decrease by approximately 134,977 ft^3. The side-by-side tunnel alignment would decrease shallow subtidal habitat by about 13,880 ft^2 and the volume of open-water habitat by 193,410 ft^3.

The Elevated Structure Alternative would decrease shallow shoreline habitat by about 6,060 ft^2 and the volume of open-water habitat by about 80,996 ft^3. Exhibit 1-1 summarizes changes in the amounts of habitat that would occur from Pier 48 to Colman Dock with the Tunnel and Elevated Structure

Alternatives. The amounts of change by depth ranges are provided in more detail in Exhibit 5-1.

During construction, a temporary sheet pile wall or other containment structure would be placed adjacent to the existing seawall at active construction areas. Placing the sheet pile would require removal of the existing riprap at the base of the seawall and possibly later replacement of the riprap. The existing seawall would then be removed and replaced by a new seawall at the same location (worst-case assumption), other than between Pier 48 and Colman Dock.

Another option is to install silt curtains or other equivalent means of protection. The sheet pile wall and silt curtains are included to avoid turbidity and sedimentation in the adjacent habitat that could occur during removal of the existing seawall and construction of the new seawall.

Exhibit 1-1. Changes in Shoreline Habitat for Each Alternative

Alternative	Pier 48 to Colman Dock			
	Bottom Habitat (ft^2)	Volume (ft^3)	Temporary Shaded Area (ft^2)	Permanent Shaded Area (ft^2)
Tunnel				
Stacked Tunnel Alignment (Preferred)	-10,000	-134,977	14,180	0
Side-by-Side Tunnel Alignment (Option)	-13,880	-193,410	14,230	0
Elevated Structure	-6,060	-80,996	14,180	5,100

A temporary ferry access bridge would be constructed over open-water habitat between Pier 48 (near S. Jackson Street) and Colman Dock to provide ferry access during construction. This temporary bridge would be built during the first stage of construction and would be removed in the final stage, so it would likely be in place between 6.0 and 7.75 years, depending on the alternative selected. Temporary construction impacts (pile driving and removal and shading shallow water habitat) over about 14,180 to 14,230 ft^2 of shallow subtidal habitat would be associated with the construction of this structure. To help maintain pedestrian access along the waterfront, the project partners are also considering the feasibility of constructing temporary over-water pedestrian walkways between some piers.

Neither of the two tunnel alignments would increase the amount of shaded area along the Elliott Bay shoreline following completion of construction. The Elevated Structure Alternative would have the sidewalk overhanging the new seawall between Pier 48 and Colman Dock and the Washington Street Boat

Landing relocated over water adjacent to the sidewalk. The sidewalk and boat landing would overhang about 5,100 ft^2 of open-water habitat. The existing Washington Street Boat Landing pergola currently overhangs an area of about 2,260 ft^2.

The stacked and side-by-side tunnel alignments currently under consideration would affect less shoreline habitat between Pier 48 and Colman Dock than the tunnel alternatives analyzed in the Draft EIS. The Elevated Structure Alternative would also reduce intertidal habitat supporting juvenile Chinook salmon, bull trout, and other salmonids, but by a lesser amount than the stacked tunnel alignment between Pier 48 and Colman Dock. The Elevated Structure Alternative also includes a new sidewalk overhanging the adjacent open-water habitat. For either alternative, the upland portion of Pier 48 could be excavated to construct replacement habitat of improved quality for the habitat lost between Pier 48 and Colman Dock. With regard to the aquatic areas, the only clear difference between the tunnel alignments and the Elevated Structure Alternative is the amount of shallow water habitat affected in the Pier 48 to Colman Dock area.

Human disturbance during construction and temporary localized sedimentation are other potential effects of the project. Construction would follow best management practices (BMPs) (see Chapter 9, Construction Mitigation) and isolate shoreline work areas from Elliott Bay with a temporary sheet pile wall (or other contractor-selected means) to protect Elliott Bay habitat and avoid inadvertent release of materials.

Temporal effects along the seawall would include the installation of the temporary sheet pile wall, isolating narrow bands of shallow water habitat adjacent to the seawall during construction. Construction at various seawall locations would take approximately 1 year from installation of the temporary sheet pile wall to completion of the new seawall and removal of the temporary sheet pile.

1.4 Fish, Wildlife, and Habitat Effects

Changes to the intertidal and shallow subtidal habitat along the shoreline would be similar to those identified in the 2004 Draft EIS Appendix R, Fisheries, Wildlife, and Habitat Discipline Report. However, the amounts of habitat altered would change at various locations.

Potential direct effects resulting from seawall reconstruction may include (1) temporary changes to invertebrate and algal resources in the area of benthic habitat disruption (along the existing seawall and the adjacent area extending to the temporary sheet pile wall) and (2) destruction of the existing flora and fauna by placing sheet pile, removing and placing riprap, and removing the existing seawall.

In addition to the nonmigratory species, the project would affect juvenile Chinook salmon, bull trout, and steelhead migrating and rearing along the Seattle shoreline. However, these effects would be minimized by restricting in-water work during their migration period (March 15 to June 14 per Washington Administrative Code [WAC] 220-110-271) or longer, depending on permit conditions, and by following BMPs for fish exclusion and noise attenuation. Some juvenile salmonids may be present in the project vicinity outside the WAC-specified period. Within the construction site, the temporary sheet pile wall or other contractor-selected means selected to protect Elliott Bay would contain any construction or demolition materials. The containment measures would be installed outside the juvenile migration period.

No substantive changes in potential impacts on bald eagles and their forage habitat along the Seattle waterfront have been identified since the Draft EIS was issued. Potential effects on wintering bald eagles would be limited to increased construction activity along the seawall, where human activity is currently intense. There is no natural intertidal habitat within the project area.

The opportunities to restore habitat functions that were previously identified for various locations along the Seattle shoreline have not changed (see the 2004 Draft EIS Appendix R, Attachment D, Habitat Restoration Opportunities Memorandum). Opportunities for habitat enhancement and restoration will be identified and developed through coordination with other projects and City of Seattle planning efforts underway along Seattle's central waterfront.

Chapter 2 METHODOLOGY

2.1 Data Collection

Data for the Draft EIS were collected from available published sources as well as directly from resource agencies, and no new data have been collected. However, for the Supplemental Draft EIS, project engineers have provided new information on the physical aspects of the alternatives for the Alaskan Way Seawall and the Alaskan Way Viaduct that would potentially alter the existing habitat characteristics and the biota inhabiting the project area.

2.2 Existing Conditions Information

Existing conditions were identified in the Draft EIS and have not changed substantively (see the 2006 Supplemental Draft EIS and 2004 Draft EIS Appendix B, Alternatives Description and Construction Methods Technical Memorandum). This includes both existing data sources and several reconnaissance surveys by Parametrix biologists (March 4, May 14, and June 4–5, 2002). The same information previously collected for habitat physical and biological characteristics was used to evaluate existing baseline conditions for the analysis and discussion of potential impacts. Information was previously gathered to identify all species of fish, wildlife, and vegetation known or likely to occur within the project area.

Analysis of EFH involves identification of habitat potentially occurring within the project area and the habitat characteristics important to those species. EFH has been defined for the purposes of the Magnuson-Stevens Act as "*those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity*" (NMFS 1999). No changes to the EFH analysis have occurred since the Draft EIS was prepared. However, final critical habitat has been designated for Chinook salmon and bull trout since the Draft EIS was published. Critical habitat for Chinook salmon includes the nearshore areas of Elliott Bay, from the extreme high tide mark to a depth of about 98 ft (30 m). The critical habitat for bull trout also includes the nearshore areas of Elliott Bay, from mean higher high water to a depth of 33 ft (10 m).

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Chapter 3 STUDIES AND COORDINATION

No new studies have been conducted for the Supplemental Draft EIS.

Since preparation of the Draft EIS, coordination has continued with the following agencies and tribes:

- National Marine Fisheries Service (NMFS)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- Muckleshoot Tribe
- Suquamish Tribe
- Snoqualmie Tribe
- Duwamish Tribe
- Tulalip Tribes
- Washington Department of Fish and Wildlife
- Washington Department of Natural Resources
- Washington State Department of Ecology
- City of Seattle
- Port of Seattle
- The Seattle Aquarium
- King County
- University of Washington, Fisheries Research Institute

Recent information gathered from agencies and existing information sources included:

- Species recently listed and proposed under the ESA.
- Fish and invertebrate species present and use of habitat within the project area.
- Information on impacts to species from potential construction and operation features.

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Chapter 4 AFFECTED ENVIRONMENT

The affected environment remains essentially the same as described in Chapter 4 of the 2004 Draft EIS Appendix R, Fisheries, Wildlife, and Habitat Discipline Report. Minor physical modifications have not materially changed the environment.

The project area has changed slightly. The north end of the project has been extended from Ward Street to Comstock Street. The Elliott Bay shoreline portion of the AWV Project extends to Broad Street, south of Bay Street, which was previously the north limit of the seawall.

The seawall along the shoreline (Exhibit 4-1) is where fish, wildlife, and vegetation resources may be affected. Since the early 1900s, the natural habitat at intertidal and shallow subtidal elevations along the seawall has been replaced by riprap or vertical concrete and wood substrate and upland fill. Exhibit 4-2 shows the types of seawall that currently exist within the project area.

The City of Seattle recently placed new riprap along a small section of the seawall in the area immediately south of the Seattle Aquarium. Physical conditions along other areas of the seawall have not changed since the Draft EIS was issued.

Fish and habitat resources potentially affected by the project alternatives remain unchanged, although two additional species are evaluated under the ESA.

4.1 Endangered, Threatened, and Proposed Species and Habitat

Since the Draft EIS was issued, updated records of species listed and proposed for listing under the ESA by NMFS and USFWS were obtained from their respective websites on July 6, 2005, at http://www.nwr.noaa.gov/ESA-Salmon-Listings/Index.cfm and http://endangered.fws.gov/wildlife.html#Species. The updated list includes marbled murrelets, southern resident killer whales, and Puget Sound steelhead DPS. Marbled murrelets have been identified as a threatened species potentially occurring occasionally within the project's ESA action area, and southern resident killer whales are now listed. The Puget Sound steelhead DPS is proposed for listing. Additional Washington State listed species (endangered, threatened, or candidate) that might occur in the project vicinity due to their mobility and habitat preferences include those listed in Exhibit 4-3. Habitat supporting sensitive life stages of these species is not present in the project area, and the presence of these species is very unlikely due to the urbanized nature of the project area.

Exhibit 4-1. Alaskan Way Seawall Structure Locations

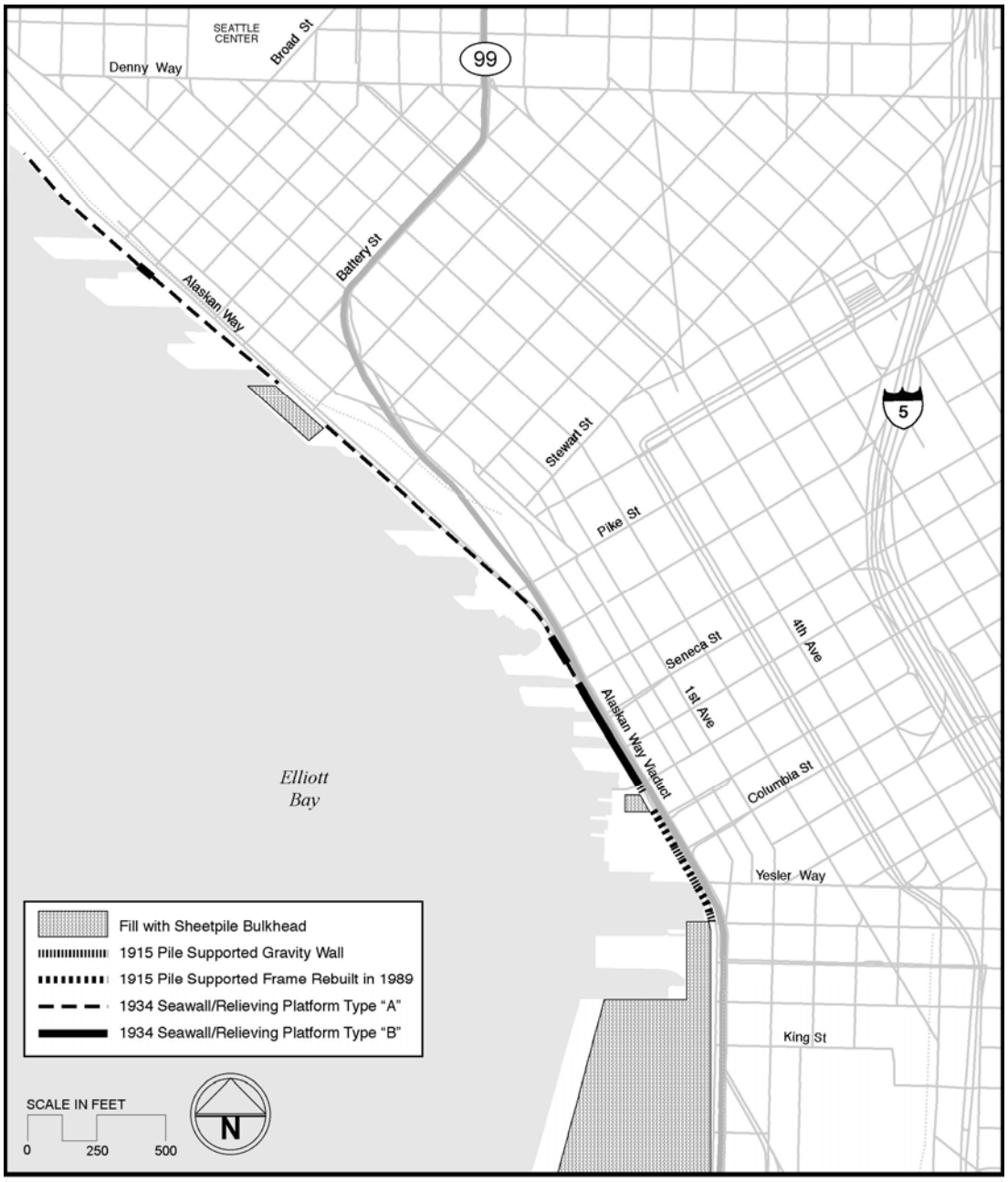
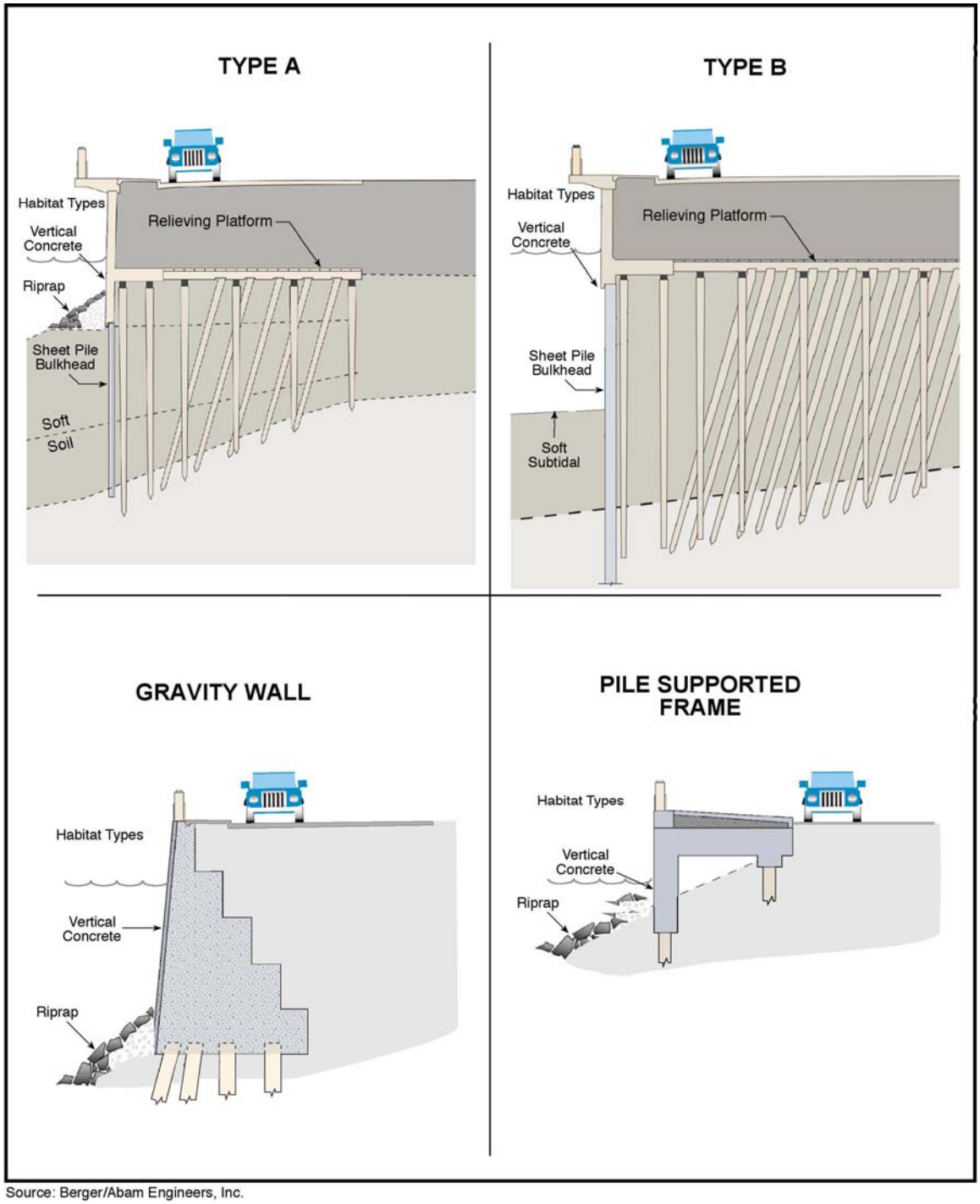


Exhibit 4-2. Cross Sections of Various Existing Alaskan Way Seawall Types Showing Basic Physical Habitat Characteristics



Source: Berger/Abam Engineers, Inc.

Exhibit 4-3. State Listed Species Potentially Occurring in the Project Vicinity

Common Name	Scientific Name	State Status
River lamprey	*Lampetra ayresi*	SC
Pacific herring	*Clupea pallasi*	SC
Eulachon	*Thaleichthys pacificus*	SC
Pacific cod	*Gadus macrocephalus*	SC
Pacific hake	*Merluccius productus*	SC
Black rockfish	*Sebastes melanops*	SC
Brown rockfish	*Sebastes auriculatus*	SC
China rockfish	*Sebastes nebulosus*	SC
Copper rockfish	*Sebastes caurinus*	SC
Quillback rockfish	*Sebastes maliger*	SC
Aleutian Canada goose	*Branta canadensis leucopareia*	ST
Brandt's cormorant	*Phalacrocorax penicillatus*	SC
Cassin's auklet	*Ptychoramphus aleuticus*	SC
Common murre	*Uria aalge*	SC
Ferruginous hawk	*Buteo regalis*	ST
Merlin	*Falco columbarius*	SC
Vaux's swift	*Chaetura vauxi*	SC
Western grebe	*Aechmophorus occidentalis*	SC
Purple martin	*Progne subis*	SC
Pacific harbor porpoise	*Phocoena phocoena*	SC

SC: State Candidate, ST: State Threatened, SE: State Endangered

4.2 Essential Fish Habitat

Essential Fish Habitat is "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The Magnuson-Stevens Act requires proposed projects with a federal nexus to evaluate potential impacts to habitat of commercially managed fish populations. Lists of salmon, groundfish, and pelagic species potentially affected by the proposed project alternatives and identified under the Magnuson-Stevens Act were previously compiled and evaluated within the 2004 Draft EIS Appendix R, Fisheries, Wildlife, and Habitat Discipline Report (Section 4.1.3). There has been no change to the habitat conditions for those species previously described in the Draft EIS.

4.3 Existing Seawall

The existing seawall has not changed since the Draft EIS, with the exception of the small area of replaced riprap immediately south of the Seattle Aquarium. Recently, the City of Seattle found that ekki wood panels intended to protect the Type B Seawall have seriously deteriorated and may need to be repaired or replaced prior to construction of the proposed project. Ekki wood is a West African hardwood that is extremely resistant to marine borers. The City of Seattle used ekki wood to cover corroded sheet pile in about 1986, but marine borers have now attacked the wood, seriously weakening many of the planks.

The seawall still consists of multiple sections with four different structure types. The locations of these structure types are shown in Exhibit 4-1, with cross sections of the structure types shown in Exhibit 4-2. Detailed information on the seawall types was provided in Section 4.1.1 of the 2004 Draft EIS Appendix R.

4.4 Fish

The fish species and habitats known to occur in the nearshore waters of Elliott Bay and the Seattle shoreline are identified in Section 4.1.2 of the 2004 Draft EIS Appendix R and have not substantively changed since the Draft EIS. No new site-specific information identifying salmon resources of the project area has been identified since the Draft EIS was prepared, although the steelhead has recently been proposed for listing. Juvenile steelhead may be found in small numbers along the face of the seawall during their outmigration to marine waters.

4.5 Marine Invertebrates

No new information has been identified since the Draft EIS that identifies the invertebrates occurring in the intertidal and shallow subtidal habitat along the seawall.

4.6 Wildlife

The urban habitat of the highly developed shoreline throughout the project area provides support only for those species highly adapted to intense human activity and completely modified environments. These conditions have not substantively changed since the Draft EIS was prepared.

4.6.1 Mammals

No new information is available on marine mammal use of the highly urbanized habitat along Seattle's waterfront. However, southern resident killer whales (*Orcinus orcas*) were recently listed as endangered under the ESA and are now included in the environmental evaluation.

4.6.2 Birds

Birds potentially found in the project area have not changed since publication of the Draft EIS. No new information has been identified for raptors potentially using the project area. The waterfowl identified in Section 4.1.5 of the 2004 Draft EIS Appendix R are still likely to use the nearshore habitat of Elliott Bay.

Marbled murrelets (*Brachyramphus marmoratus*) are listed as a threatened species and have been known to occasionally occur within the project's ESA action area. However, no recorded observations of marbled murrelets within inner Elliott Bay have been found. Substantial boating activity along the Seattle waterfront likely discourages marbled murrelets from using this area, but they could potentially be present in the project vicinity.

4.7 Vegetation

No new information is available on the marine macrophytes (algae) and riparian vegetation potentially affected by the project.

Chapter 5 OPERATIONAL IMPACTS AND BENEFITS

The environmental analysis now evaluates the Tunnel Alternative (the Preferred Alternative) and the Elevated Structure Alternative. Both alternatives include seawall replacement. The Tunnel Alternative is evaluated with both the stacked tunnel alignment (the preferred alignment) and the side-by-side tunnel alignment. Compared to the Tunnel Alternative evaluated in the Draft EIS, these two alignments have slightly different potential impacts in the Pier 48 to Colman Dock area of the shoreline.

5.1 New Seawall

The location of the proposed seawall has changed since the Draft EIS. Previously, the new seawall was proposed entirely on the upland side of the existing seawall. The new seawall is now proposed to be located either within the plane of the existing seawall or on its landward side, depending on final design. However, it is likely that the Type B Seawall sections would be replaced within the plane of the existing seawall, and the Type A Seawall sections would be replaced on the upland side of the existing seawall.

Potential impacts of the seawall are very similar to those identified in Chapter 5 of the 2004 Draft EIS Appendix R, Fisheries, Wildlife, and Habitat Discipline Report. Changes in the amounts of impacts are the result of relatively small changes in the design of the alternatives and the construction techniques likely to be employed (see the 2006 Supplemental Draft EIS Appendix B, Alternatives Description and Construction Methods Technical Memorandum, for detailed descriptions).

The location of the new seawall has changed, resulting in a reduced amount of aquatic habitat gained with tunnel alignments for the shoreline north of Colman Dock. Between Pier 48 and Colman Dock, the amount of aquatic habitat removed by the tunnel alignments would be less than identified in Exhibit 5-1 of the Draft EIS Appendix R. The Elevated Structure Alternative would also remove aquatic habitat between Pier 48 and Colman Dock (Exhibit 5-1).

Exhibit 5-1. Changes in Amounts of Elliott Bay Shoreline Habitat for Each Alternative (–10 to +11.6 ft MHHW)

Alternative	Tidal Elevation (MHHW)	Pier 48 to Colman Dock		Colman Dock to Broad Street	
		Volume (ft^3)	Area (ft^2)	Volume (ft^3)	Area (ft^2)
Stacked Tunnel Alignment	+11.6 to +10	-16,000	0	32,904	0
	+10 to +4	-60,000	0	123,390	0
	+4 to 0	-40,000	-2,300	82,260	0
	0 to -4	-14,010	-4,670	27,020	20,565
	-4 to -10	-4,950	-2,750	0	0
	> -10	-17	-280	0	0
	Total	-134,977	-10,000	265,574	20,565
Side-by-Side Tunnel Alignment	+11.6 to +10	-22,208	0	28,496	0
	+10 to +4	-83,280	0	106,860	0
	+4 to 0	-55,520	-2,300	71,240	0
	0 to -4	21,182	-6,230	27,020	17,810
	-4 to -10	-11,112	-4,630	0	0
	> -10	-108	-720	0	0
	Total	-193,410	-13,880	233,616	17,810
Elevated Structure	+11.6 to +10	-9,696	0	23,392	0
	+10 to +4	-36,360	0	87,720	0
	+4 to 0	-24,240	-1,730	58,480	0
	0 to -4	-6,440	-2,300	25,680	14,620
	-4 to -10	-4,200	-2,000	0	0
	> -10	-60	-30	0	0
	Total	-80,996	-6,060	195,272	14,620

MHHW = mean higher high water

For most of the Seattle waterfront, impacts to the shoreline habitat would be generally the same as those identified in Chapter 5 of the 2004 Draft EIS Appendix R. Exhibit 5-1 above summarizes the changes in shoreline habitat that would occur with the Tunnel Alternative and Elevated Structure Alternative.

The area at the base of the seawall would be intertidal and subtidal riprap. With the Tunnel Alternative, the existing intertidal area and a portion of the subtidal area between Pier 48 and Colman Dock would be filled by the tunnel and new seawall. The Elevated Structure Alternative would fill a portion of the existing intertidal and subtidal area between Pier 48 and Colman Dock with road fill and a new seawall. With the Elevated Structure only, the existing seawall would be replaced with a new seawall constructed with a

sidewalk cantilevered (about 7.5 ft) over the shoreline aquatic habitat between Pier 48 and Colman Dock.

With the new seawall, the decreases in Elliott Bay bottom area between Pier 48 and Colman Dock with either tunnel alignment or the Elevated Structure Alternative would be smaller than the increases in the bottom surface area north of Colman Dock. Likewise, the volume increase north of Colman Dock would be greater than the decrease between Pier 48 and Colman Dock. Therefore, the project would have a net gain in habitat in Elliott Bay with either alternative. The habitat filled might be replaced with the excavation of upland fill at Pier 48.

Please refer to Chapter 5 of the 2004 Draft EIS Appendix S, Water Resources Discipline Report, for discussion of the project's operational impacts and benefits related to water quality. There have been minor changes in operational impacts and benefits, as described in Chapter 5 of the 2006 Supplemental Draft EIS Appendix S. These changes would provide a slight improvement in water quality compared to the description provided in Section 5.1.2 of the 2004 Appendix S because retrofitting of a larger area of pavement would occur.

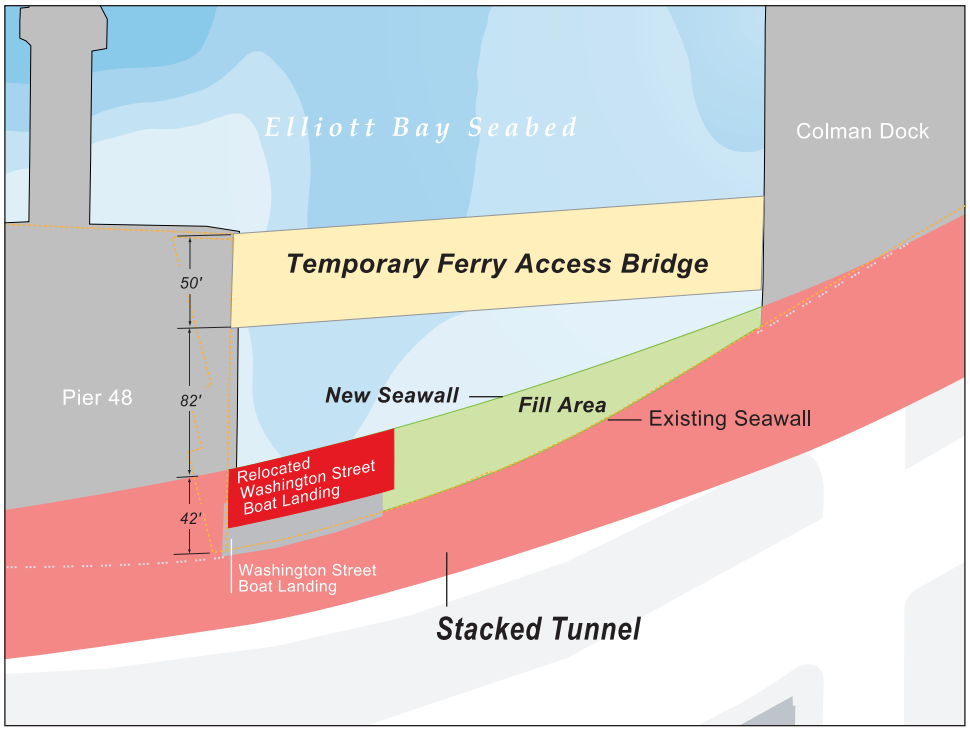
5.2 Tunnel Alternative (Preferred Alternative)

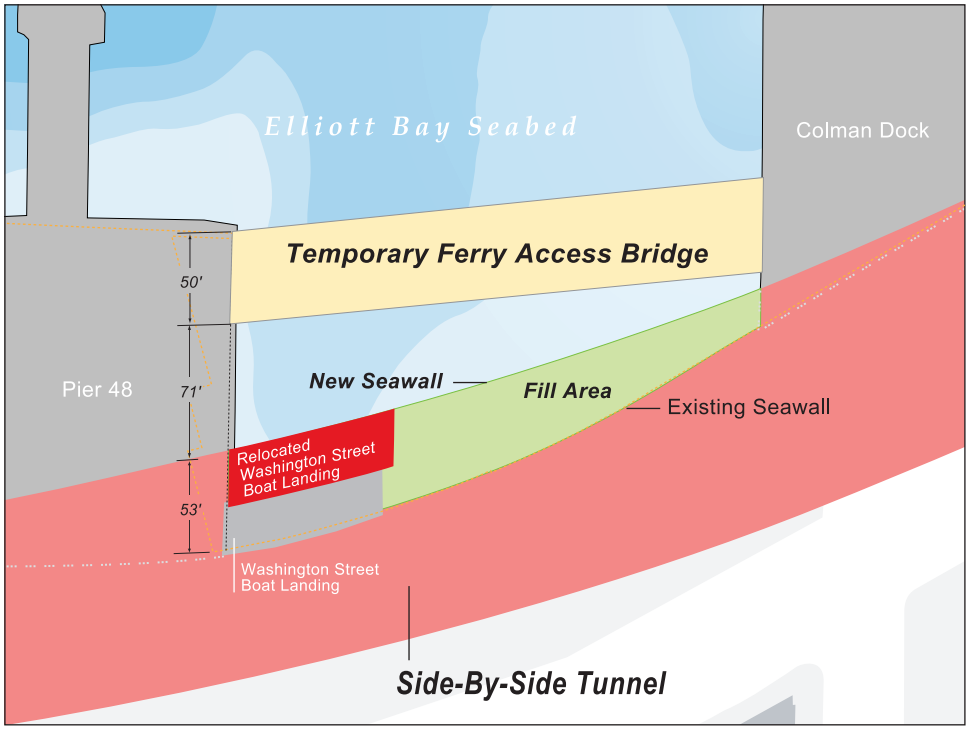
5.2.1 Stacked Tunnel Alignment

The operational effects of the stacked tunnel alignment (Exhibit 5-2) would be essentially the same as the side-by-side tunnel and the bypass tunnel evaluated in the Draft EIS. Between Pier 48 and Colman Dock, a section of seawall about 310 ft long would extend out into Elliott Bay a maximum of 42 ft. This would decrease the bottom area of Elliott Bay by 10,000 ft^2 and the water volume by 134,977 ft^3.

North of Colman Dock, the current design of the new seawall would place portions of the new seawall (6,670 ft total) on the upland side of the existing seawall. Several of these areas have existing fill on the seaward side of the seawall, resulting in no increase in Elliott Bay habitat. Removal of the existing seawall would return a narrow strip of previously filled area to Elliott Bay's aquatic habitat along 5,750 ft of shoreline. This change would increase the bottom area of Elliott Bay by 20,565 ft^2 and the water volume by 265,574 ft^3.

Exhibit 5-2. Tunnel Alternatives – Pier 48 to Colman Dock





5.2.2 Side-by-Side Tunnel Alignment

The side-by-side tunnel alignment would be essentially the same as the Tunnel Alternative evaluated in the Draft EIS. However, the amount of area involved and impacts to the habitat between Pier 48 and Colman Dock would be slightly less than described in Section 5.4 of the 2004 Draft EIS Appendix R.

The current side-by-side tunnel alignment would remove a portion of the shallow subtidal habitat between Pier 48 and Colman Dock (see Exhibit 5-2) in this area. Changes to habitat supporting fish, invertebrates, and macroalgae would be of the same nature as those changes described in Section 5.4 of the 2004 Draft EIS Appendix R. However, the magnitude of the changes would be less than described above. Elliott Bay open-water habitat would decrease by 193,410 ft^3, reducing the amount of living space for production of planktonic and pelagic organisms. Benthic habitat for fish and invertebrates would decrease by up to 13,880 ft^2 between Pier 48 and Colman Dock. This change would increase the bottom area of Elliott Bay by 17,810 ft^2 and the water volume by 233,616 ft^3 (see Exhibit 5-1).

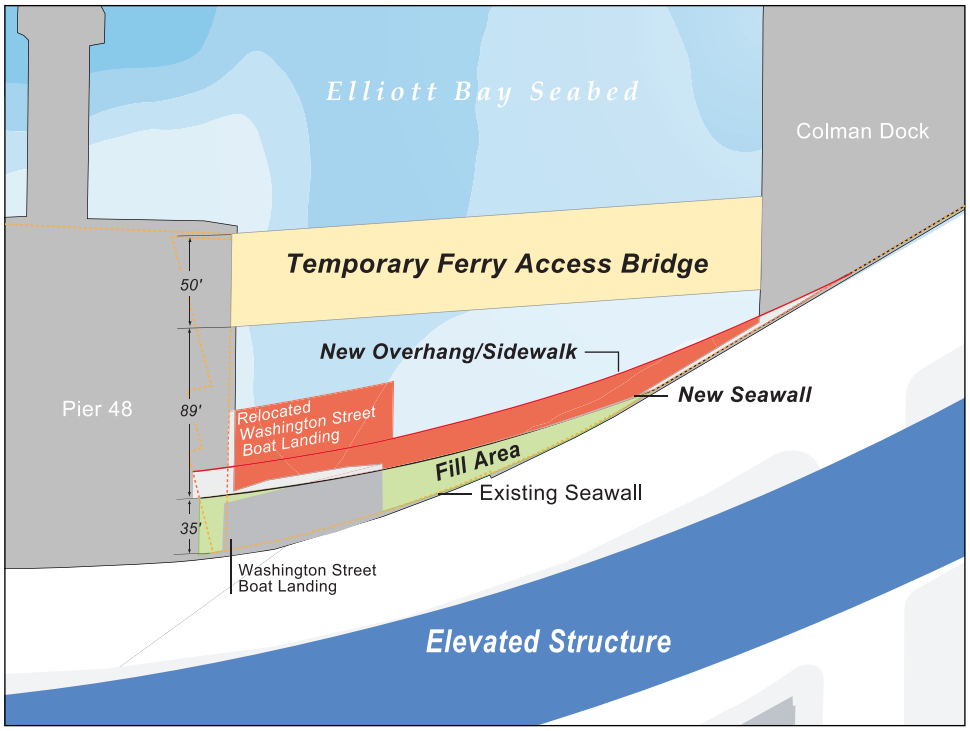
5.3 Elevated Structure Alternative

The Elevated Structure Alternative is similar to the Rebuild Alternative evaluated in the Draft EIS. However, the Elevated Structure alignment would extend approximately 35 ft into Elliott Bay between Pier 48 and Colman Dock, tapering in to the existing seawall near Colman Dock. North of Colman Dock, the Elevated Structure Alternative would construct a new seawall using an L-wall type of construction in combination with strengthening the weak soils behind the seawall with jet grouting or other soil improvement methods. Soil strengthening behind the seawall would stabilize this soil by mixing cement grout into the soils.

The new seawall location would require about 6,060 ft^2 of intertidal and shallow subtidal habitat to be filled between Pier 48 and Colman Dock (Exhibit 5-3). The volume of open-water aquatic habitat in Elliott Bay between Pier 48 and Colman Dock would decrease by about 80,996 ft^3. However, the volume between Colman Dock and Broad Street would increase by about 195,272 ft^3.

A new sidewalk would overhang the edge of Elliott Bay by 7.5 ft, shading approximately 5,100 ft^2 of shoreline area. The remainder of the seawall would be built in the same plane as or slightly upland of the existing seawall, depending on final design. All other effects would remain as described in Section 5.2 of the 2004 Draft EIS Appendix R.

Exhibit 5-3. Elevated Structure Alternative – Pier 48 to Colman Dock



5.4 Benefits

The major benefit of the proposed project is the greatly increased reliability of the seawall and avoidance of a potential catastrophic failure that would damage the Elliott Bay shoreline habitat if the existing seawall fails.

Other benefits of the proposed project would include the following:

- Although both alternatives would result in a net gain in habitat area, the Tunnel Alternative (the stacked alignment) would result in a greater net gain in habitat area. Exhibit 5-1 shows changes in basic amounts of habitat that would occur between Pier 48 and Colman Dock.
- Improvements in water quality, as described in the 2006 Supplemental Draft EIS Appendix S, could subtly improve habitat conditions near the seawall.
- Numerous creosote-treated piles would be removed along the face of the existing seawall.

As identified in Section 5.7 of the 2004 Draft EIS Appendix R, benefits to the natural environment would result primarily from potential improvements to intertidal and shallow subtidal habitat along the Seattle shoreline. Under each alternative, the new seawall would subtly decrease the water area of Elliott Bay during the construction period.

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Chapter 6 CONSTRUCTION IMPACTS

6.1 Seawall Location and Construction Changes

With each alternative, much of the existing seawall between Pier 48 (S. Washington Street) and approximately Broad Street would be replaced. Constructing the seawall would likely take approximately 36 months. The lengths of seawall types that currently exist in the project area are summarized in Exhibit 6-1. The locations of each type are shown on Exhibit 4-1 and cross-sections are shown on Exhibit 4-2.

Exhibit 6-1. Seawall Lengths within the Project Area

Seawall Type	Length (ft)	
	S. Jackson Street to Union Street	Union Street to Broad Street
Pile-Supported and Gravity Seawall	1,274	0
Type B Seawall	1,289	175
Type A Seawall	0	1,900

Basic construction methods for the project have not changed since the Draft EIS was issued. The new seawall would be replaced with a new secant pile wall or with soil strengthening and a new seawall face. A secant pile wall is a series of adjacent drilled shafts. Alternating shafts overlap adjacent shafts, producing an interlocking wall.

A temporary sheet pile wall (or other containment structure) to protect Elliott Bay has been added to the proposed project. The temporary sheet pile wall would be placed on the seaward side of the existing seawall to protect nearshore habitat, water quality, and marine life from soil, sediments, or other materials that could potentially be released during construction of the new seawall. Temporary sheet piles would be placed by vibration rather than impact hammer. At locations where the piers are attached to the shoreline and it is impractical to place sheet pile walls, silt curtains or other containment structures would be placed among the piles adjacent to the seawall.

During Traffic Stage 1, the temporary over-water bridge providing access between Pier 48 and Colman Dock would be constructed on piles for each alternative and option. This temporary bridge would produce over-water cover of about 14,200 ft² of Elliott Bay, primarily with depths of -10 to -20 ft MHHW. (See Exhibit 1-1). The remaining space between the bridge and the shoreline would remain open.

To help maintain pedestrian access along the waterfront during construction, the project partners are also considering the feasibility of constructing temporary over-water pedestrian walkways between piers. Temporary overhead poles for utilities may also be needed along the central waterfront.

North of the new tunnel from about Union Street to Broad Street, the soil behind the seawall would be strengthened by jet grouting. Dewatering of waste material generated by the soil grouting would be conducted within the project site, and water would be treated as required prior to discharge (see the 2006 Supplemental Draft EIS Appendix S, Water Resources Discipline Report).

6.2 Pile Driving

The project would likely require placing an undetermined number of hollow steel piles (16 to 30 inches in diameter) to support the Pier 48 to Colman Dock access bridge and construction activities at Pier 48, Pier 62/63, and potentially other locations. These piles would preferably be placed by vibratory driving but may be driven or proofed by impact hammer. Pile driving in the water using impact methods has the potential to affect fish and marine mammal behavior and injure or kill fish. Effects to fish, mammals, and perhaps birds correlate to the amount of energy required to drive the pile and the energy thereby propagated through the water column. Other methods of pile placement (vibratory or pressure) would have lesser effects and may be used where feasible. All pile placement would be done during times when migratory juvenile salmon are not present in the shallow nearshore environment.

Tangible effects on the general behavior and distribution of fish have been observed for juvenile salmonids and juvenile pile perch in the immediate vicinity of pile driving by impact hammer. Young salmonids may tend to avoid pile driving sound within a radius of about 600 m (656 yards) of the sound source in the marine environment according to Feist (1991). Although juvenile pink and chum salmon in the vicinity of pile driving did show some avoidance of the immediate pile driving location, they did not change their shoreline orientation or decrease foraging (Feist 1991). Young pile perch have been injured and killed in the immediate vicinity of pile driving (Stotz and Colby 2001).

Sound energy measurements in water are reported as decibel (dB) readings relative to a reference value of one micropascal (μPa). A μPa is a measure of absolute pressure. Decibels have a logarithmic relationship to μPa, resulting in a 10-fold increase in energy with a 1 dB increase in measured sound.

Pile driving sound potentially affects fish and marine mammal behavior only where the sound levels produced substantially exceed ambient sound levels. In Elliott Bay, ambient sound levels have not been measured but are likely to be as high as 145 dB_{peak} (re 1 μPa) or higher. Routine operation of ferries, tugs, tour boats, ships, and a variety of other craft along the Seattle shoreline produces a

rather noisy in-water environment in this area. Impact hammer pile driving is likely to produce sound pressure levels of about 180 to 210 dB (re 1 μPa) within the water column at a short distance (within 50 ft). Impact driving of piles can produce sound pressure levels over a substantial range of sound intensities. Driving piles of only 16 to 30 inches in diameter (the size likely to be used for the AWV Project) would likely generate maximum sound levels of 210 dB (re 1 μPa) within a short distance from the piles. At Friday Harbor, Laughlin (2005) measured sound levels at the bottom 10 m from a driven pile that ranged from 183 dB_{peak} to 206 dB_{peak}.

While pile driving can produce high sound levels, sound levels attenuate rapidly in shallow marine water. Pile driving along the seawall would occur at depths in the range of about 10 to 40 ft. Nedwell et al. (2003) recorded an average reduction of 0.15 dB/m of sound pressure levels produced by pile driving in shallow water (less than 40 ft deep). With a sound source of 194 dB (re 1 μPa), they measured only 134 dB at a distance of 1,312 ft (400 m), which was within the range of ambient sound levels. Thus, it is likely that the sound levels produced by pile driving along the Elliott Bay shoreline would attenuate to background levels within about 1,500 ft of the source.

Driving steel piles by impact hammer also has the potential to transmit sufficient sound energy to the adjacent water to injure or kill fish, at least in marine waters of the depths present along the seawall. Hammer-type driving of hollow steel piles can produce sound pressure levels of about 180 to 210 dB (re 1 μPa), which may injure or kill some fish in the immediate vicinity of the source. However, pile placement would be done at times of the year when vulnerable juvenile migratory fish species are not present.

In a recent review of available information, Hastings and Popper (2005) determined that the effects resulting from pile driving are best evaluated by sound exposure levels (SELs) rather than sound pressure levels. They concluded that the key characteristics for pile driving are likely to be the peak positive and negative pressures and their time durations, which are combined to calculate the cumulative pressure squared and SEL. The SEL is based on the cumulative sum of the square of the sound pressure, giving the positive and negative pressures equivalent contributions because the pressure squared is always positive. Hastings and Popper (2005) also concluded that conservative protection of fish of all sizes from physical injury is likely to be provided by maintaining the SEL below about 194 dB (re 1 μPa^2/second).

6.3 Construction Water Quality

There is some potential for release of harmful materials and production of high turbidity levels during construction of each of the alternatives. The project design now incorporates temporary sheet pile walls or other containment

measures to provide equivalent protection of Elliott Bay where practical, and turbidity curtains under piers to avoid these potential effects. These techniques would be effective in the low current velocity environment of the Seattle waterfront underneath existing piers.

Water currents in Elliott Bay along the waterfront are generally moderate to weak and run parallel to the waterfront at the end of the piers. Currents in Elliott Bay are generally insufficient to resuspend and transport mud sediment (Curl et al. 1988). The benthic substrate along the Seattle waterfront is predominately mud (McLaren and Ren 1994), with the net sediment transport to the south in a clockwise path. Sediment transport is primarily due to storm energy and is driven by deep currents rather than by the dominant surface current pattern. Between the perpendicular piers at the shoreline, the currents tend to be weak and of mixed direction. Any temporary increase in turbidity would be adjacent to the work area and is therefore assumed not to have measurable off-site impacts.

Delivery of construction materials and removal of excess soil and demolition materials may occur at the Pier 48 and Pier 62/63 locations. At both locations, it may be necessary to remove existing structures and place new temporary or permanent piles. Barge movement at these locations would be similar to existing navigation movements along the shoreline and would not represent a new or different impact. Barge loading and unloading would occur at the locations of existing facilities within previously dredged shoreline areas. There are no eelgrass beds in the areas where barge moorage would occur.

Planned construction of the seawall would involve in-water work between July 15 and February 15. Small numbers of migrating juvenile salmon may be present along the shoreline habitat of inner Elliott Bay at times outside the spring migration period, which is generally between March 15 and June 14.

There are no eelgrass beds or other features likely to attract concentrations of forage fish that would attract bull trout to the urbanized seawall shoreline where the work would occur. Individual bull trout may be present in the vicinity but are likely to avoid the disturbance in the immediate work area. Effects to fish, birds, and marine mammals could be produced by the construction activities of placing the temporary sheet pile walls (or other contractor-selected means that are equally protective of Elliott Bay) and driving piles. Other construction activities would be sufficiently isolated from the aquatic habitat to avoid effects to fish, birds, and marine mammals.

Human activity during construction would be the same as considered in Chapter 6 of the 2004 Draft EIS Appendix R.

Chapter 7 SECONDARY AND CUMULATIVE IMPACTS

Changes to the alternatives since the Draft EIS have not changed the basic objective of the project. The project is a transportation replacement project that would not increase capacity, and no secondary (indirect) impacts are expected. Cumulative impacts resulting from the incremental effect of this proposed project when added to other past, present, or future projects would be minor.

The Seattle Ferry Terminal at Colman Dock is located on Seattle's Elliott Bay shoreline at Pier 52. Washington State Ferries is currently planning to increase the dock capacity to accommodate growth in passenger volumes and upgrade the facility to current design standards and security requirements. The specific extent and location of any changes to Colman Dock have not been determined at this time. Planning and design of improvements to the Seattle Ferry Terminal are independent of the AWV Project, but the projects are being closely coordinated because they involve adjacent sites.

Several waterfront projects are currently being evaluated by others for portions of the Seattle shoreline. However, specific alternatives are not yet proposed for these projects. In addition, changes to the shoreline from the Waterfront Park to Pier 62/63 are being considered by the City of Seattle. The proposed reconstruction of Waterfront Park, the Seattle Aquarium, and Pier 62/63 would likely produce positive cumulative impacts by improving intertidal habitat conditions, depending on the final design of this project.

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Chapter 8 OPERATIONAL MITIGATION

Appropriate mitigation for the proposed project has changed due to changes in the location of the new seawall. In the Pier 48 to Colman Dock area, each of the tunnel alignments would place the new seawall closer to the existing shoreline and remove less aquatic habitat than identified for the original options in the Draft EIS. These changes would decrease the mitigation needed for this portion of the project. The Elevated Structure Alternative would place the new seawall farther from the shoreline than described in the Draft EIS, increasing the mitigation needed for this alternative.

North of Colman Dock, the new seawall would now be built in the same plane as or slightly upland of the existing seawall at various locations. This change from the Draft EIS would not increase the amount of aquatic habitat along the shoreline as much as identified in the Draft EIS.

A potential mitigation opportunity would be to remove some of the upland portion of Pier 48 to construct new shallow water habitat as mitigation for similar aquatic habitat that would be removed from the Seattle waterfront with either of the alternatives. Habitat features could be incorporated into the new seawall face. With each alternative, new shallow subtidal and intertidal habitat might be constructed from the upland portion of Pier 48 to replace the filled habitat. This would be an overall benefit to fish and wildlife. The new seawall would also remove the high risk of seawall failure and the subsequent severe impacts to habitat.

The City is currently conducting an evaluation of intertidal habitat panels that may be added to the face of the new seawall at appropriate locations. These habitat panels offer the potential to incorporate desirable substrate characteristics that could enhance the biological productivity of the shoreline. This concept offers the potential to improve habitat conditions where previous fill prevents construction of normal beach slopes and substrates. The more natural physical characteristics might support algae, invertebrates, and young salmon.

A memorandum identifying potential habitat enhancement opportunities along the Seattle waterfront was previously submitted to various resource agencies (see the 2004 Draft EIS Appendix R, Attachment D). Specific mitigation and habitat restoration options will be identified through additional coordination with resource agencies and design of the Preferred Alternative for the seawall and viaduct.

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Chapter 9 CONSTRUCTION MITIGATION

The basic construction approach has not changed since the Draft EIS was issued, other than inclusion of a temporary sheet pile wall or other containment measures to protect Elliott Bay habitat at active seawall construction locations to avoid impacts to Elliott Bay.

The project partners are evaluating additional conservation measures that may avoid, minimize, rectify, or compensate for impacts to species and habitat. They will design the proposed action to incorporate BMPs and conservation measures during construction as a part of the Preferred Alternative to be evaluated in the Final EIS.

In-water construction along the Elliott Bay shoreline is likely to be prohibited from March 15 to June 14 (per WAC 220-110-271) or longer, depending on permit conditions, during each year of construction to protect migrating juvenile salmonids (Chinook, chum, coho, steelhead, bull trout). Most construction would occur on the upland side of the existing seawall. In addition, a temporary sheet pile wall or other containment measures to protect Elliott Bay would be used to avoid in-water construction impacts.

Construction materials and wastes would be prevented from entering Elliott Bay by implementing BMPs into the design and construction methods of the selected alternative.

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Chapter 10 PERMITS AND APPROVALS

10.1 Federal Regulations

There have been no substantive changes to federal regulations pertinent to the project since the Draft EIS was issued.

10.2 State Regulations

There have been no substantive changes to Washington State regulations pertinent to the project since the Draft EIS was issued.

10.3 City Regulations

There have been no substantive changes to City of Seattle regulations pertinent to the project since the Draft EIS was issued.

10.4 ESA Species Information

Southern resident killer whales and steelhead are included in this environmental assessment because Southern resident killer whales are now listed as endangered and steelhead are now proposed for listing as threatened under the ESA. Marbled murrelets are evaluated because of the potential effects of noise generated by pile driving for this ESA listed species.

No substantive new information has been identified for Chinook salmon, bull trout, bald eagles, or EFH since the Draft EIS was issued.

Analysis of potential effects to ESA listed species is being conducted as part of preparation of a biological assessment (BA) for the Federal Highway Administration (FHWA) and Washington State Department of Transportation (WSDOT).

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Chapter 11 REFERENCES

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