ENVIRONMENTAL CHECKLIST

for the

Terminal 91 Berths 6 & 8 Redevelopment Project

Port of Seattle SEPA File # 2021-06

prepared for

Port of Seattle

September 2021

EA Engineering, Science, and Technology, Inc., PBC
Grette Associates
HRA

PREFACE--

The purpose of this Environmental Checklist is to identify and evaluate significant probable environmental impacts that could result from the **Terminal 91 Berths 6 & 8 Redevelopment Project** and to identify measures to mitigate those impacts.

Originally built as one of the Port of Seattle's first facilities, Terminal 91 (T-91) Berths 6 & 8 are the last remaining original timber pier structures at the terminal and are at the end of their service life. Approximately 30 percent of the apron at Berths 6 & 8 is currently condemned and the remaining sections are posted with load limits. Berths 6 & 8 were last rehabilitated in 1985, with only minor updates since then. Redevelopment of Berths 6 & 8 is considered to be critical to ensuring long-term viability of the Port as the home to the North Pacific Fishing Fleet.

The State Environmental Policy Act (SEPA)[1] requires that all governmental agencies consider the environmental impacts of a proposal before the proposal is decided upon. This Environmental Checklist has been prepared in compliance with the SEPA Rules, effective April 4, 1984, as amended (Chapter 197-11), Washington Administrative Code; and Port of Seattle SEPA Resolution No. 3650.

This document is intended to serve as SEPA review for site preparation work, demolition, construction and operation of the proposed **Terminal 91 Berths 6 & 8 Redevelopment Project**. Analysis associated with the proposed project contained in this Environmental Checklist is based on plans for the project, which are on file with the Port of Seattle. While not construction-level in detail, the schematic plans accurately represent the eventual size, location and configuration of improvements and are considered adequate for analysis and disclosure of environmental impacts.

This Environmental Checklist is organized into three major sections. Section A of the Checklist (starting on page 1) provides background information concerning the Proposed Action (e.g., purpose, proponent/contact person, project description, project location, etc.). Section B (beginning on page 13) contains the analysis of environmental impacts that could result from implementation of the proposed project, based on review of major environmental parameters. This section also identifies possible mitigation measures. Section C (page 41) contains the signature of the proponent, confirming the completeness of this Environmental Checklist.

Relevant project analyses that served as a basis for this Environmental Checklist include: the Greenhouse Gas Emissions Worksheet (EA, 2021), Biological Evaluation (Grette Associates, 2021), and Historic/Cultural Resources Analysis (HRA, 2021). These reports are on file at the Port of Seattle, and are included as appendices to this SEPA Checklist.

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[1] Chapter 43.21C. RCW

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PURPOSE

The State Environmental Policy Act (SEPA), Chapter 43.21 RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. The purpose of this checklist is to provide information to help identify impacts from the proposal (and to reduce or avoid impacts, if possible) and to help the Port of Seattle to make a SEPA threshold determination.

A. BACKGROUND

1. Name of Proposed Project:

Terminal 91 Berths 6 & 8 Redevelopment Project (Port of Seattle SEPA File 2021-06)

2. Name of Applicant:

Port of Seattle

3. Address and Phone Number of Applicant and Contact Person:

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Port of Seattle
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Seattle, WA 98111
206-549-2945
butsick@portseattle.org

4. Date Checklist Prepared

September 2021

5. Agency Requesting Checklist

Port of Seattle (the Port)

6. Proposed Timing or Schedule (including phasing, if applicable):

The **Terminal 91 Berths 6 & 8 Redevelopment Project** analyzed in this Environmental Checklist involves site preparation work (including over-water demolition and in-water maintenance dredging), demolition, and construction. Site preparation and construction is expected to begin in Spring 2023 with build-out and occupancy by Fall 2024.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

No other specific development is planned for the T-91 Berths 6 & 8 site at this time.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal:

Studies prepared specifically for this SEPA Checklist include:

- Greenhouse Gas Emissions Worksheet (EA 2021);
- Biological Evaluation (Grette Associates 2021); and
- Historic/Cultural Resources Analysis (HRA 2021);

Past studies used to prepare this SEPA Checklist include:

- Former Seattle Naval Supply Depot Piers 90 and 91 – Port of Seattle; Formerly Used Defense Site #F10WA012501 Remedial Investigation Draft Final Report, (US Army Corps of Engineers 2013)
- T-91 Historical Review Report (Windward Environmental 2017)
- T-91 Submerged Lands Area Preliminary Investigation, Surface Sediment Characterization Results – Phase 1 and Phase 2 Reports (Windward Environmental, 2018)
- Terminal 91 Berths 6 & 8 Redevelopment Debris Survey & Sediment Depths, (KPFF Consulting Engineers and Echelon Engineering, Inc. 2021)
- Pier 90 Independent Remedial Action Report, Pier 90 Workplan for Confirmation Sampling, and Pier 91 Workplan for Additional Assessment Terminal 91 – PES Environmental, Inc, 2009

Additional documentation includes:

- Joint Aquatic Resource Permit Application
- Water Quality Monitoring Plan
- Hydraulic Project Approval Application
- Underwater Noise Monitoring Plan
- Shoreline Substantial Development Permit Application
- Comprehensive Drainage Control Plan

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain:

There are no other applications that are pending approval that directly affect the property covered by the **Terminal 91 Berths 6 & 8 Redevelopment Project**.

10. List any government approvals or permits that will be needed for your proposal, if known:

The following approvals or permits are anticipated to be required for proposed redevelopment at T-91 Berths 6 & 8.

Federal Agencies

U.S. Army Corps of Engineers

- Clean Water Act Section 404 Permit
- Rivers and Harbors Act Section 10 Permit

National Marine Fisheries Service

- Endangered Species Act Section 7 Compliance

State and Regional Agencies

Washington State Department of Ecology
- Construction General NPDES Permit
- Coastal Zone Management Act Consistency Determination
- Clean Water Act Section 401 Certification

Washington State Department of Fish and Wildlife
- Hydraulic Project Approval (HPA)

Local Agencies

City of Seattle, Department of Construction and Inspections -- permits/approvals associated with the proposed project, including:
- Demolition Permits
- Grading Permit
- Building Permits
- Mechanical Permits
- Electrical Permits
- Certificates of Occupancy
- Comprehensive Drainage Control Plan approval
- Shoreline Substantial Development Permit (SSDP)

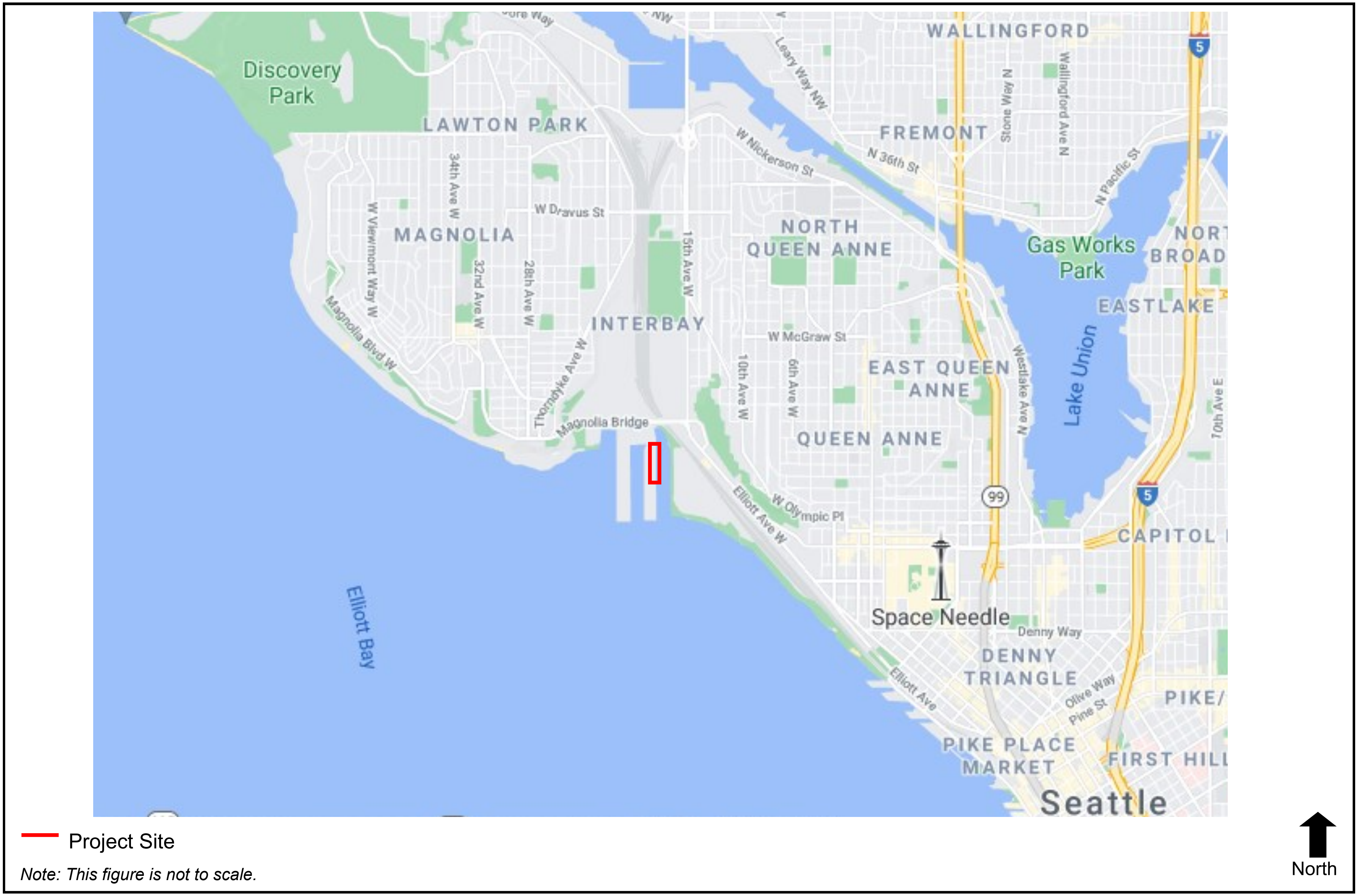
11. Give a brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

Introduction

The Terminal 91 (T-91) Berths 6 & 8 site is located on the northern edge of Elliott Bay, in the Interbay area of the City of Seattle (see **Figure 1** and **Figure 2**).

Originally built as one of the Port of Seattle's first facilities, Terminal 91 (T-91) Berths 6 & 8 are the last remaining original timber pier structures at T-91 and are at the end of their service life. Approximately 30 percent of the apron at Berths 6 & 8 is currently condemned and the remaining sections are posted with load limits. Berths 6 & 8 were last rehabilitated in 1985 with only minor subsequent updates. Redevelopment of Berths 6 & 8 is considered to be critical to ensuring long-term viability of the Port as the home to the North Pacific Fleet.

Terminal-91 Berths 6 and 8 Redevelopment Project
Environmental Checklist



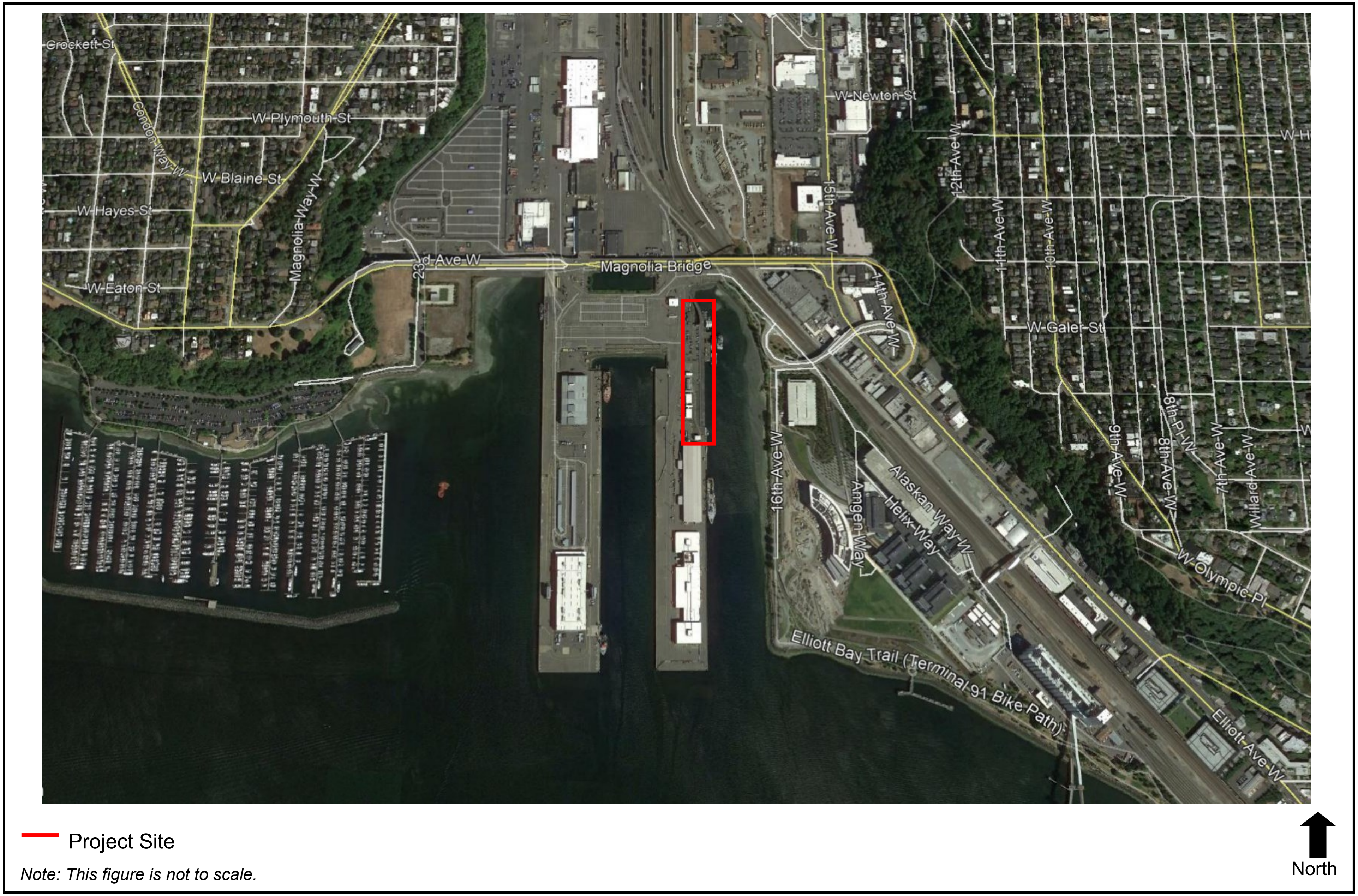
Source: Google Maps and EA Engineering, 2021

EA Engineering, Science, and Technology, Inc., PBC

Figure 1

Vicinity Map

Terminal-91 Berths 6 and 8 Redevelopment Project
Environmental Checklist



Source: Google Earth and EA Engineering, 2021

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Figure 2
Aerial Map

Existing Conditions

The approximately 2.7-acre site is an urban maritime industrial area on an urban waterway and consists of approximately 66,230 sq.ft. of pier and apron area (over-water and pile supported), approximately 44,300 sq.ft. upland pavement area, and approximately 8,700 sq.ft. of building footprint area.[2] The approximately 66,230 sq.ft. pier and apron portion of the site is supported by approximately 2,300 12-inch diameter creosote-treated timber piles. An approximately 3,410 sq.ft. over-water float system attached to the east edge of Berth 8. **Table 1** summarizes existing site area characteristics of the site. **Figure 3** illustrates the existing site conditions.

Table 1
EXISTING SITE AREA CHARACTERISTICS

Site Use	Area (sq.ft.)/Use
Pier and Apron (overwater pile supported)	66,230[a]
Upland Pavement (located on fill material)[b]	44,300
Building A-500 Footprint	2,400
Building A-501 Footprint	500
Building A-400 Footprint	2,200
Building A-300 Footprint	1,900
Building A-301 Footprint	700
Port Police Dive Storage	1,000
Total	**119,230 (2.73 ac.)**
Overwater Float	3,410[c]
Number of Support Piles	2,300 (12-in. dia.)

[a] Includes the 900 sq.ft. of footprint for Building A-310.
[b] Does not include upland area under buildings
[c] The 3,410 sq.ft of overwater float consists of:
11'x56'loading dock ramp and 11'x56' floating dock
36'x45' and 9'x62' floating structures
Does not include barge and gangway equipment

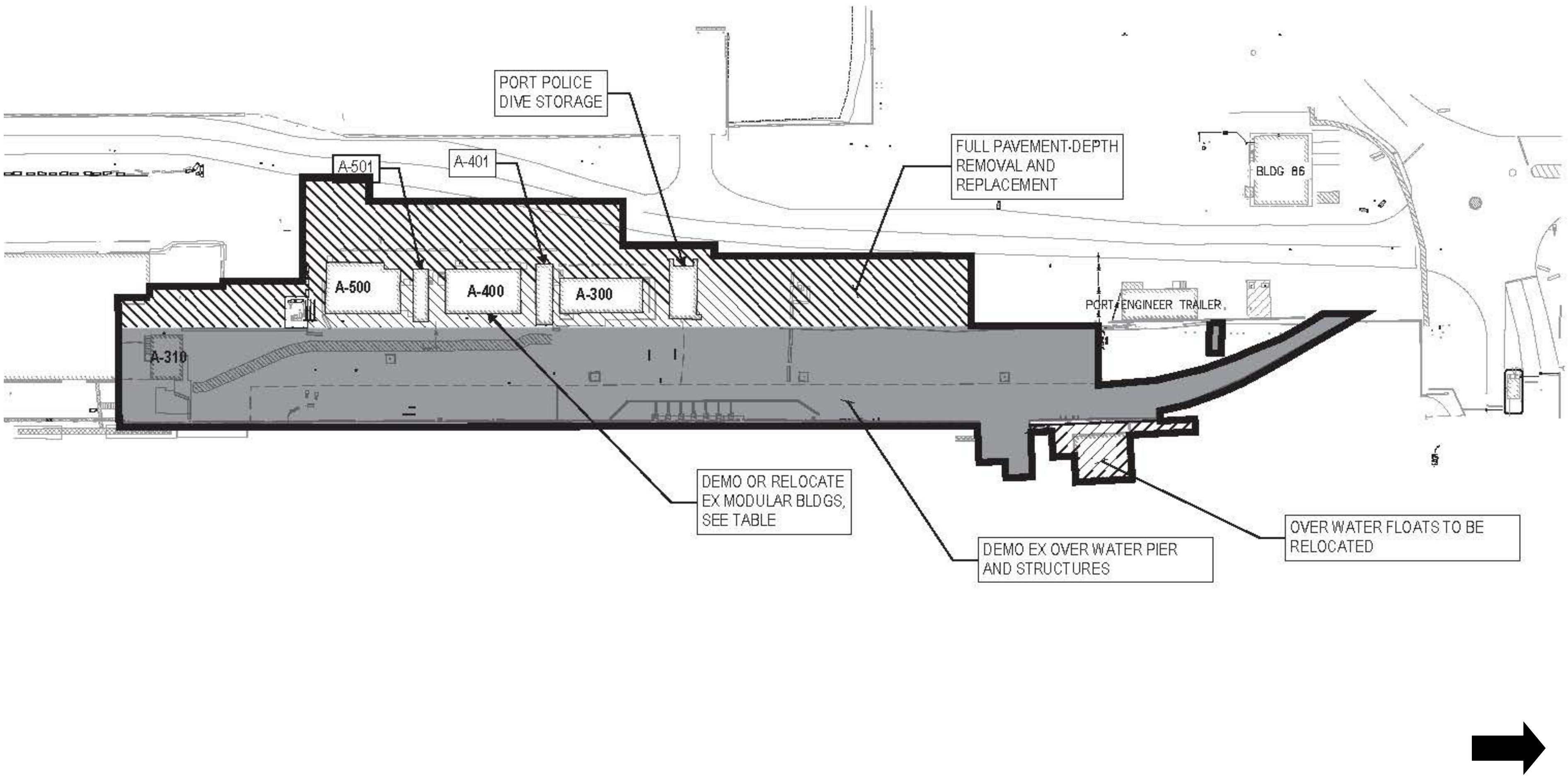
The total area in over-water structure area on the site totals 66,230 square feet, with approximately 3,410 square feet of overwater float attached to Berth 8 (including approximately 1,600 square feet of creosote-treated timber float) as summarized in **Table 2.**

Table 2
EXISTING OVER-WATER COVERAGE AREA

Overwater Use	Area (sq.ft.)
Pier and Apron	66,230
Overwater Float	3,410
Total	**69,640**

[2] 8,700 sq.ft. of building footprint area on upland fill material; approximately 900 sq.ft. of building footprint located on existing overwater pier and apron area and included in the 66,230 sq.ft. of pier and apron area.

Terminal-91 Berths 6 and 8 Redevelopment Project
Environmental Checklist



Note: This figure is not to scale.

Source: KPFF, 2021

EA Engineering, Science, and Technology, Inc., PBC

Figure 3

Existing Conditions Map

The site contains seven (7) buildings containing a total of 9,600 square feet of building space. All of the buildings are single-story structures, with building heights ranging from 14 to 28 feet. Building uses include Port of Seattle Police and Operations, Port of Seattle Engineering, and other Port support uses. Approximately 116 parking spaces are located on the T-91 Berths 6 & 8 Redevelopment site, including 68 standard parking stalls and 48 decreased capacity stalls that are located on the existing pier with a maximum load capacity.

Proposal

The proposed **T-91 Berths 6 & 8 Redevelopment Project** is intended to redevelop the existing condemned and load limited area associated with Berths 6 & 8 to provide improved berths suitable to ensure the long-term viability of the Port as the home to the North Pacific Fishing Feet.

The proposal includes replacement of the existing creosote-treated timber pier and apron with new wharf structure (including associated piles), relocation of the adjacent float system (including boat storage), replacement of existing slope armoring, improvements to the existing bulkhead, dredging of the adjacent channel, upland paving replacement, demolition/relocation of existing buildings, and construction of existing buildings (see **Figure 4** for a site plan of the proposed project).

The following primary demolition, relocation, and redevelopment elements are proposed:

<u>Demolition</u>

- Over-water Timber Pier and Apron Structure – 66,230 sq.ft.
- Creosote-treated timber piles – approximately 2,300 12-inch piles (cut at top of subgrade).
- Upland Pavement Area – 44,300 sq.ft.
- Seven Buildings[3] – 9,600 sq.ft. (demolished or relocated).
- Removal of eight (8) existing storm water outfalls and elimination of all deck drains

<u>Relocation</u>

- Over-water Float – 1,600 sq.ft. relocated[4], 1,810 sq.ft. remaining
- Installation of 4 18-inch steel guide piles

<u>Redevelopment</u>

- Over-water pre-cast concrete decking Pier Replacement – 60,710 sq.ft.
- 378 piles (including 288 24-inch concrete octagonal piles and 90 20-inch steel fender piles with 24-inch high density HDPE facing.
- Slope Excavation and Armoring Replacement.
- Sheet Pile Wall Installation.
- Upland Pavement Replacement[5] – 38,000 sq.ft.

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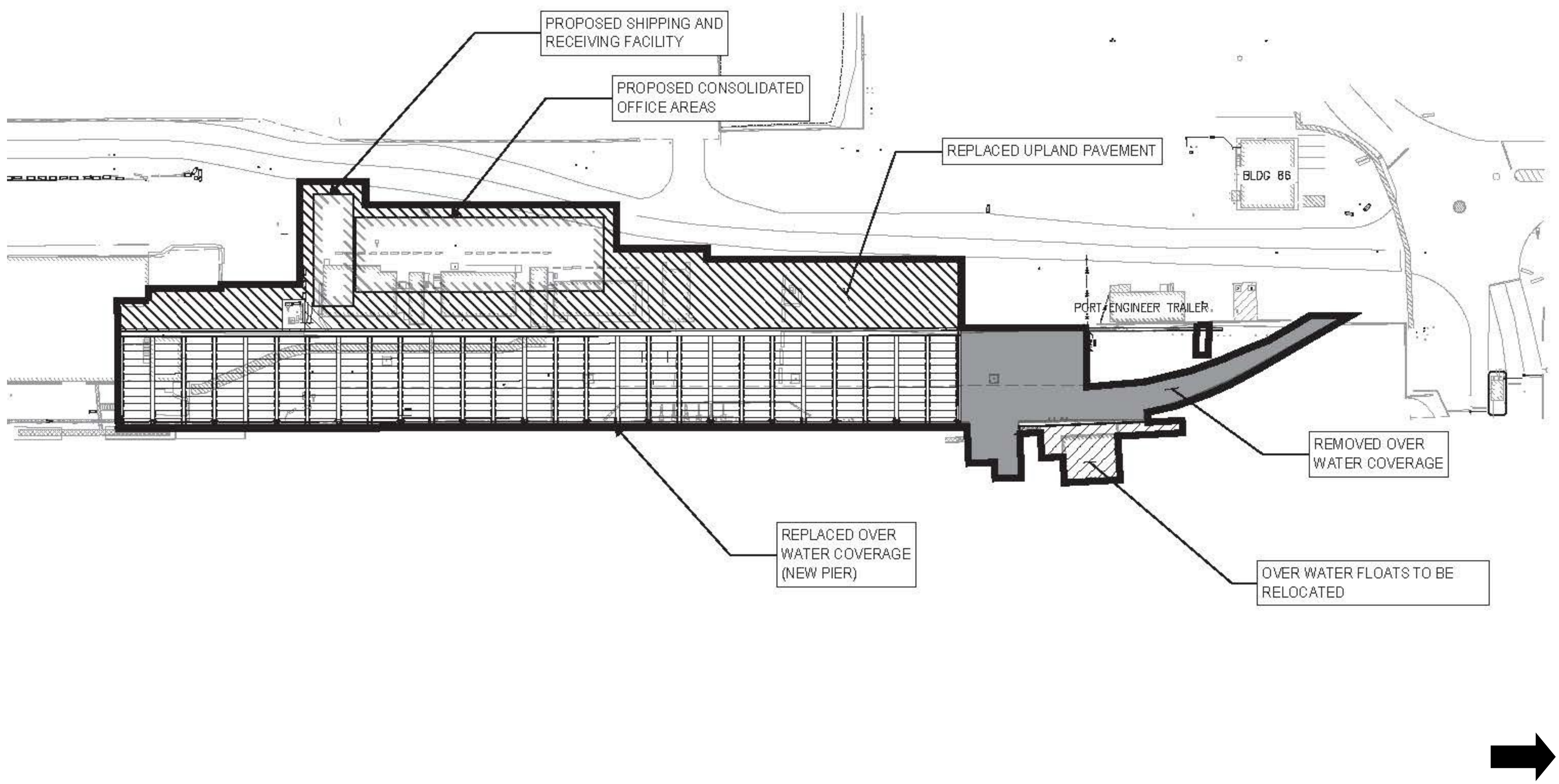
[3] Buildings A-310, A-500, A-501, A-400, A-300, A-301, Police Boat Storage
[4] Up to 290 sq.ft. of new overwater area could be added for new gangway.
[5] Excludes pavement under proposed buildings.

Terminal-91 Berths 6 and 8 Redevelopment Project
Environmental Checklist



Note: This figure is not to scale.

Source: KPFF, 2021

EA Engineering, Science, and Technology, Inc., PBC

Figure 4

Site Plan

- Consolidated Office Building – 12,000 sq.ft.
- Shipping and Receiving Building – 3,000 sq.ft.
- Installation of new upland treatment system for stormwater drainage.
- Consolidation of existing drainage (8 outfalls and deck drains) to a single 18-inch under-pier outfall (rebuilt in same location as existing 12-inch outfall), discharging treated storm water to riprap slope

Table 3 provides a comparison of existing site conditions with site conditions under the proposal. Note: Because the proposed T-91 Berths 6 & 8 Redevelopment Project proposes a smaller over-water pier and apron structure footprint than currently exists, the total square feet of developed area on the site under the proposal is less than under existing conditions.

Table 3
EXISTING/PROPOSED SITE AREA CHARACTERISTICS COMPARISON

Site Use	Existing Area Sq.Ft./Use	Proposed Area Sq.Ft./Use
Pier and Apron (overwater pile supported)	66,230[a]	60,710[c]
Upland Pavement (located on fill material)	44,300[b]	38,000
Building Footprint (located on fill material)	9,600	15,000
Total	**119,230 (2.73 ac.)**	**113,710 (2.61 ac)[c]**
Overwater Float	3,410	3,410 (1,810 sq.ft. remaining, 1,600 sq.ft. relocated[d])
Number of Support Piles	2,300 (12-in. dia.)	378[e]

[a] Includes the 900 sq.ft. of Building A-310 footprint
[b] Does not include upland area under buildings.
[c] Reduced site area reflects area in removed over-water pier area.
[d] Up to 290 sq.ft. of new overwater area could be added for new gangway.
[e] 288 24-in diameter concrete octagonal piles and 90 20-inch steel fender piles with 24-inch HDPE sheath

Proposed In-Water/Over Water Redevelopment Detail

As indicated previously, the total area in over-water structure area on the site (pier and apron area) and associated with site uses (adjacent overwater float) totals approximately 69,640 square feet as summarized in Table 4. With the proposed T-91 Berths 6 & 8 Redevelopment Project, the total square footage of overwater area would be reduced by approximately 5,520 sq.ft. compared to existing conditions.

Table 4
EXISTING/PROPOSED OVER-WATER COVERAGE AREA COMPARISON

Overwater Use	Existing Area (sq.ft.)	Proposed Area (sq.ft.)
Pier and Apron	66,230	60,710
Overwater Float	3,410	3,410 – 1,810 remaining, 1,600 relocated
Total	**69,640**	**64,120**

The T-91 Berths 6 & 8 Redevelopment Project includes replacement of the existing creosote-treated timber pier and apron area with new wharf structure (including associated piles) and relocation of a portion of the existing float attached to Berth 8. In addition, the proposal includes the replacement of the existing slope armoring, abandonment in-place of the existing bulkhead and installation of a new sheet pile wall, and dredging the channel adjacent to the berths.

<u>Wharf Replacement</u>

Components of the proposed replacement of the wharf includes: removal of 66,230 sq.ft. of existing timber decking; removal of approximately 2,300 12-inch diameter creosote-treated timber piles; installation of 60,710 sq.ft. of pre-cast concrete decking; and, installation of 378 piles (including 288 24-inch concrete octagonal piles and 90 20-inch steel fender piles with 24-inch high density HDPE facing). Refer to **Appendix A** for detail.

<u>Slope Excavation and Armoring Replacement</u>

Replacement of slope armoring would include: removal of approximately 25,000 cubic yards of existing material (riprap and debris); and installation of 10,600 cubic yards of fill (including quarry spalls, heavy riprap, and fish mix to fill voids).

Excavation and installation of slope armoring would be conducted using land based and/or barge-mounted excavators. Material removed would be assessed for possible reuse and/or in-water disposal; material unsuitable for reuse or in-water disposal would be transported to an approved upland disposal facility. Refer to **Appendix A** for detail.

<u>Sheet Pile Wall Installation</u>

Installation of a new sheet pile wall and abandonment of the existing bulkhead would include: removal of the top approximately six vertical feet of 780 linear feet of the creosote-treated timber bulkhead (above the mud line) and capping; and, installation of 780 linear feet of steel sheet pile (approximately six feet of exposed height) directly water ward of the existing abandoned wall. Refer to **Appendix A** for detail.

<u>Float Relocation</u>

The proposal includes removal and relocation of the small boat storage and float system from its existing location for future relocation to the northeast portion of the Smith Cove Waterway on the north side of Berth 7. Relocation of the small boat storage and float system would include relocation of approximately 1,600 sq.ft. of existing floats and up to 290 sq.ft. of new overwater area for a new gangway. Refer to **Appendix A** for detail.

Proposed Upland Redevelopment Detail

As indicated previously, the T-91 Berths 6 & 8 Redevelopment Project includes demolition of existing upland pavement, demolition of seven existing buildings, new replacement upland paving, and construction of two new buildings.

Paving

Approximately 44,300 square feet of existing upland pavement would be demolished and removed from the site, with approximately 38,000 square feet of new upland pavement provided[6]. Proposed new upland paving work would include approximately 3,200 cubic yards of excavation and approximately 3,200 cubic yards of fill. All excavated material would be held in drainage-controlled areas and reused to the extent possible. Removed pavement and excess excavated material would be tested to verify character of the material, and would be disposed off-site at an approved receiving site.

Buildings

The existing seven single-story buildings on the site, totaling approximately 9,600[7] square feet in footprint/building space, would be demolished and/or relocated.

Two new buildings would be constructed on the uplands portion of the site as follows:

- Shipping and Receiving Facility – Approximately 3,000 square foot single-story building at a height of approximately 23 feet.

- Consolidated Office Building – Approximately 12,000 square foot single-story building at a height of approximately 23 feet.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any. If a proposal would occur over a range of area, provide the range or boundaries of the site(s).

The proposed T-91 Berths 6 & 8 Redevelopment Project site is located at Pier 90 at the northern shore of Elliott Bay. The site is at the northeast portion of Pier 90 and includes Port of Seattle owned upland, shoreline, and aquatic areas (refer to Figures 1 and 2).

The legal description of the site is on file with the Port of Seattle (SEPA File # 2021-06)

[6] Pavement area exclusive of new building footprint area.

[7] Includes 8,700 sq.ft. of building space on the upland pavement area and approximately 900 sq. ft. of building space on the overwater pier and apron area.

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site (circle one):
Flat, rolling, hilly, steep slopes, mountainous, other:

The T-91 Berths 6 & 8 Redevelopment site is generally flat, including the upland paved area and overwater pile-supported pier and apron area. However, the City of Seattle Environmental Critical Areas map indicates “Steep Slope (40%)” at the extreme northeast edge of the site; the slope area consists of rock armored shoreline slope.

b. What is the steepest slope on the site (approximate percent slope)?

The steep slope area at the extreme northeast edge of the site, with a slope greater than 40%.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

The upland paved portion of the T-91 Berths 6 & 8 Redevelopment site overlays fill with marine deposits approximately 15 feet below existing pavement. The fill material is described as Tidal Flat Deposit consisting of silt, sand, and organic sediments with some shells.

No agricultural land of long-term commercial significance is present at the terminal.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

The Puget Sound region is a seismically active region; thus, the T-91 Berths 6 & 8 Redevelopment site could experience seismic activity, which may cause surface rupture, liquefaction and subsidence and landslides. All of Terminal 91 is within a Liquefaction Prone area[8]. Liquefaction Prone areas are environmentally critical areas usually associated with a shallow groundwater table that lose substantial strength during earthquakes.

e. Describe the purpose, type, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

A limited amount of grading and site disturbance would be required for proposed redevelopment of the paved upland portion of the site. Ground and site disturbance would

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[8] Seattle Department of Construction and Inspections (SDCI) GIS Map. http://web6.seattle.gov/dpd/maps/dpdgis.aspx.

take place in existing improved, impervious areas. A total of approximately 3,200 cubic yards (cy) of excavation and 3,200 cy of clean fill would be required.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Erosion is possible in conjunction with any construction activity occurring on upland areas. Site work associated with upland pavement demolition, building demolition/relocation, and new pavement/building foundations would expose soils and increase the potential for erosion. Implementation of a Temporary Erosion and Sediment Control (TESC) plan would minimize potential impacts. Once the construction is complete, no erosion is anticipated because soils would not be exposed. Stormwater conveyance will be designed and installed on site per the City of Seattle stormwater manual.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt, buildings)?

Approximately 100 percent of the T-91 Berths 6 & 8 Redevelopment site under the proposal would be covered with impervious surfaces. As indicated below, under the proposal the amount of impervious surface on the upland portion of the site (paving/building footprint) would be the same as under existing conditions, and the amount of developed impervious surface associated with pile supported pier/apron area would decrease.

Site Use	Existing Area Sq.Ft./Use	Proposed Area Sq.Ft./Use
Pier and Apron (overwater pile supported)	66,230	60,710
Upland Pavement (located on upland fill material)[a]	44,300	38,000
Building Footprint (located on upland fill material)	8,700	15,000
Upland Subtotal	53,000	53,000
Total	**119,230 (2.73 ac.)**	**113,710 (2.61 ac.)[b]**

[a] Does not include upland area under buildings.
[b] Reduced site area reflects area in removed over-water pier area.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Comprehensive Drainage Control Plans (including Construction Best Management Practices and Erosion and Sediment Control Plans) would be submitted as part of Grading and Building Permit applications, in accordance with City of Seattle requirements.

2. Air

a. What type of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

The proposed project could result in localized increases in air emissions (primarily carbon monoxide and dust) due to construction vehicles, equipment and activities.

To evaluate the climate change impacts of the proposed T-91 Berths 6 & 8 Redevelopment Project, a Greenhouse Gas Emissions Worksheet was prepared to estimate the emissions footprint for the lifecycle of the project on a gross-level basis. The emissions estimates use the combined emissions from the following sources:

- Embodied Emissions – extraction, processing, transportation, construction and disposal of materials and landscape disturbance;
- Energy-related Emissions – energy demands created by the development after it is completed; and,
- Transportation-related Emissions – transportation demands created by the development after it is completed.

The Worksheet estimates are based on building use and size, but as mentioned above, the estimates also consider emissions associated with construction of the development and transportation demand from the project. The estimated lifespan emissions for the proposed redevelopment project would be approximately 17,910 metric tons of carbon dioxide equivalent ($MTCO_2e$). Based on the average building lifespan listed in the worksheet (62.5 years), the estimated annual emissions would be approximately 290 $MTCO_2e$ (see **Appendix D** to this Checklist for the Greenhouse Gas Emissions Worksheets)

The proposed project will be designed to conform to applicable regulations and standards of agencies regulating air quality in Seattle, including: the Environmental Protection Agency (EPA), Washington State Department of Ecology (DOE) and the Puget Sound Clean Air Agency (PSCAA).

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

The Burlington Northern Santa Fe (BNSF) mainline and switching yard to the east/northeast, 15th Avenue/Elliott Avenue W to the east, and the Magnolia Bridge to the north are sources of emissions and odors in the area. There are no other off-site sources of air emissions or odors that may affect the proposed project.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

The following mitigation measures will be implemented to control emissions and/or dust during construction:

- All construction equipment will be maintained in proper working order and in compliance with Washington State regulations for vehicle emissions.
- During construction, the site will be watered as necessary to reduce fugitive dust emissions.
- Construction-related trucks would avoid prolonged periods of vehicle idling.
- Using electrically operated small tools in place of gas-powered small tools, wherever feasible.

3. Water

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

The proposed project is located in the northeast portion of Smith Cove on the north side of Elliott Bay.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

The proposed project will include replacement of the existing creosote-treated timber pier and apron with a new wharf structure (including associated pile), relocation of the small boat storage and float system, replacement of the existing slope armoring, abandonment-in-place of the existing bulkhead and installation of a new sheet pile wall.

Please see attached plan and figures for a detailed project description.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

Approximately 25,000 cubic yards of existing material would be removed from the existing shoreline armoring at the site. Approximately 10,600 cubic yards of fill would be placed into the water as part of the shoreline armoring portion of the project. This would include approximately one-foot thickness of quarry spalls, three-foot thickness of riprap, and fish mix to fill the voids. Fill material will be clean fill sourced from a local quarry or reused from the existing shoreline armoring.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No surface water withdrawals or diversions are required for the proposed project.

5) **Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.**

   Terminal 91 Berths 6 and 8 lie within Elliott Bay. The pier structure extends over a FEMA mapped coastal high hazard zone (VE), with a base flood elevation of 13 feet NAVD 88.

6) **Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.**

   Suitable dredge material may be disposed of at the Elliott Bay non-dispersive Open-Water Disposal site, depending on approval of the DMMP. Unsuitable dredge material dewatered upland could enter surface waters; however, the material will be dewatered, treated, and disposed of according to the dredge material management office/program (DMMO/DMMP) and applicable permit requirements.

   All operating equipment at the site will be subject to best management practices (BMPs) and Spill Prevention, Containment and Countermeasures (SPCC) plans implemented to avoid and minimize potential releases of fuel and petroleum products used by maintenance dredging equipment. Incidental fallback of dredged material will be controlled by best management practices intended to minimize release of sediments from the dredge bucket and haul barge back into the aquatic environment. Unavoidable release of sediments and resulting turbidity from the operation will be managed through application of site specific temporary mixing zones that have been developed pursuant to Washington State Water Quality Standards.

b. Ground:

1) **Will ground water be withdrawn, or will water be discharged to ground water? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.**

   No groundwater would be withdrawn or water discharged to ground water.

2) **Describe waste material that will be discharged into the ground from septic tanks or other sources; industrial, containing the following chemicals; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.**

   Waste material would not be discharged into the ground from septic tanks or other sources. The proposed buildings would connect to the City's sewer system and would discharge directly to the sewer system.

c. Water Runoff (including storm water):

1) **Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.**

Stormwater from the existing upland (including pier and wharf) areas discharges through catch basins to eight dedicated outfalls that vary in size from 4-inches to 12-inches in diameter. Outfalls only convey stormwater from the Port which then discharges without treatment directly to the waterway. Stormwater collected on the existing pier is discharged directly via deck drains to the waterway. The stormwater conveyance system at the site is entirely owned by the Port and there are no other municipal stormwater systems located within the project area.

The proposed T-91 Berths 6 & 8 Redevelopment Project includes reconstruction of one 18-inch outfall, discharging treated stormwater to riprap slope and consolidation of eight (8) existing outfalls and deck drains to the new outfall which will drain into Elliott Bay.

2) Could waste materials enter ground or surface waters? If so, generally describe.

No. The proposed stormwater drainage control systems and associated mitigation measures would prevent waste materials from entering ground water or surface waters.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

No, the project would not alter or otherwise affect drainage patterns in the site vicinity.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

The proposed stormwater design for the project would consolidate existing outfalls and deck drains to be collected in a single system. Stormwater treatment would be provided per City of Seattle requirements, including pre-treatment and basic treatment. Downstream of treatment, stormwater will be discharged to a single rebuilt 18-inch outfall.

4. Plants

a. Check or circle types of vegetation found on the site:

__deciduous tree
__evergreen tree
__shrubs
__grass
__ pasture
__ crop or grain
__ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
__ water plants: water lily, eelgrass, milfoil, other
__other types of vegetation:

The site is a Port terminal and commercial pier and thus there is minimal vegetation located on the site.

b. **What kind and amount of vegetation will be removed or altered?**

No vegetation will be removed for the proposed project.

c. **List threatened or endangered species known to be on or near the site.**

There are no threatened or endangered plant species on or near the site.

d. **Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:**

No landscaping is planned at the site, as it will remain a commercial terminal for the Port of Seattle.

e. **List all noxious weeds and invasive species known to be on or near the site.**

There are no noxious weeds or invasive plant species known to be on or near the site.

5. Animals

a. **Circle (underlined) any birds and animals that have been observed on or near the site or are known to be on or near the site:**

birds: songbirds, hawk, heron, eagle, other: seagulls, pigeons.
mammals: deer, bear, elk, beaver, other: small mammals.
fish: bass, salmon, trout, herring, shellfish.

Birds and small mammals tolerant of urban conditions may use and may be present on and near Terminal 91. Mammals likely to be present include: raccoon, eastern gray squirrel, mouse, rat, opossum, muskrat and feral cats.

Birds common to the area include: European starling, house sparrow, rock dove, American crow, seagull, western gull, Canada goose, American robin, osprey, and house finch.

The Washington State Department of Fish and Wildlife (WDFW) indicates that the site area includes Puget Sound nearshore and estuarine zone Priority Habitats. WDFW Priority Species in the site area and vicinity include Pacific lamprey, Pacific herring, Bull trout, Chinook salmon, chum salmon, pink salmon, coho salmon, cutthroat trout, kokanee, sockeye salmon, pygmy whitefish, steelhead, Pacific cod, Pacific hake, English sole, rockfish, lingcod, common loon, common murre, western grebe, Brandt's cormorant, shearwaters, storm petrels, terns, great blue heron, black crowned night hero, brant, cavity nesting ducks, bald eagle, waterfowl concentrations, purple martin, Dall's porpoise, gray whale, harbor seal, Pacific harbor porpoise, orca, California sea lion, Steller sea lion, butter clam, geoduck, native littleneck clam, and Dungeness crab (see **Appendix B** for further details on animals in the site area).

b. **List any threatened or endangered species known to be on or near the site.**

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Endangered Species Act (ESA)-listed species with the project area include Puget Sound Chinook salmon, Puget Sound steelhead, bull trout, bocaccio, yelloweye rockfish, Southern Resident killer whale (SRKW), humpback whale, and marbled murrelet. Critical habitat for Puget Sound Chinook salmon, bull trout, rockfish, SRKW is also present within the project area. A Biological Evaluation (BE) was prepared for this application that considers the potential impacts to listed species and critical habitats. Based on the analysis provided within the BE, it is anticipated that the project may affect, but is not likely to adversely affect, the ESA-listed species or critical habitat that is located within the project area (see **Appendix B** for further details).

c. Is the site part of a migration route? If so, explain.

The entire Puget Sound area is within the Pacific Flyway, which is a major north-south flyway for migratory birds in America—extending from Alaska to Patagonia. Every year, migratory birds travel some or all of this distance both in spring and in fall, following food sources, heading to breeding grounds or travelling to overwintering sites. The proposed buildings would be of a similar height to adjacent structures; therefore, no impacts on the Pacific Flyway migration route are expected.

d. Proposed measures to preserve or enhance wildlife, if any:

The proposed project would enhance aquatic wildlife habitat by removing the above-the-mudline portion of 2,300 creosote-treated timber pile from the aquatic environment and replacing those piles with concrete piles. The project would also enhance aquatic habitat through placement of fish mix (small cobble) along the shoreline armoring to create additional surface area for habitat. Additionally, temporary and permanent stormwater control system plans (including installation of basic stormwater treatment and implementation of construction Best Management Practices (BMPs) and erosion and sediment control approvals) would be implemented, which would limit stormwater impacts on fisheries resources.

Measures and BMPs are identified as part of the biological evaluation (BE) for this application and include general construction BMPs, pile removal/installation water quality measures, and pile removal/installation noise abatement. See **Appendix B** for further details on specific measures and BMPs.

Marine mammal monitors would also be onsite during all pile driving activities.

e. List any invasive animal species known to be on or near the site.

Invasive species found in King County include European starling, house sparrow and eastern gray squirrel.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electricity is the primary source of energy that would serve the proposed project. Electricity is supplied from two 4,160-kilovolt (kV) substations (SS-3 and SS-4). On-site distribution is provided to buildings, lift stations, lighting, and to shore power.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No. The proposed project would not affect adjacent properties' use of solar energy.

e. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The following proposed mitigation measures apply to redevelopment of the project site.

- Where feasible, building systems will include high efficiency lighting and electrical fixtures, and mechanical systems.
- Where feasible, external lighting will be primarily powered by photovoltaic panels.

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? If so, describe.

The Port of Seattle does not maintain or store any hazardous materials on the project site as part of their current operations. However, some hazardous materials are known to be located in the vicinity of the site. See below for details.

1) Describe any known or possible contamination at the site from present or past uses.

A four-acre parcel to the north of Pier 90 and 91 is the site of a former tank farm; the northern portion of the project site falls within the Terminal 91 Tank Farm Affected Area, as defined in the Department of Ecology cleanup site (ID# 2674). The tank farm facility was constructed in 1920 and was used as a permitted dangerous waste treatment and storage facility beginning in 1980. The tank farm operated as a fuel storage facility from the late 1920s through to when it was demolished in 2005. Chemical Processors, Inc. (Chempro) subleased the tank farm from the Port when the Port was leasing the property from the Navy. The company used the facility for waste oil recovery and wastewater treatment. Chempro received a permit for waste management operations in 1980. In 1992, Burlington Environmental, Inc. (BEI-formerly known as Chempro) and the port were issued a Part B Resource Conservation and Recovery Act (RCRA) permit for the continued operation of a dangerous waste management facility. In 1995, BEI ceased operations at the tank farm. Once the dangerous waste permit was closed, the cleanup process started under a closure plan approved by Ecology in 2003. Further investigation and cleanup plan selection, design, planning, and permitting were conducted for the contaminated soil and groundwater from 2005 to 2013. The cleanup action plan was implemented in 2014 and 2015.

All of the sediments and upland areas at T-91 are included in one of two Department of Ecology MTCA Agreed Orders due to being contiguously owned property of a dangerous waste facility in the upland. There is known sediment contamination with concentrations exceeding the Washington State Sediment Management Standards. The extent of contamination in the vicinity of the project area is unknown. Dredged sediment will need to be characterized under the requirements of the Dredged Material Management Program to determine if any dredged material is suitable for open water disposal. Any material not meeting the open water suitability requirements will be disposed of upland at an appropriate landfill (e.g., subtitle C or D). There is known soil contamination around and in the backfill of utilities located along the western edge of the project area. This discrete cleanup unit (independent cleanup site B.32) was closed but limited contamination remains due to in accessibility due to the utilities. Any soil removed from this area during the project will need to be sampled and disposed of off-site at an approved landfill.

The proposed project site is located in the vicinity of an area identified by the USACE Formerly Used Defense Site #F10WA012501 Remedial Investigation Draft Final Report (US Army Corps of Engineers, May 2013) as potentially containing discarded military munitions (DMM). These areas are generally located in the south portion of the channel between Pier 90 and Pier 91 and outside of the proposed project area.

The Port of Seattle has prepared a Discarded Military Munitions Management Plan (AECOM, August 2015) to address the response to a potential discovery of DMM. The proposed project does not involve the collection of any DMM items and any identified DMM would remain in place, to be addressed by either the formerly used defense site (FUDS) investigation and removal action or by the Port Police Department Dive Unit during its regular inspections.

In the case that a DMM is discovered to have been inadvertently removed via dredging, the Port will immediately notify the US Army Corps of Engineers and Department of Defense at Joint Base Lewis-McChord.

The contractor will not conduct disposal operations for suspected or known DMMs. The Port of Seattle Security will take custody of any DMM discovered during construction activities. Custody of the DMM will then be transferred to JBLM for disposal and final disposition at their permitted site.

JBLM is located approximately 9 miles southwest of Tacoma, Washington and operates under the jurisdiction of the United States Army Joint Base Garrison. DMM will be transported in accordance with applicable local, state, and federal regulations (i.e., bracing, blocking, segregation of incompatible explosives, and appropriate notifications).

The water adjacent to the southern portion of Pier 90 at T-91 is also classified as Category 5 for polychlorinated biphenyls (PCBs). However, this area is outside of the proposed project boundary.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

No known hazardous chemicals/conditions are anticipated to affect the project, except as noted above in Section 7.a.1.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

Hydraulic oil and fuel would be used and could be stored onsite during construction. If handled improperly, oil and fuel spills could occur during construction. No toxic or hazardous chemicals, beyond what is typical for the proposed uses (household cleaners, etc.), are anticipated to be produced or stored after the project is operational.

4) Describe special emergency services that might be required.

No special emergency services are anticipated to be required because of the projects. As is typical of urban development, it is possible that normal fire, medical and other emergency services may, on occasion, be needed from the City of Seattle.

5) Proposed measures to reduce or control environmental health hazards, if any:

The following proposed mitigation measures will be implemented during redevelopment at the project site.

- Spill prevention and response planning would be conducted prior to the start of construction to prevent and, if needed, respond to hydraulic oil or fuel spills.
- Conventional dust control measures would be implemented to minimize the exposure of workers and the immediate surrounding populations to construction-generated dust.
- A Discarded Military Munitions Management Plan (AECOM, August 2015) was previously prepared for the Port of Seattle to address the response to a potential discovery of DMM. The proposed project does not involve the collection of any DMM items and any identified DMM would remain in place, to be addressed by either the FUDS investigation and removal action or by the Port Police Department Dive Unit during its regular inspections.
- Dredged sediment will need to be characterized under the requirements of the Dredged Material Management Program to determine if any dredged material is suitable for reuse or open water disposal. Any material not meeting the open water suitability requirements will be disposed of upland at an appropriate landfill (e.g., subtitle C or D).
- All activities will be conducted in accordance with an approved Section 401 Water Quality Certification.

b. Noise

1) What types of noise exist in the area that may affect your project (for example: traffic, equipment operation, other)?

Traffic noise associated with adjacent streets is relatively high at certain times of day, particularly along 15th Avenue W and Elliott Avenue W east of the site, which are both major arterials with access to downtown Seattle. The project vicinity contains numerous noise sources from both commercial and industrial uses, including Port tenants, nearby industrial facilities and the facility location in a working maritime industrial area. Railroad tracks associated with Burlington Northern Santa Fe (BNSF) operations are also located to the east and north of the site and are a substantial source of noise. Existing noise sources are not expected to adversely affect the proposed project.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from site.

The proposed project would create construction activity and equipment noise related to demolition of buildings and building construction.

The project site is zoned for Industrial uses. Residential uses are generally considered the most sensitive potentially affected receivers for a project; however, the nearest residences are located approximately 1,800 feet to the east of the site on the edge of Queen Anne and approximately 2,500 feet to the west in the Magnolia neighborhood. Commercial development uses are located approximately 600 feet to the east of the project site.

Construction noise would be short-term and would occur during daytime hours. Typical construction noise activities would include demolition and building construction and would employ equipment such as dump trucks, excavators, pavers, generators and compressors.

Redevelopment of Berths 6 and 8 would require the installation of new concrete piles. The concrete piles need to be driven by impact pile driving. According to the Seattle Municipal Code (Chapter 25.08), construction noise limits for industrial zones to receiving residential and commercial properties is and hourly sound level (Leq) of 85 and 90 A-weighted decibels (dBA) and a maximum sound level (Lmax) of 100 and 105 dBA, respectively. Archived sound level measurement data of pile driving activities indicate that the hourly sound level (Leq) of pile driving at a distance of 100 feet is approximately 86 dBA. The Lmax of pile driving is estimated to be 104 dBA at a distance of 100 feet. In the absence of intervening terrain, structures, or dense vegetation, sounds from construction equipment and activities (usually point sources) decrease about 6 dBA for each doubling in distance from the source. Therefore, construction sound levels are estimated under 60 dBA for the hourly Leq and under 80 dBA for the Lmax, which are below City of Seattle noise limits.

However, even with low levels of pile driving noise, the unique nature of impact pile driving noise can result in the loudest sounds being audible at the businesses and residences nearest this activity. This noise could potentially be perceived by some neighbors as intrusive or a nuisance, but the low overall sound levels and compliance with Seattle's noise code would minimize the potential for significant impacts. The proposed project would comply with provisions of Seattle's Noise Code (SMC, Chapter 25.08); no noise variances are anticipated.

Once the site uses are operational, no significant long-term noise impacts are anticipated that would exceed those typical of existing uses; the redevelopment would comply with provisions of the City of Seattle's Noise Ordinance.

3) Proposed measures to reduce or control noise impacts, if any:

The following proposed mitigation measure will be implemented with the proposed project.

- The project would comply with provisions of the City's Noise Ordinance (SMC 25.08); specifically: construction hours would be limited to standard construction hours (non-holiday) from 7 AM to 10 PM and weekends and holidays from 9 AM to 10 PM. If extended construction hours are necessary, the Port and/or its contractor would apply to the City for a noise variance.
- The Port will continue to engage with nearby neighborhoods via the Terminal 91 Neighbors Advisory Committee (NAC) to hear concerns from nearby residents, and will respond to concerns as appropriate.
- Pile driving will be limited to between 8 am and 5 pm weekdays and 9am and 5 pm weekends and holidays.

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The overall Terminal 91 property is established with a mix of marine commercial/industrial and marine transportation uses, including Piers 90 and 91, which host the North Pacific Fishing Fleet and a cruise ship terminal south of the Magnolia Bridge, and cruise terminal accessory parking, warehouse, and outdoor storage uses north of the Bridge.

The proposed T-91 Berths 6 & 8 Redevelopment Project site is located at the northeast portion of Pier 90 and includes Port of Seattle owned upland, shoreline, and aquatic areas. The approximately 2.60-acre site currently contains over-water pier and apron area (pier supported), upland pavement area, and seven structures. Uses within the existing buildings include Port of Seattle Police offices, Port of Seattle operations offices, Port of Seattle engineering offices, and a small building associated with American Seafood Company's operations. Approximately 30 percent of the apron area is condemned with the remaining sections posted with load limits.

Terminal 91, including the T-91 Berths 6 & 8 Redevelopment Project site, is located within one of two designated Manufacturing/Industrial Centers in the City of Seattle – the Ballard-Interbay-Northend Manufacturing/Industrial Center (BINMIC). These areas are home to the city's industrial businesses and are designated as regional resources for retaining and attracting jobs, and maintaining a diversified economy. A more detailed description of land

and shoreline uses at and around the project site is provided below. The potential for the proposed project to affect current land uses is also discussed.

The proposed T-91 Berths 6 & 8 Redevelopment Project is intended to redevelop the site, including existing condemned and load limited area, to provide improved berths suitable to ensure the long-term viability of the Port as the home to the North Pacific Fishing Fleet.

The following primary demolition, relocation, and redevelopment elements are proposed:

Demolition

- Over-water Timber Pier and Apron Structure – 66,230 sq.ft.
- Creosote-treated timber piles – approximately 2,300 12-inch piles (cut at top of subgrade).
- Upland Pavement Area – 44,300 sq.ft.
- Seven Buildings[9] – 9,600 sq.ft (demolished and/or relocated)

Relocation

- Over-water Float – 1,600 sq.ft. relocated, 1,810 sq.ft. remaining

Redevelopment

- Over-water pre-cast concrete decking Pier Replacement – 60,710 sq.ft.
- 378 piles (including 288 24-inch concrete octagonal piles and 90 20-inch steel fender piles with 24-inch high density HDPE facing.
- Slope Armoring Replacement.
- Sheet Pile Wall Installation.
- Upland Pavement Replacement[10] – 38,000 sq.ft.
- Consolidated Office Building – 12,000 sq.ft.
- Shipping and Receiving Building – 3,000 sq.ft.

These uses would be allowed by the site's IG1 U/45 zoning classification and Urban Industrial Shoreline Master Program (SMP) designation. They would also be consistent with the types and character of the land uses in the surrounding area on and offsite. The height, bulk and scale of the proposed buildings would be consistent with the sites' zoning classifications and SMP designation and existing development in the area.

b. Has the site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

No, the site has not been used as working farmlands or forest lands for over 100 years.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

[9] Buildings A-310, A-500, A-501, A-400, A-300, A-301, Police Boat Storage

[10] Excludes pavement under proposed buildings.

No. The site is in an urban area and would not affect or be affected by working farm or forest land; no working farm or forest land near this urban site.

c. Describe any structures on the site.

The T-91 Berths 6 & 8 Redevelopment site contains seven (7) buildings containing a total of approximately 9,600 square feet of building space. Except for A-310, all buildings are single-story, with heights ranging from 14 to 28 feet. Building uses include Port of Seattle Police and Operations, Port of Seattle Engineering, and other Port and Port tenant support uses.

d. Will any structures be demolished? If so, what?

Yes, all the structures on the T-91 Berths 6 & 8 Redevelopment Project site are expected to be demolished and/or relocated, including Buildings A-310, A-500, A-501, A-400, A-300, A-301, and Port Police Dive Storage.

f. What is the current zoning classification of the site?

The T-91 Berths 6 & 8 Redevelopment Site is zoned Industrial General 1 Unlimited/45 (IG1 U/45).

The site is also within the Ballard-Interbay-Northend Manufacturing Industrial Center (BINMIC). As noted above, this is one of two designated Manufacturing/Industrial Centers in the City of Seattle. These areas are home to the city's thriving industrial businesses, and are designated as important regional resources for retaining and attracting jobs, and maintaining a diversified economy.

f. What is the current comprehensive plan designation of the site?

The Future Land Use Map in the Seattle Comprehensive Plan identifies the T-91 Berths 6 & 8 Redevelopment site as a Manufacturing Industrial Center.

g. If applicable, what is the current shoreline master program designation of the site?

The site is located within the Urban Industrial Shoreline Master Program (SMP) designation.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

Based on the SDCI GIS mapping, the T-91 Berths 6 & 8 contain the following Environmentally Critical Areas.

- <u>Liquefaction Prone Area</u> – the entire Terminal 91 and Interbay area is classified as Liquefaction Prone Area.

- Flood Prone Area – Pier 90, Pier 91, and all over-water features along Elliott Bay classified as Flood Prone Area.

- Steep Slope (40%) – the extreme northeast edge of the site associated with the Port's Engineering Office is classified as Steep Slope.

i. Approximately how many people would reside or work in the completed project?

The project would not contain any residential units; therefore, no people would reside in the completed project. With the proposed T-91 Berths 6 & 8 Redevelopment Project, employment would be the same as under existing conditions, with approximately 30 to 50 employees on the site.

j. Approximately how many people would the completed project displace?

The completed development project would not displace any people on a permanent basis. Under the proposed T-91 Berths 6 & 8 Redevelopment Project employment would be the same as under existing conditions, with approximately 30 to 50 employees on the site.

k. Proposed measures to avoid or reduce displacement impacts, if any:

No displacement impacts would occur and no mitigation measures are necessary.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The project is compatible with existing and projected land uses and plans, and no mitigation is necessary.

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:

The project site is not located near agricultural or forest lands and no mitigation measures would be necessary.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

No housing units would be provided.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

No housing presently exists onsite and none would be eliminated.

c. Proposed measures to reduce or control housing impacts, if any:

No housing impacts would occur and no mitigation measures would be necessary.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

Consistent with the site's IG1 U/45 zoning and Urban Industrial SMP designation, the proposed Consolidated Office Building and Shipping/Receiving Building will not exceed 35 feet.

Building design for the proposed buildings would likely consider contextual materials that relate to the surrounding maritime industrial setting, although the design has not been finalized at this time.

b. What views in the immediate vicinity would be altered or obstructed?

The City of Seattle's public view protection policies are intended to "protect public views of significant natural and human-made features: Mount Rainier, the Olympic and Cascade Mountains, the downtown skyline, and major bodies of water including Puget Sound, Lake Washington, Lake Union and the Ship Canal, from public places consisting of specified viewpoints, parks, scenic routes and view corridors identified in Attachment 1" to the SEPA code.[11] And it is City policy to protect public views of the Space Needle from designated public places.[12]

The T-91 Berths 6 & 8 Redevelopment Project is not expected to result in significant impacts on views from City-designated public viewpoints, parks, scenic routes or view corridors of significant natural and human-made features; or views of the Space Needle from City-designated public places, as described below.

<u>Designated Viewpoints and Designated Views of the Space Needle</u>

The nearest City-designated viewpoints are Smith Cove Park approximately 600 feet to the west, Kinnear Park approximately 0.5 mile to the southeast, Magnolia Elementary School Playground approximately one mile to the northwest, and Soundview Terrace Park approximately two miles to the east. The nearest designated view of the Space Needle is from Kerry Park on the south side of Queen Anne hill, approximately two miles southeast of the. Views of water, mountains, or downtown skyline from these viewpoints would not change with the proposed T-91 Berths 6 & 8 Redevelopment Project because of the distance from the viewpoints, topographic separation, and position of the site relative to the viewpoints.

<u>Scenic Routes</u>

City-designated scenic routes near the T-91 Berths 6 & 8 Redevelopment Project site include:

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11 SMC Chap. 25.05.675 P.2.a.i.

12 SMC Chap. 25.05.675 P.2.c.

- Elliott Avenue West to the east; and,
- Magnolia Bridge to the north.

The proposed T-91 Berths 6 & 8 Redevelopment Project would not affect protected views to the water from either Elliott Avenue W or the Magnolia Bridge. The Magnolia Bridge right-of-way is elevated above the site, the type of ships using the site would not change from historic conditions, the buildings' square footage and height would be similar to current conditions, and the proposal would not affect views toward the water from this roadway. From Elliott Avenue W, the proposed T-91 Berths 6 & 8 Redevelopment Project would not affect views toward the water from this roadway.

c. Proposed measures to reduce or control aesthetic impacts, if any:

No significant aesthetic/views impacts are anticipated with the proposed project and no mitigation measures are proposed.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

At times during the construction process, area lighting of the job site (to meet safety requirements) may be necessary, which will be noticeable proximate to the project site. In general, however, light and glare from construction of the proposed project is not anticipated to adversely affect adjacent land uses.

The four existing light poles and fixtures on the site would be removed and replaced with five new light poles and fixtures. Security lighting would be provided for new buildings similar to lighting for existing buildings. To the extent feasible, Dark-Sky compliant light fixtures will be used. The overall level of light and glare on the site is not expected to differ substantially from that presently occurring on the site and in the site vicinity.

Shadows

Seattle's SEPA policies aim to "minimize or prevent light blockage and the creation of shadows on open spaces most used by the public."[13] Areas of the City outside Downtown that are to be protected include:

- publicly-owned parks;
- public school yards;
- private schools which allow public use of schoolyards during non-school hours; and
- publicly owned street ends in shoreline areas.

There are no protected open space areas that are proximate to the T-91 Berths 6 & 8 Redevelopment Project site where the project could block light or cast shadows.

[13] SMC 25.05.675 Q2.

c. Could light or glare from the finished project be a safety hazard or interfere with views?

No light or glare safety hazards or view interferences are anticipated.

d. What existing off-site sources of light or glare may affect your proposal?

No off-site sources of light or glare are anticipated to affect the proposed T-91 Berths 6 & 8 Redevelopment Project.

e. Proposed measures to reduce or control light and glare impacts, if any:

No significant long term light or glare-related environmental impacts are anticipated, including for motorists on 15th Avenue W and Elliott Avenue W immediately east of the site because of the proposed T-91 Berths 6 & 8 Redevelopment Project, and no mitigation measures are necessary.

However, the following mitigation measures would further to reduce overall light and glare from the T-91 Berths Redevelopment Project.

- New outdoor lighting could be provided by light fixtures with well shielded sources that have precise optical control to focus light to the site and limit spill-over light, including use of Dark-Sky compliant specifications to the extent feasible.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

Public recreational opportunities in the vicinity of the site include:

- Smith Cove Park: Located approximately 0.25 mile west of the site and west of Pier 91. Smith Cove Park includes approximately 0.8 acres of landscaped upland area and approximately 520 linear feet of shoreline.

- Terminal 91 Pedestrian/Bicycle Pathway (Elliott Bay Trail): Located immediately east of the site, the Elliott Bay Trail includes a paved trail with landscaping on either side. The Elliot Bay Trail loops around the perimeter of Terminal 91 and continues south through Elliott Bay Park.

- Centennial Park—Located approximately 0.25 mile south of the site, this park contains approximately 10.5 acres and 4100 linear feet of shoreline.

f. Would the proposed project displace any existing recreational uses? If so, describe.

The project would not displace any existing recreational uses.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

No significant recreation impacts are anticipated, and no mitigation measures are necessary.

13. Historic and Cultural Preservation

A detailed Cultural Resources Assessment was prepared for the T-91 Berths 6 & 8 Redevelopment project by HRA in June 2021 (see **Appendix C**). The following responses summarize the findings in this report.

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? If so, specifically describe.

The nearest City-designated historic landmark is the "Admiral House", which is listed in the National Register of Historic Places, located approximately 0.35 mile west of the site.

Two architectural resources were identified on the site; Pier 90 and Pier 90 Railroad Spur. These architectural resources are described below.

<u>Pier 90</u>

Originally constructed in 1913, Pier 90 is one of two piers located within Terminal 91. Pier 90 was constructed in 1913 and was primarily used for loading and unloading shipments. During World War II, the pier was used by the U.S. Navy for "extensive naval craft mooring, repair, and deactivation activities". While the naval station does not appear to have been associated with a significant World War II mission, it was used to supply and repair ships. The Navy sold the pier to the Port of Seattle in 1976.

Pier 90 is approximately 2,540 ft long and 300 ft wide, with two larger buildings at the south end (outside of the Project site). Only a portion of Pier 90 is located within the Project site. Within the Project site, Pier 90 is paved in asphalt and is supported by wood piers and beams. Some areas of the substructure are concealed by corrugated metal. The eastern edge of the pier within the site includes a former railroad spur that was abandoned and paved over. On the east side of the pier are two floating docks, one of which contains a metal-framed boathouse. According to Port of Seattle staff, the boathouse was constructed in 2018 to replace an earlier boathouse constructed in the 1980s. Additional buildings on Pier 90 within the site include warehouse and office buildings constructed in the 1990s. They are generally rectangular, clad in T1-11, with side-gabled roofs; none of these buildings are 45 years old or older.

While Pier 90 is significant for its association with naval activity in the Puget Sound during World War II, due to substantial alterations the pier no longer conveys that significance. It is determined that Pier 90 within the Project site does not retain sufficient integrity from its period of construction (1913) and does not qualify for listing in the National Register of Historic Places (NRHP) under any criteria (see **Appendix C** for detail).

Pier 90 Railroad Spur

Built in 1942, the Pier 90 railroad spur was one of several spur lines once located on Pier 90. This railroad spur follows the eastern edge of the pier and is approximately 880 ft long. The Navy had paved the spur by 1969, and it is currently used to access two floating docks on the eastern edge of Pier 90 within the project site. Along the spur are several wood bumpers and metal posts. It is unclear if the Navy fully removed the railroad tracks, so the tracks may still be in place. The wood support piers and trestle are still present.

The railroad spur has been abandoned and paved and does not convey historic significance (see **Appendix C** for detail).

g. **Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.**

Potential impacts to cultural resources with the proposed T-91 Berths 6 & 8 Redevelopment project were evaluated in the Cultural Resources Report (see **Appendix C**). Below are summaries of the ethnographic and historic context of the site and vicinity.

Ethnographic Context

Archeological sites dating to the early to mid-Holocene (the Holocene began about 11,700 years before present) are more commonly found in the region. Human land use was generally structured around the value of natural resources available in the local environments, including fresh water, terrestrial and marine food resources, forests and suitable terrain. Terminal 91 is within the traditional territory of the Duwamish, a southern South Coast Salish people who spoke Southern Lushootseed; historically, members of the Suquamish and Muckleshoot Tribes also used this vicinity. A major Duwamish winter village was located on the north shore of Salmon Bay. A boulder now known as “Four Mile Rock” at the foot of the Magnolia Bluff is an ethnographically recorded place.

Historic Context

In the late 1700s, Euro-American exploration and settlement of the region began, including on the south shore of Salmon Bay. In 1855, following the signing of the Point Elliot Treaty and others, area tribes were forced to abandon their Puget Sound villages and relocate to reservations. In 1911, the Port of Seattle was created and in 1913 the Port acquired property at the south end of Smith Cove. The Port constructed Piers 90 and 91 in 1913 and 1919, respectively, which were used for loading and unloading lumber, steel, coal, and other materials.

In 1942 the U.S. Navy acquired Terminal 91 through condemnation and turned it into an active naval station. The Navy’s operations at the station consisted of extensive naval craft mooring, repair, and deactivation activities. The Navy continued to use Terminal 91 through the Korean War, though operations and activities slowed.

In 1972, the Navy began leasing a portion of Terminal 91 back to the Port of Seattle, and in 1976, deeded approximately 200 acres to the Port. Between 1976 and 1977, the Port demolished all of the transit sheds constructed by the Navy. In 1986, the Port used fill from the Pier 32 area to create the Short Fill area between Piers 90 and 91. Terminal 91 was primarily used at this time for cold storage and maritime services.

Previously Recorded Archaeological Sites

Two previously recorded archaeological sites are located within 0.25 mile of the site, none of which are located within the site. Archaeological site 45KI1033, located within the water adjacent to the site, is a submerged historic-period debris scatter consisting of munitions associated with the previous use of Pier 91 as a naval supply depot. The site was recorded as part of the USACE Munitions Response Project for Pier 90 and 91 and consisted of a total of 224 pieces of military debris and discarded military munitions located on the seafloor surrounding Pier 91. The cultural materials were associated with the U.S Navy's supply depot at this location during World War II to 1976. No determination has been made on the site's eligibility for listing in the NRHP.

The second archaeological site is 45KI1200, located 0.25 mile west of the site. This historic-period debris scatter and associated structures were recorded in 2014 during the South Magnolia CSO Storage Tank Project. The cultural materials from the site are associated with a "low-income, multi-ethnic community that occupied the Smith Cove tide flats between approximately 1911 and 1942". The artifacts recorded within the site include glass bottles, ceramics, leather shoes, furniture fragments and construction materials with a total of 2,600 total artifacts. No determination has been made on the site's eligibility for listing in the NRHP.

(See **Appendix C** for details.)

c. **Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.**

Background research for the T-91 Berths 6 & 8 Redevelopment Project was conducted using a research radius of 0.25 mile. The Washington Department of Archaeology and Historic Preservation (DAHP) online database (Washington Information System for Architectural and Archaeological Records [WISAARD]) was reviewed for previous cultural resources studies, archaeological site records, cemetery records, and historic properties listed in the NRHP or the Washington Heritage Register (WHR) within the research radius. The statewide predictive model layer on WISAARD was reviewed for probability estimates for archaeological resources within the research radius.

Historic Resource Associates' (HRA's) in-house library was consulted for information on the environmental, archaeological, and historical context of the site and vicinity. Ethnographic sources were reviewed for information regarding place names, burials, and land-use practices. Historic-period plats from the U.S. Surveyor General's (USSG) General Land Office (GLO) were reviewed for the presence of structures and features that might be extant within the site vicinity, as well as indicators of potential archaeological sites and past land-use patterns. Other online historic-period map archives were consulted to determine the history of land use in the site vicinity (See **Appendix C** for details.)

h. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

The following proposed mitigation measure applies to proposed redevelopment at the T-91 Berths 6 & 8 Redevelopment Project.

- Although the historic period wood structure is recommended “not eligible for listing in the NRHP”, a Monitoring and Inadvertent Discovery Plan (MIDP) would be developed and followed during the removal of pavement in the vicinity of the railroad grade along the west side of Pier 90. The MIDP will include protocols for the treatment of any features (ties or rails) related to the railroad if they are found.

14. Transportation

a. Identify public streets and highways serving the site or affected geographic area and describe the proposed access to the existing street system. Show on site plans, if any.

The T-91 Berths 6 & 8 Redevelopment site is located at the northeast portion of Pier 90 at Terminal 91. The site is located west of Elliott Avenue West, and south of the Garfield Street Overpass and the Magnolia Bridge.

The site is served by a vehicle entrance located to the immediate north (Gate 1) accessing the Galer Street Overpass. The Galer Street Overpass connects with the overall Seattle street grid via Elliott Avenue West. Access to the site with the T-91 Berths 6 & 8 Redevelopment Project from the overall Seattle street grid would continue as under current conditions.

b. Is site or affected geographic area currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

Yes, public transit routes associated with King County Metro are provided on Elliott Avenue West to the east of the site. The nearest transit stop is provided near the Elliott Avenue/West Galer Street intersection (RapidRide D Line W. Galer St. stop), approximately 500 feet to the northeast.

c. How many additional parking spaces would. the completed project have? How many would the project or proposal eliminate?

There are currently approximately 116 parking spaces on the T-91 Berths 6 & 8 Redevelopment site, including 68 standard parking stalls and 48 decreased capacity stalls that are located on the existing pier with a maximum load capacity.

Existing parking spaces that would be removed during demolition would be replaced as part of project construction. A total of 116 parking spaces would continue to be located on the site subsequent to construction.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

The T-91 Berths 6 & 8 Redevelopment project would not include any improvements to existing roads, streets or pedestrian/bicycle facilities.

The existing north/south main drive aisle on the site would shift approximately 30 feet to the west under the proposal.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

Terminal 91 (T-91) Berths 6 & 8 are the last remaining original timber pier structures at the terminal and are at the end of their service life. Approximately 30 percent of the apron at the Berths 6 & 8 site is currently condemned and the remaining sections are posted with load limits. Redevelopment of Berths 6 & 8 is intended to improve the shipping use of Port of Seattle's T-91 Pier 90, and is considered to be critical to ensuring long-term viability of the Port as the home to the North Pacific Fleet.

Accordingly, the proposal is intended to support Port marine operations and use would occur in the immediate vicinity of water. The proposal would not use or interfere with rail or air transportation.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

Proposed uses, activities, and number of employees on the site under the T-91 Berths 6 & 8 Redevelopment Project would be similar to historic conditions (i.e. conditions prior to condemnation and establishment of load limits), and the number of vehicle trips associated with proposed site uses would not change substantially from historic conditions.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

The project would not interfere or be affected by the movement of agricultural and forest products on the roadway network near the site area.

h. Proposed measures to reduce or control transportation impacts, if any.

No impacts are anticipated and no mitigation is proposed.

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

No. The project would not result in an increased need for public services.

b. Proposed measures to reduce or control direct impacts on public services, if any.

Proposed uses, activities, and number of employees on the site under the T-91 Berths 6 & 8 Redevelopment Project would be similar to historic conditions (i.e. conditions prior to condemnation and establishment of load limits), and the demand for emergency public services would not be anticipated to change. It is anticipated that adequate service capacity is available within the area and city as a whole to preclude the need for additional public facilities/services.

16. Utilities

a. Circle utilities currently available at the site: <u>electricity</u>, <u>natural gas</u>, <u>water</u>, <u>refuse service</u>, <u>telephone</u>, <u>sanitary sewer</u>, septic system, other.

All utilities are currently available at the site and have adequate capacity to serve the proposed redevelopment project.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in immediate vicinity that might be needed.

Utilities and providers (in parentheses) proposed for the projects would include the following:

- Water – The existing water system that is located under areas of the pier that is proposed to be demolished would be rerouted as part of construction. New water appurtenances would be installed along the face of the new pier with new connections for the proposed new buildings (Seattle Public Utilities).
- Sewer – New buildings would be connected and routed to existing lift stations which would be retrofitted to account for new flows from the project (Seattle Public Utilities).
- Natural Gas – Natural gas service currently exists on the site and no new services are proposed (Puget Sound Energy).
- Telecommunications – New telecommunications connections to existing infrastructure at the Port (Century Link, Comcast).
- Electrical – The existing electrical distribution system on the site would have selective in-kind replacements for degraded equipment and equipment that would be relocated from inappropriate areas (Seattle City Light).
- Refuse/Recycling Service (Cleanscapes/Recology).

C. SIGNATURES

The above answers are true and complete to the best of my knowledge. I understand the lead agency is relying on them to make its decision.

Signature:

Danielle R. Butsick

Danielle Butsick, Sr. Environmental Management Specialist, Port of Seattle

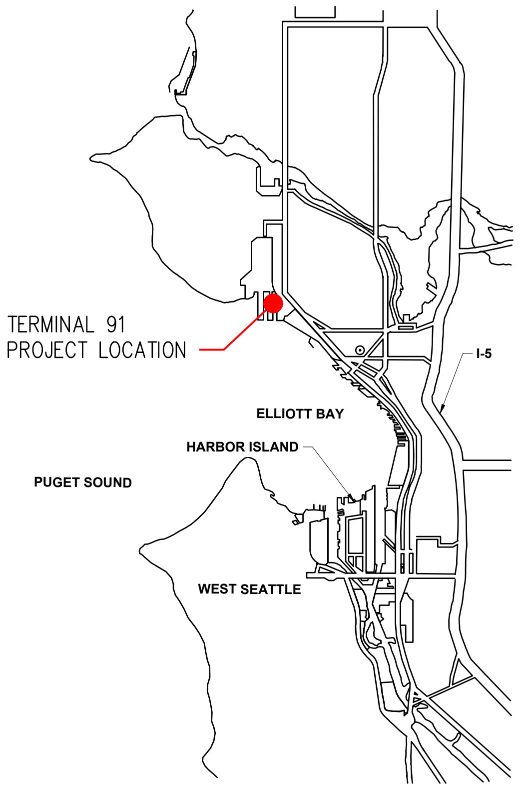
Date submitted:

September 17, 2021

Appendix A

TERMINAL 91 BERTHS 6 & 8 EXHIBITS

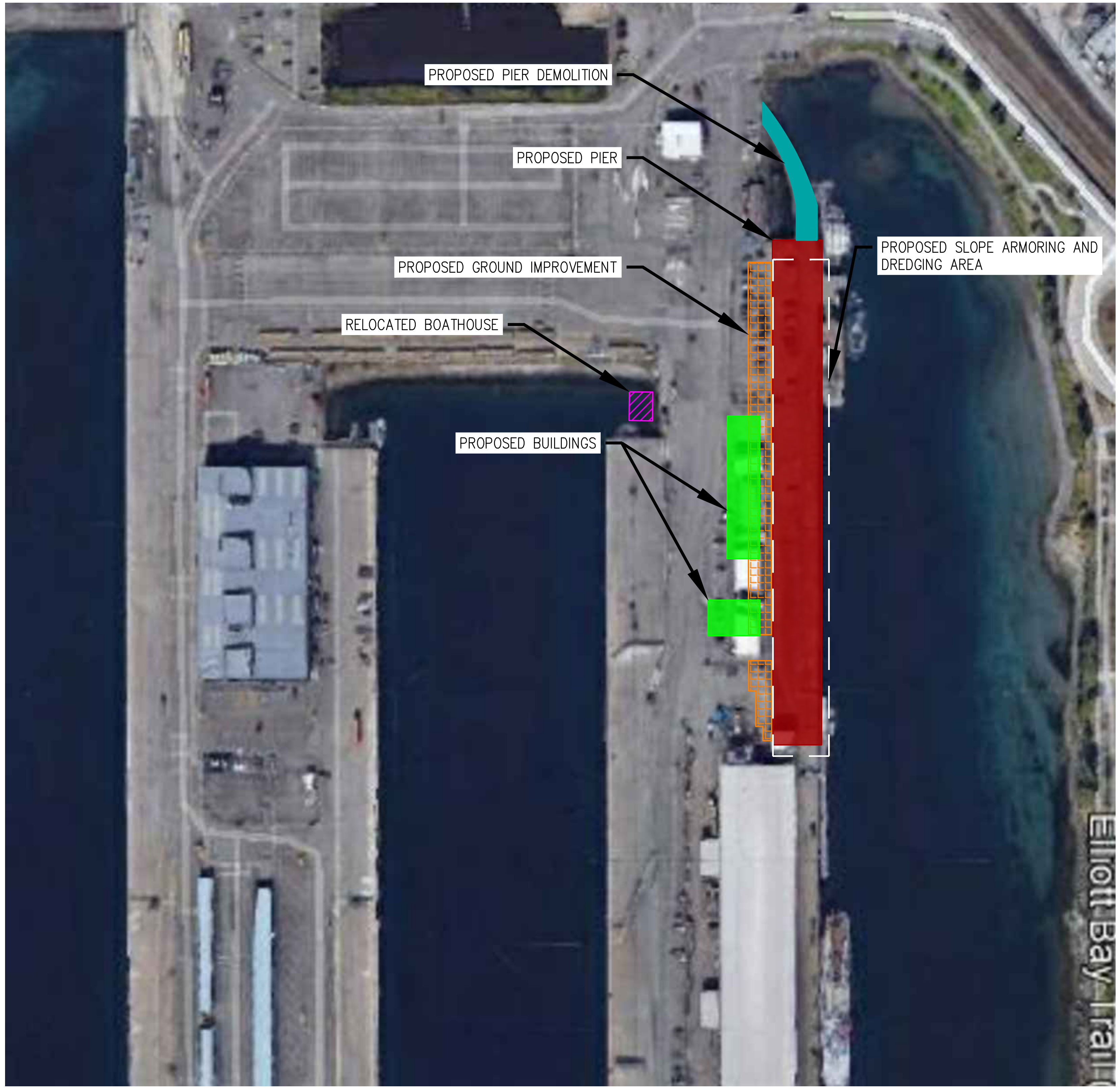
VICINITY MAP



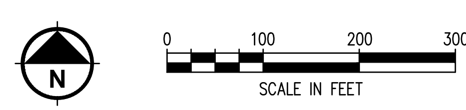
PROJECT LOCATION

ADDRESS: TERMINAL 91
2001 WEST GARFIELD STREET
SEATTLE, WA 98119
PARCEL NUMBER: 766620-1146
LATITUDE: 46.630 N
LONGITUDE: -122.381 W
PROPERTY OWNERS: PORT OF SEATTLE, CRUISE LLC

T91 BERTHS 6 & 8 REDEVELOPMENT SITE MAP



SOURCE: GOOGLE MAP



PROJECT DESCRIPTION

THE PROPOSED PROJECT WOULD IMPROVE THE CONDITION OF T-91 BERTHS 6 & 8 TO ACCOMMODATE COMMERCIAL FISHING PROCESSOR VESSELS, AND TO RESTORE THE FUNCTIONAL USE OF CONDEMNED AND LOAD-LIMITED PORTIONS OF THE PIER STRUCTURE

THE WORK OF THIS PROJECT IS LIMITED TO REPLACEMENT OF THE EXISTING TIMBER APRON PORTIONS OF BERTH 6 & 8 AND MODIFICATION OF TERMINAL ELEMENTS IMMEDIATELY ADJACENET TO THE PIER. THE PROPOSED IMPROVEMENTS TO BERTHS 6 & 8 INCLUDE BUT NOT LIMITED TO THE FOLLOW:

PROPOSED IMPROVEMENTS	QUANTITY
DEMOLITION OF EX CREOSTE TIMBER PIER AND APRON STRUCTURE	66,230 SF
REMOVAL OF EX SLOPE ARMORING UNDER DOCK	25,000 CY
REPLACEMENT OF SLOPE ARMORING	10,600 CY
RELOCATION OF EX SMALL BOAT STORAGE FLOAT	1890 SF
INSTALLATION OF NEW SHEET PILE WALL	780 LF
REPLACE EX CREOSOTE TIMBER WITH NEW CONCRETE WHARF	60,710 SF
INSTALLATION OF NEW STORMWATER TREATMENT SYSTEM	1 EA
INSTALLATION OF NEW UNDER-PIER 18" DIAMETER OUTFALL FOR TREATED STORMWATER	1 EA
CONSOLIDATION OF EX OUTFALLS	8 EA
INSTALLATION OF GROUND IMPROVEMENT	11,500 SF±
CONSTRUCTION OF NEW BUILDINGS	15,400 SF

PURPOSE OF THE PROJECT

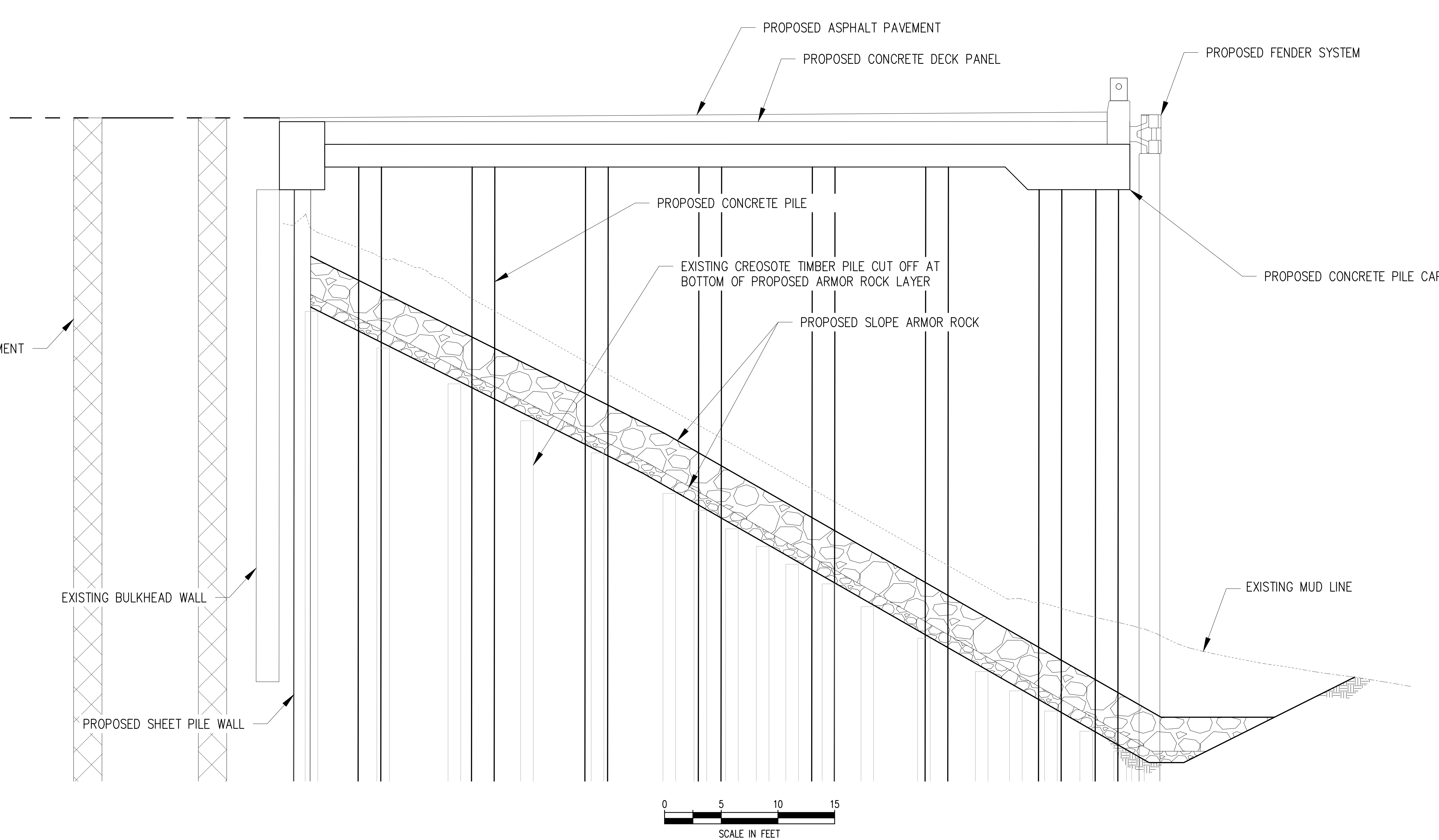
THE PORT PROPOSES TO REDEVELOP BERTHS 6 & 8 AT TERMINAL 91. THE EXISTING FACILITY IS A DETERIORATING CREOSOTE-TREATED TIMBER WHARF WITH GENERALLY HEAVILY DETERIORATED TIMBER PILING SUPPORTING TIMBER PILE CAPS, STRINGERS, AND DECKING. MANY OF THESE ELEMENTS ARE IN AN ADVANCED STAGE OF DETERIORATION AND AS A RESULT LARGE PORTIONS OF THE WHARF ARE CONDEMNED. THE REMAINDER HAS BEEN LOAD-RATED FOR ALLOWABLE LOADING SIGNIFICANTLY BENEATH THE ORIGINAL DESIGN LIVE LOAD ALLOWANCES. THE EXISTING SUPERSTRUCTURE AND PILING ABOVE THE MUDLINE WILL BE REMOVED AND DISPOSED OF. WHERE NEW PILING DOES NOT CONFLICT WITH EXISTING PILING, THE INTENT IS TO CUT EXISTING PILES AT THE MUDLINE AND LEAVE THE EXISTING PILES EMBEDDED IN THE GROUND TO MAINTAIN IN-SITU SLOPE STABILITY. EXISTING PILE STUBS REMAINING WOULD THEN BE COVERED BY THE NEWLY PLACED RIPRAP LAYER. THE EXISTING PILING IS LIKELY IN GOOD CONDITION FROM JUST BELOW THE MUDLINE TO THE TIP DUE TO THE ANAEROBIC ENVIRONMENT AND THE INABILITY OF MARINE BORERS TO ACCESS THE PILING BELOW THE MUDLINE.

THE EXISTING BULKHEAD WALL IS ALSO IN AN ADVANCED STATE OF DETERIORATION AND WILL BE ABANDONED IN PLACE WITH A NEW STEEL SHEET PILE BULKHEAD WALL INSTALLED JUST WATERWARD OF THE EXISTING BULKHEAD. NO BENEFIT FROM THE EXISTING BULKHEAD WALL WILL BE ASSUMED WITH RESPECT TO SLOPE STABILITY OR SOIL RETENTION.

REFERENCE #: APPLICANT : PORT OF SEATTLE LOCATION: 2001 WEST GARFIELD STREET, SEATTLE WA 98119	NAME: TERMINAL 91 BERTHS 6 & 8 REDEVELOPMENT ADJACENT PROPERTY OWNERS: CITY OF SEATTLE, BNSF, CRUISE LLC.	Port of Seattle kpff 1601 5th Avenue, Suite 1300 Seattle, Washington 98101 (206) 382-0600 Fax (206) 382-0500

DATE: 9/1/2021

T91 BERTHS 6 & 8 REDEVELOPMENT TYPICAL PROPOSED WHARF CROSS SECTION



REFERENCE #: APPLICANT : PORT OF SEATTLE LOCATION: 2001 WEST GARFIELD STREET, SEATTLE WA 98119	NAME: TERMINAL 91 BERTHS 6 & 8 REDEVELOPMENT ADJACENT PROPERTY OWNERS: CITY OF SEATTLE, BNSF, CRUISE LLC.	Port of Seattle kpff 1601 5th Avenue, Suite 1300 Seattle, Washington 98101 (206) 382-0600 Fax (206) 382-0500

DATE: 9/1/2021

Appendix B

BIOLOGICAL EVALUATION

PORT OF SEATTLE
TERMINAL 91 BERTHS 6 & 8 REDEVELOPMENT

BIOLOGICAL EVALUATION

PREPARED FOR:

PORT OF SEATTLE
P.O. BOX 1209
SEATTLE, WA 98111

SEPTEMBER 2021

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1. INTRODUCTION

The Port of Seattle (the "Port") proposes to redevelop Berths 6 & 8 at Terminal 91. Berths 6 & 8 are the last remaining original timber pier structures at Terminal 91 and are at the end of their service life. Approximately 30% of the apron is currently condemned and the remaining sections are posted with severe load limits. Originally built as one of the Port's first facilities, this section of the terminal was last rehabilitated in 1985 and little has been done to the structure since then. Redevelopment of Berths 6 & 8 is critical to ensuring the long-term viability of the Port as the home to the North Pacific Fishing Fleet.

The project will include demolition of approximately 62,250 square feet of timber pier and apron structure, removal of existing debris on the slope and installation of new slope armoring, relocation of the existing small boat storage and float system, installation of a new sheet pile cut-off wall at the top of the slope under the wharf and extending approximately 90 feet north, construction of a new wharf structure including concrete piles, cast-in-place concrete pile caps, precast concrete deck, bull rail, fendering system, isolation joint with the existing apron structure to remain, bollards, and utility vaults, and consolidation of existing stormwater conveyance and discharge in the Project area to one rebuilt 18" outfall with basic treatment.

As part of the Berths 6 & 8 Redevelopment Project (Project), the Port submitted an application for a U.S. Army Corps of Engineers (USACE) authorization under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. The Endangered Species Act (ESA) requires federal agencies to ensure that they do not authorize, fund, or carry out actions that are likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of critical habitat for such species. ESA is co-administered by the National Oceanographic and Atmospheric Administration Fisheries Service (NOAA Fisheries[1]) and U.S. Fish and Wildlife Service (USFWS).

This Biological Evaluation (BE) addresses the potential effects of the proposed Project on the listed species and designated critical habitats summarized in Table 1, and has been prepared to assist USACE in its review of the permit application. This list of species is based on the Project's USFWS Official Species Lists (Consultation Code 01EWFW00-2021-SLI-1682) and information received from NOAA Fisheries West Coast Region species list website (http://www.westcoast.fisheries.noaa.gov/protected_species/species_list/species_lists.html, queried June 18, 2021). Gray wolf (*Canis lupus*), streaked horned lark *(Eremophila alpestris strigata*), and Yellow-billed cuckoo (*Coccyzus americanus*) are identified on the USFWS Official Species List; however, because the nearshore marine Project area lacks suitable habitat for these species, the Project will have no effect on them so they are not discussed further within this BE. Similarly, green sturgeon (*Acipenser medirostris*), Pacific eulachon (*Thaleichthys pacificus*), and leatherback sea turtle (*Dermochelys coriacea*) are listed by NMFS but do not occur in the Project area so will not be covered in this BE.

In addition, an evaluation of the effects of the proposed Project on Essential Fish Habitat (EFH) has also been prepared pursuant to the Magnuson-Stevens Fishery Conservation and Management

[1] This document uses NOAA Fisheries as the universal short reference for the NOAA National Marine Fisheries Service. Service publications, particularly Federal Register notices, may be referenced NOAA, NMFS, and NOAA Fisheries, as indicated by citations in this document.

Act (MSFCMA) as amended by the 1996 Sustainable Fisheries Act (SFA). The effects of the proposed Project on EFH are addressed in an attachment to this application.

Table 1. Summary of ESA species and critical habitats and effects determinations.

Listed Species	Federal Status	Agency	Designated CH in Action Area?	Effects determination on species	Effects determination on CH
Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*)	Threatened	NMFS	Yes	NLAA	NLAA
Puget Sound Steelhead Trout (*Oncorhynchus mykiss*)	Threatened	NMFS	No	NLAA	NLAA
Bull Trout (*Salvelinus confluentus*)	Threatened	USFWS	Yes	NLAA	NLAA
Bocaccio Rockfish (*Sebastes paucispinis*)	Endangered	NMFS	Yes	NLAA	NLAA
Yelloweye Rockfish (*Sebastes ruberrimus*)	Threatened	NMFS	Yes	NLAA	NLAA
Southern Resident Killer Whale (*Orcinus orca*)	Endangered	NMFS	Yes	NLAA	NLAA
Humpback Whale (*Megaptera novaeangliae*)	Endangered, Threatened[1]	NMFS	No	NLAA	--
Marbled Murrelet (*Brachyramphus marmoratus*)	Threatened	USFWS	No	NLAA	--

[1] As of October 11, 2016, humpback whales are categorized into 14 DPSs. Two listed DPSs occur on the west coast of the U.S.: Mexico (threatened) and Central America (endangered; NOAA 2016a).

[2] NMFS – While in the marine environment; USFWS – While on nesting beaches. As there have been no documented sightings of leatherback sea turtle in Puget Sound, this species is not addressed further.

Notes: NE – No Effect; LAA – Likely to Adversely Affect; NLAA – May Affect, Not Likely to Adversely Affect

2. PROJECT DESCRIPTION

2.1 BACKGROUND

The Port proposes to redevelop Berths 6 & 8 at Terminal 91. The existing facility is a deteriorating creosote-treated timber wharf with generally heavily deteriorated timber piling supporting timber pile caps, stringers, and decking. Many of these elements are in an advanced stage of deterioration and as a result large portions of the wharf are condemned. The remainder has been load-rated for allowable loading significantly beneath the original design live load allowances. The existing superstructure and piling above the mudline will be completely removed and disposed of. Where new piling does not conflict with existing piling, the intent is to leave the existing piles embedded in the ground to maintain in-situ slope stability. The existing piling is likely in good condition from just below the mudline to the tip due to the anaerobic environment and the inability of marine borers to access the piling below the mudline.

The existing bulkhead wall under the wharf is also in an advanced state of deterioration and will be abandoned in place with a new steel sheet pile bulkhead wall installed just waterward of the existing bulkhead. No benefit from the existing bulkhead wall will be assumed with respect to slope stability or soil retention.

2.2 PROJECT DESCRIPTION

The Port proposes to replace the deteriorating facilities at Berths 6 & 8 at Terminal 91 in Smith Cove on the north side of Elliott Bay. The Project will include replacement of the existing creosote-treated timber pier and apron with a new wharf structure (including associated pile), relocation of the small boat storage and float system, replacement of the existing slope armoring, and abandonment-in-place of the existing under-wharf bulkhead and installation of a new sheet pile wall just waterward of the existing bulkhead.

Wharf Replacement

Components of the wharf replacement include:

- Removal of approximately 66,230 square feet (ft^2) of existing timber pier,
- Removal of approximately 2,300 12-inch (in) diameter creosote-treated timber pile, cut at the mudline or extracted where conflicts with new piling exist,
- Installation of 288 24-in concrete octagonal pile,
- Installation of 60,710 ft^2 of pre-cast concrete decking,
- Installation of 90 20-in steel fender pile with full-round 24-in diameter high density polyethylene (HDPE) sheaths, and
- Consolidation of eight (8) existing outfalls and deck drains to one rebuilt 18” diameter outfall with basic treatment which will discharge on the riprap slope. All deck drains will be eliminated.

When no conflict occurs with location of new pile, creosote-treated timber pile will be cut at the top of the subgrade and removed in order to maintain slope stability. Conflicting pile will be extracted by crane by using a vibratory hammer. Pile will be cut by divers equipped with chainsaws or by biting with a dredge bucket, and pile and timber decking will be removed using land-based and/or floating crane barges for disposal at an approved upland facility. A debris boom will be installed around the work area in order to contain any floating debris produced during the demolition and new construction work.

The new concrete wharf will be 780 feet long with 25-foot spacing between cast-in-place concrete pile cap bents. The pile cap bents will support pre-cast concrete deck panels and a cast-in-place or precast concrete bullrail. The precast concrete panels will be overlain by asphalt concrete. The wharf will be constructed utilizing floating derrick barges, support barges, and assisting tugs. Prestressed concrete pile will be installed to support the new apron. Concrete pile will be impact driven with an estimated installation production rate of approximately three (3) pile per day over approximately 100 work days. Steel fender pile will be primarily installed using a vibratory hammer, though impact driving may be required to achieve final tip elevation. The production rate for the steel fender pile is estimated at eight (8) pile per day over approximately 13 work days. Pile installation workdays represent the number of days in which pile driving may occur but may not be consecutive. These days may occur with breaks over the full in-water work window.

Small Boat Storage and Float System Removal/Relocation

The Port proposes to remove the small boat storage and float system from its existing location (northeast corner of Terminal 91) and relocate the boat house to Berth 7 (northwest corner of Pier 90). Removal/relocation of the small boat storage and float system would include:

- Relocation of 1,600 ft^2 of small boat storage and 290 ft^2 of access floats on the west side of Pier 90 (Berth 7).
- Installation of four (4) 18-inch steel pipe guide piles.

Floats will be removed and reinstalled in the new location using land-based and/or floating crane barges. No guide pile currently exist in place. New guide pile will primarily be installed using a vibratory hammer, though impact driving may be required to achieve final tip elevation. The production rate for the steel guide pile is estimated at eight (8) pile per day over approximately 0.5 work days. Pile installation workdays represent the number of days in which pile driving may occur but may not be consecutive. These days may occur with breaks over the full in-water work window. The floats and small boat storage will be anchored/affixed to the existing pier and guide piles using steel pile collars with abrasion resistant surfaces.

Slope Excavation and Armoring Replacement

Replacement of primarily under-wharf slope armoring will include the following components:

- Removal of 25,000 cubic yards (CY) of existing material on the slope (riprap, sediment, and debris),
- Installation of 10,600 cubic yards of fill, including:
    - 1-foot thickness of quarry spalls,
    - 3-foot thickness of heavy riprap, and
    - Fish mix to fill the voids (above -10 feet mean lower low water [ft MLLW]).

Excavation/dredging of the excess slope material and installation of new slope armoring will be conducted using land-based and/or barge-mounted excavators or a clamshell bucket and barge derrick. Material will be removed and assessed for possible re-use. Informed by results from sediment characterization planned for August 2021 (to be conducted by Windward Environmental as part of the Terminal 91 MTCA cleanup actions), non-reusable material will be disposed of at a designated in-water disposal site wherever possible. All other material will be transported to an approved upland disposal site. The disposal plan is to be coordinated with EPA and DOE via the Dredge Material Management Program and a disposal plan will be developed accordingly. The top of the toe of the new armoring will be placed at -39 ft MLLW and will be a total of 4-feet thick to provide scour protection and stability. The armoring will be installed to a 2H:1V slope between approximately +5.6 ft and -10 ft MLLW, then to a 1.75H:1V slope between -10 and -39 ft MLLW. The area will be excavated to a subgrade depth that will allow installation to a 1-foot thickness of quarry spalls and a 3-foot thickness of riprap.

Sheet Pile Wall Installation

The sheet pile wall is positioned at the top of the slope under the wharf, extending approximately 90 feet north beyond the wharf edge. Installation of a new sheet pile wall and abandonment of the existing bulkhead will include the following components:

- Removal of the top approximately four feet of 780 linear feet (LF; approximately 690 LF under the wharf and 90 LF north of the wharf edge) of the existing bulkhead above the mudline and capping. The existing bulkhead type varies along the length and consists of either steel sheet pile, tied back creosote treated timber, or tied back creosote treated timber with a concrete fascia.
- Installation of approximately 780 LF of steel sheet pile (approximately six feet of exposed height; approximately 690 LF under the wharf and 90 LF extending north of the wharf edge) directly adjacent (waterward) of the existing abandoned wall.

Cutting and removal of the exposed portion of the existing bulkhead will be done by crews on upland or barge mounted equipment and land-based or crane-mounted excavators. Removed material will be disposed of at an approved upland facility. Installation of the new sheet pile wall will be conducted primarily using a vibratory hammer, though impact driving may be required to achieve final depths. The estimated installation production rate is approximately 20 LF of wall per day for approximately 42 work days. Installation workdays represent the number of days in which pile driving may occur but may not be consecutive. These days may occur with breaks over the full in-water work window.

Table 2. Project elements and quantities above and below the high tide line.

Project Element	Work Item	Dimensions (incl. pile diameter)	Above the HTL		Below the HTL		Total Area (ft²)	No.
			Volume (CY)	Area (ft²)	Volume (CY)	Area (ft²)		
Timber Pier and Apron/ New Wharf Structure	Removal – Overwater Structure Deck	-	-	66,230	-		66,230	N/A
	Removal – Creosote Pile	12" Diameter	-	-	-	1,817	1,817	2,300
	Installation – Concrete Pile	24" Octagonal	-	-	-	815	815	288
	Installation – Steel Pile Fender	20" Diameter Pile with 24" Diameter HDPE Facing	-	-	-	283	283	90
	Installation – Concrete Deck	77'-10"x780'	-	60,710	-		60,710	N/A
Slope Armoring	Removal – Existing Material	-	-	-	25,000	-	-	N/A
	Installation	-	-	-	10,600	-	-	N/A
Small Boat Storage/ Float System	Removal – Boat Storage	-	-	-	-	1,600	1,600	N/A
	Removal -- Floats	-	-	-	-	290	290	N/A
	Installation – Boat Storage	-	-	-	-	1,600	1,600	N/A
	Installation – Floats	-	-	-	-	290	290	N/A
	Installation – Steel Guide Pile	18" Diameter	-	-	-	7	7	4
Sheet Pile Wall	Removal	4' Height x 780 LF	-	-	-	-	-	N/A
	Installation (Bulkhead Cap Bottom to Mudline)	6' Exposed Height x 780 LF	-	-	-	-	-	N/A

2.3 CONSTRUCTION TIMING

The Port proposes to conduct this work when all authorizations are received, with in-water work occurring within the approved in-water work window. Onsite construction is projected to begin in the second quarter of 2023, with terminal opening expected in 2024. The USFWS, NOAA Fisheries, and WDFW set closure periods during which in-water work cannot be conducted to protect outmigrating salmonids. Per the USACE, the expected work window for salmonids is July 2 through March 2 and for bull trout is July 16 through February 15 (USACE 2017). Thus, the combined work window is ***July 16 through February 15.*** No forage fish utilize the Project area.

Occasional isolated observations of marbled murrelets have occurred in the project vicinity. The Port will work with US Fish and Wildlife to determine whether a daily marbled murrelet work window from 2 hours after sunrise to 2 hours before sunset should be implemented for this project during marbled murrelet breeding season (April 1 through September 23).

3. DESCRIPTION OF PROJECT AREA

3.4 Habitat Zones

For the purposes of this BE, intertidal habitat is defined as aquatic habitat located from MHHW (+11.38 ft MLLW) to -4.0 ft MLLW. Shallow subtidal habitat is located between -4.0 ft MLLW to -10.0 ft MLLW. Subtidal habitat includes all habitat deeper than -10.0 ft MLLW. Extreme high water (EHW) in the Project Area is +14.48 ft MLLW.

3.5 Project Area

The Project area includes Berths 6 & 8 at Terminal 91 and surrounding aquatic areas, including deep water areas at the berth face (JARPA Drawings Sheets 1-3). Terminal 91 is set within a highly-modified maritime industrial area and urban waterway. Berths 6 & 8 are primarily committed to fishing processor vessels. Properties adjacent to the Port's facilities generally share a similar setting and support similar uses. These uses include transportation facilities, maritime industrial facilities, and moorage.

3.5.1 Habitat Description

Existing environmental conditions reflect modifications associated with current and historic commercial uses. The shoreline area is dominated by over-water pier, riprap slopes, constructed seawalls, and bulkheads. Subtidal areas are dredged to -28 feet (8.5 meters) Mean Lower Low Water (MLLW). Sand, silt, and mud are the dominant substrate types. Ambient underwater noise near the Port's facilities is estimated to be approximately 120 dB_{RMS} (Laughlin 2020).

The site provides limited rearing habitat for juvenile salmonids. Forage fish spawning habitat is also lacking. The upland area around T-91 provides little habitat for wildlife as the site is paved and the surrounding area is used for industrial and commercial purposes. There are no riparian or natural habitats upland of the Project area.

3.6 Action Area

Action Area is defined as "…all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). Therefore, the Action Area encompasses the Project Area as well as all habitats that could be directly or indirectly affected by project components. This would include the area encompassed by pile driving-related sound above the ambient noise level, which is assumed to be 120 dB_{RMS} (Laughlin 2020).

Vibratory installation of 20-inch steel pipe pile is estimated to generate noise levels of 170 dB_{RMS} (ICF J&S and Illingworth and Rodkin 2012). Using the Practical Spreading Loss Model, sound would attenuate to ambient levels within 13.4 miles. Due to the nestled positioning of Berths 6 & 8 on the northern end of the east side of Terminal 91, the area is constrained by landmasses before sound can attenuate to ambient levels. Sound would extend across Elliott Bay as far as the southern end of the East Waterway, approximately four miles from the source (Figure 1).

Figure 1. T-91 Berths 6 & 8 Action Area.

4. LISTED SPECIES AND CRITICAL HABITAT

The ESA-listed species associated with the action area are Puget Sound Chinook salmon, Puget Sound steelhead, bull trout, bocaccio, yelloweye rockfish, Southern Resident killer whale, humpback whale, and marbled murrelet. Designated critical habitat associated with the Action Area includes that for Puget Sound Chinook salmon, bull trout, listed rockfish, and Southern Resident killer whale. The geographic distribution and boundaries of critical habitat areas as well as the extent of the action area within these critical habitats are discussed below.

4.1 LISTED SPECIES

4.1.1 Puget Sound Chinook Salmon

The Puget Sound ESU includes all naturally spawned Chinook salmon originating from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North Sound, and the Strait of Georgia. It also includes fish from 26 artificial propagation programs (see NOAA 2014a). On March 24, 1999, NOAA formalized listing of Puget Sound Chinook salmon as threatened under the ESA (NOAA 1999). The threatened status was reaffirmed on April 14, 2014 (NOAA 2014a).

The nearest Chinook stocks to the Greater Elliott Bay Area are the Green/Duwamish River stock and the Lake Washington stocks (Lake Washington-Cedar, Issaquah Creek, and North Lake Washington Tributaries). Adult Chinook could be present in the Action Area from mid-June through mid-October. Sub-adult Chinook could be present in the Action Area any month of the year. Juvenile Chinook are present in Elliott Bay in May through October (Anchor QEA 2019).

Lake Washington Chinook spawn from September through November in the Cedar River and Bear/Cottage Lake, Issaquah, Little Bear, North, and Kelsey Creeks (Lake Washington/Cedar/Sammamish Watershed Salmon Recovery Council 2017). The majority of the Lake Washington juvenile Chinook proceed through the lake system and out through the locks from April through August. Chinook utilize the nearshore habitat of Puget Sound for foraging from April through August, but can be found in the nearshore habitat year-round. Small numbers of juvenile Chinook may be present in the Salmon Bay Waterway until the end of August (Warner and Fresh 1999). Studies of Puget Sound marinas indicate that juvenile salmonids and other fish tend to concentrate in these areas and may favor the marina environment over nearby natural shoreline areas (Heiser and Finn 1970; Parametrix 1981; Thom et al. 1989).

Life history and stock information on Chinook utilizing Elliott Bay and surrounding waters can be found in the following references: Salo 1969; Weitkamp and Campbell 1980; Meyer et al. 1981; Weitkamp and Schadt 1982; Jones & Stokes Associates, Inc. 1990; Parametrix, Inc. 1990; WDFW and WWTIT 1994; Warner and Fritz 1995; Cordell et al. 1997, 1998, and 2001; Parametrix, Inc. et al. 2000; R2 Resource Consultants 2000; Anchor QEA 2019.

4.1.2 Puget Sound Steelhead

The Puget Sound Distinct Population Segment (DPS) includes all naturally spawned steelhead originating below natural and manmade impassable barriers from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North

Sound and the Strait of Georgia. It also includes fish from six artificial propagation programs: the Green River Natural Program; White River winter Steelhead Supplementation Program; Hood Canal Steelhead Supplementation Off-station Projects in the Dewatto, Skokomish, and Duckabush Rivers; and the Lower Elwha Fish Hatchery Wild Steelhead Recovery Program (NOAA 2014a). This ESU was originally listed on May 11, 2007 (NOAA 2007). The ESA status of this ESU is threatened (NOAA 2014a).

Washington Department of Fish and Wildlife (WDFW) stock information for steelhead may be found in the Washington State Salmon and Steelhead Stock Inventory (http://apps.wdfw.wa.gov/salmonscape/map.html) queried June 15, 2021. The closest watersheds with data for steelhead stock within the vicinity of the Action Area are the Green/Duwamish River, which empties into the East Waterway and then Elliott Bay and the Lake Washington watershed. The Green/Duwamish River watershed contains winter and summer stocks ('healthy" and "depressed", respectively), and the Lake Washington watershed contains a winter stock ("critical").

"Steelhead" generally refers to the anadromous form of the trout species *Oncorhynchus mykiss*, which also includes freshwater rainbow or redband trout. In the Green/Duwamish River, juvenile rearing habitat is located approximately nine to 15 miles upstream in the Green River (WDFW 2021). Juvenile steelhead typically outmigrate to salt water after two years in freshwater and are between 140 and 160 mm in length from April to mid-May. Little is known about their habitat use in Puget Sound, but it is generally thought that they move offshore quickly. Intensive beach seining during juvenile salmon outmigration in central Puget Sound resulted in only nine captured steelhead over a two-year period (Brennan et al. 2004).

Steelhead from the Lake Washington winter steelhead stock may also be present in Elliott Bay. Fish from this stock spawn throughout the Lake Washington basin including the Cedar River, Sammamish River, Issaquah Creek, May Creek and several other creeks and small tributaries. Lake Washington steelhead migrate through the Lake Washington Ship Canal and Ballard Locks to and from Puget Sound. Adults have been observed to migrate upstream through the Locks starting in October (NMFS 2005). Juvenile steelhead typically outmigrate through the Locks from mid-June to early July (Kerwin 2001).

Based on the above information, sub-adult and adult steelhead may seasonally use the deeper waters of Elliott Bay for migration and foraging, but are not expected to be present in significant numbers at any time.

Life history and population information on steelhead potentially found in the Action Area can be found in the Final Listing Determination (NOAA 2007), the Status Review Update for Puget Sound Steelhead (NMFS 2005), and the Designation of Critical Habitat for Lower Columbia River Coho Salmon and Puget Sound Steelhead (NOAA 2016a).

4.1.3 Bull Trout

The Coterminous United States DPS includes all bull trout in the lower 48 states. This DPS was listed on November 11, 1999 (USFWS 1999). The Coastal Recovery unit includes bull trout from the Puget Sound, Olympic Coast, and Lower Columbia River geographic regions (USFWS 2015b).

Eight core areas of this Recovery Unit within the Puget Sound are currently occupied by bull trout: Chilliwack River, Nooksack River, Upper Skagit River, Lower Skagit River, Stillaguamish River, Snohomish and Skykomish River, Chester Morse Lake, and Puyallup River (USFWS 2015b). The Puget Sound geographic region also includes associated marine waters supporting the anadromous life history form of bull trout and additional shared Forage Migration and Overwintering (FMO). In Puget Sound, this includes Puget Sound and Hood Canal marine areas, the Samish River, Lake Washington, the lower Green River (Duwamish), and the lower Nisqually River (USFWS 2015a). The ESA status of this DPS is threatened (USFWS 2009).

The Green/Duwamish River is the nearest river to the Action Area. Bull trout were once common in the Green/Duwamish River system; however, dramatic changes to the watershed have severely reduced the watershed size and flow. This has resulted in the degradation, loss and fragmentation of much of the bull trout habitat (City of Seattle 2007). Currently, bull trout use of the Green/Duwamish River basin is very low. Adult bull trout have been identified in the Green/Duwamish river basin and may use this area for foraging, migration, and overwintering (Tanner 1991; Meyer et al. 1981; Goetz et al. 2004). However, there is no indication that the system supports a spawning population (Watson and Toft in WDFW 2004). Sightings/captures of sub-adult or adult bull trout in the Elliott Bay are documented in USFWS 2004 and Goetz et al. 2004. Sub-adult or adult bull trout found in Elliott Bay are likely from nearby core populations such as the Puyallup River, the Snohomish/Skykomish River, or the Stillaguamish River.

One bull trout stock, the Cedar River-Chester Morse Lake stock, has been identified in the Lake Washington watershed. Although reproducing populations of bull trout occur in the upper Cedar River basin in Chester Morse Lake, they are geographically isolated from the lower Cedar River and Lake Washington stocks (WDFW 2004). There have been a few reports of subadult and adult bull trout occurring in Lake Washington, the Chittenden Locks, and in Shilshole Bay; it is thought that these were anadromous fish that strayed into the lake system via the Locks and are not part of a local spawning population (City of Seattle 2007 and references therein; WDFW 2004).

Based on the available information, bull trout use of Elliott Bay and the Berths 6 & 8 Action Area is likely low. Because adults are not present in the area, juveniles are also unlikely to be present in the Action Area at any time due to the lack of a spawning population in the Green/Duwamish River system and the Lake Washington River system.

Life history and stock information on Coastal/Puget Sound bull trout potentially found in the Action Area can be found in the following references: Ratliff 1992; Rieman and McIntyre 1993, 1995; Kraemer 1994; Warner and Fritz 1995; Bonneau and Scarnechia 1996; Buchanan and Gregory 1997; Lee et al. 1997; USFWS 1999; USACE 2000; USFWS 2015a, 2015b.

4.1.4 Bocaccio

The Puget Sound/Georgia Basin DPS includes all bocaccio originating from Puget Sound and the Georgia Basin (NOAA 2014a). This DPS was originally listed on April 28, 2010 (NOAA 2010). The ESA status of this DPS is endangered (NOAA 2014a).

Bocaccio are large rockfish, often reaching up to three feet in length. Like other rockfish species, bocaccio give birth to live larval young that are pelagic for several months. Juveniles settle into nearshore habitat that is composed of aquatic vegetation such as macroalgae-covered rocks or sand/eelgrass habitat (Love et al. 2002). They typically inhabit shallower water than adults, though still are most commonly found in relatively deep waters (100 to 400 feet; COSEWIC 2002). As with most rockfish species, bocaccio migrate to deeper water as they mature – adults are usually found well off the bottom at depths of between 165 feet and 825 feet (Love et al. 1991; Love et al. 2002). They often congregate around rocky bottom and outcrop habitat, though occasionally wander into mudflats (NMFS 2008). Juvenile bocaccio are planktivorous, feeding on larval krill, diatoms, and dinoflagellates. Adults are piscivorous, primarily feeding on other rockfishes, hake sablefish, anchovies, lanternfish, and squid (NMFS 2008). Bocaccio are prey of Chinook salmon, terns, and harbor seals (NMFS 2008).

Bocaccio have not been documented in Puget Sound since 2001, although it is assumed an extant population exists (NMFS 2008). For WDFW management purposes, Palsson et al. (2009) describes seven Groundfish Management Regions in Puget Sound and the Strait of Juan de Fuca. Within these regions, bocaccio are most commonly recorded in the Central Sound Region (Palsson et al. 2009; Miller and Borton 1980). Larval bocaccio in the pelagic stage may be present throughout Puget Sound year-round, including in Elliott Bay where larval *Sebastes spp.* have been documented (Waldron 1972). Juveniles may be found in the nearshore kelp and eelgrass habitats in Elliott Bay in spring and summer, though the Action Area does not have a macroalgae presence, so is not ideal rearing habitat. Adult bocaccio have been documented within Elliott Bay (Washington et al. 1978; Dinnel et al. 1986).

Life history information on bocaccio potentially occurring in the action area can be found in the following references: Love 1992; NMFS 2008; Drake et al. 2010; and NMFS 2016b.

4.1.5 Yelloweye Rockfish

The Puget Sound/Georgia Basin DPS includes all yelloweye rockfish originating from Puget Sound and the Georgia Basin (NOAA 2014a). This DPS was originally listed on April 28, 2010 (NOAA 2010). The ESA status of this DPS is threatened (NOAA 2014a).

Yelloweye rockfish, one of the larger rockfish, are generally considered rare in Puget Sound (Love et al. *in* NMFS 2008). Like other rockfish, yelloweye rockfish give birth to live larval young that are pelagic for several months. Juvenile yelloweye rockfish are planktivorous, and generally settle in shallow, high relief zones, crevices and sponge gardens (Love et al. *in* NMFS 2008). Juveniles move from shallow rocky reefs to deeper pinnacles and rocky habitats as they mature (NMFS 2008). Adults generally inhabit water between approximately 40 and 1,500 feet deep, but are most common between 300 and 600 feet (Love et al. 2002). They exhibit site fidelity and do not stray far from their site (NMFS 2008). Adult yelloweye have been observed in association with coral reefs at depths between approximately 650 and 820 feet in the Olympic Marine Sanctuary off the Washington Coast during coral surveys (Brancato et al. 2007). Due to their large size, adults prey on a wider range of prey items than bocaccio or canary rockfish, including smaller rockfish, sand lance, gadids, flatfishes, shrimp, crab, and gastropods (Love et al. 2002 and Yamanaka et al. 2006 in NMFS 2008). Yelloweye rockfish are preyed on less frequently than most rockfish due to their size, though they are occasionally preyed upon by killer whales.

In general, yelloweye rockfish have been observed more frequently in north Puget Sound than in the southern areas (Miller and Borton 1980). Larval rockfish have been documented within Elliott Bay, but were not documented to species (Waldron 1972). Juvenile yelloweye rockfish do not typically occupy shallow waters (Love et al. 1991) and are very unlikely to be in Elliott Bay. Adult yelloweye rockfish have been documented within Elliott Bay (Washington et al. 1978; Dinnel et al. 1986).

Life history information on yelloweye rockfish potentially occurring in the action area can be found in the following references: Love 1992; NMFS 2008; Drake et al. 2010; and NMFS 2016b.

4.1.6 Southern Resident Killer Whale

The Southern Resident DPS of killer whales (SRKW) includes animals from the J, K, and L pods, except such whales placed in captivity prior to November 2005 and their captive progeny (NOAA 2014a). This DPS was ESA-listed as endangered on November 18, 2005 (NOAA 2005a; NOAA 2014a). A number of factors have been identified by NOAA Fisheries as having resulted in the listing of these whales as endangered. Sound and disturbance from vessel traffic, toxic chemicals which accumulate in top predators, and uncertain prey availability (primarily salmon) all have been identified as concerns for the continued survival of this population (Lacy et al. 2017).

The SRKW has spring through fall ranges in Puget Sound and the Straits of Georgia and Juan de Fuca. J pod typically inhabits the Puget Sound/Straits area year-round, while the K and L pods often spend October through June on the outer coast, as far south as Monterey Bay, California. K and L pods are occasionally sighted in Puget Sound during the winter (Orca Network 2021a, b). In the 23-year period between 1990 and 2013, SRKWs were sighted in Elliott Bay on 52 total days (Table 3). Based on a review of the Orca Network sightings map, SRKWs were sighted in Puget Sound on 199 days in the six year period of January 2015 through December, though the number of individuals represented in those sightings is not known (http://www.orcanetwork.org, queried June 15, 2021; Table 2). Most sightings occurred in the late fall through the winter months.

It is unlikely that SRKWs would be present in the Action Area.

Table 3. Total monthly Southern Resident killer whale sighting days in Elliott Bay (1990-2013; Orca Network 2021a) and in Puget Sound from 2015-2020.

Year(s)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals*
1990-2013 – Elliott Bay	10	5	2	1	0	0	0	3	4	8	9	10	52
2015-2020 – Puget Sound	17	2	2	20	0	0	0	0	18	27	64	49	199
Monthly Totals*	27	7	4	21	0	0	0	3	22	35	73	59	251

* Totals represent days with sightings throughout Puget Sound; therefore, totals may be overestimates reflecting multiple sightings of the same whale(s) on the same day.

Life history information on SRKWs can be found in the following references: Braham and Dahlheim 1982; Calambokidis and Baird 1994; Reeves and Leatherwood 1994; Dahlheim and Heyning 1999; Ford et al. 2000; Barrett-Lennard and Ellis 2001; NOAA 2006a, 2006b; Gaydos and Pearson 2011; and NMFS 2019b and 2020.

4.1.7 Humpback Whale

Humpback whales were listed as endangered when the Endangered Species Act was enacted on June 2, 1970. In 2016, NOAA Fisheries designated 14 DPSs for this species and reevaluated the listing status for each DPS (NMFS 2016a). Based on the designation, whales from three listed DPSs from the California/Oregon/Washington Stock may be present in Washington waters: the Mexico DPS, the Central America DPS, and small numbers from the Hawaii DPS. The Mexico DPS breeds or winters off mainland Mexico and the Revillagigedo Archipelago, transits through Baja California, and are the primary animals that compose the northern Washington-southern British Columbia feeding group (n = 2,806; NMFS 2019a; NOAA 2019). The Central America DPS breeds in waters off of Costa Rica, Panama, Guatemala, El Salvador, Honduras, and Nicaragua and feeds along the west coast of the United States and southern British Columbia (n = 783; NOAA 2019). The Hawaii DPS breeds in Hawaiian waters and primarily migrates to Alaska to feed, with small numbers utilizing Washington feeding grounds. The ESA status of the Mexico DPS is threatened, the Hawaii DPS is not-listed, and the Central America DPS is endangered (NMFS 2016a).

When humpback whales are on their northern feeding grounds, they typically inhabit coastal waters (within 50 nautical miles of shore) with high plankton and forage fish productivity (Evans 1987; Calambokidis and Steiger 1995). Feeding grounds are characterized by cooler temperatures, depths ranging from ~10-200 m deep near the shelf edge to deep continental shelf waters, and areas of upwelling where prey is found in high concentrations (NOAA 2019). Because humpbacks do not feed during migration south or throughout the metabolically taxing breeding, calving, and nursing time on the southern breeding grounds, humpbacks rely on building food stores when on their feeding grounds (Evans 1987; Baraff et al. 1991 *in* NOAA 2019).

Habitat conditions in the Action Area are not suitable for humpback whales; thus they are considered unlikely to be present.

Life history information on humpback whales potentially found in the action area can be found in the following references: Scheffer and Slipp 1948; Evans 1987; Braham 1991; Calambokidis and Steiger 1995; Calambokidis and Quan 1997; and Calambokidis et al. 1997, 1998, 2001, and 2018; Gaydos and Pearson 2011; NMFS 2018; NMFS 2019a.

4.1.8 Marbled Murrelet

Marbled murrelets in Washington, Oregon, and California were listed on October 1, 1992 (USFWS 1992). The ESA status of this population is threatened.

Marbled murrelets feed in marine waters but nest in old-growth coniferous forests. While murrelet at-sea foraging behavior is not well understood, murrelets typically forage in marine waters between 20 and 80 meters (65 and 262 feet) deep, though they have been observed foraging in water as shallow as 1 meter (3 feet) and as deep as 100 meters (328 feet; Ralph et al. 1995). Marbled murrelets reportedly feed on a wide variety of prey, including sand lance, Pacific herring, and other marine taxa such as crustaceans. Murrelets nest in old growth or mature forests composed of conifers, including Douglas fir, western red cedar, Sitka spruce, and western hemlock. Designated critical habitat for the marbled murrelet applies only to nesting habitat, and does not occur in or near the Action Area (USFWS 2011).

Marbled murrelets may have a transient presence in the Action Area as they migrate, but due to the distance from old growth forests, presence is considered unlikely.

Life history and population information on marbled murrelets potentially found in the action area can be found in the following references: Carter 1984; Parametrix, Inc. 1996; Ralph et al. 1995; USFWS 1995, 1996, 1997; Desimone 2016; Lorenz et al. 2016, 2017, and 2019.

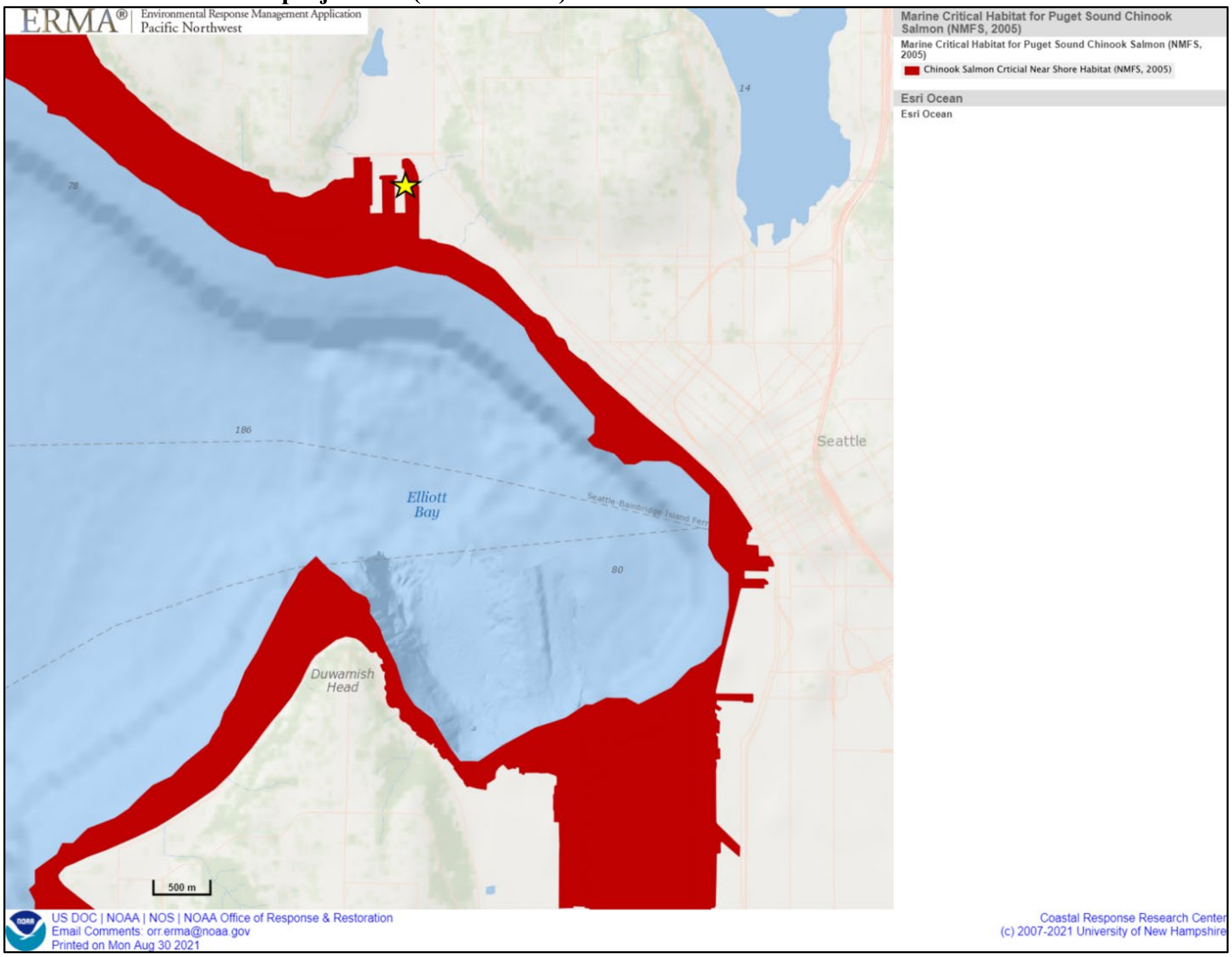
4.2 DESIGNATED CRITICAL HABITATS

4.2.1 Puget Sound Chinook Salmon Critical Habitat

On September 2, 2005, NMFS designated critical habitat for 12 Evolutionary Significant Units (ESU) of Pacific salmon and steelhead, including critical habitat for the Puget Sound Chinook ESU (NOAA 2005b). Critical habitat for this ESU includes 15 associated sub-basins within Puget Sound and the Nearshore Marine Areas associated with each of 19 Water Resource Inventory Areas (WRIAs Figure 2). Nearshore Marine Areas include the entirety of the nearshore zones of Puget Sound from Extreme High Water (EHW) out to a depth of -30 m MLLW (-98 ft MLLW). This includes areas adjacent to islands, Hood Canal, and the Strait of Juan de Fuca (to the mouth of the Elwha River; NOAA 2005c). The Project Area in north Elliott Bay is located in WRIA 8 – Cedar-Sammamish (Figure 2).

Designated critical habitat within the Nearshore Marine Area includes the photic zone habitat, based on the presence of macrophytes (eelgrass and macroalgae) that are important to rearing, migrating, and maturing Chinook salmon and forage fish (NOAA 2005b). In addition to determining effects of the proposed Project on Chinook salmon, potential effects on their critical habitat also must be addressed. Based on this critical habitat designation, the entirety of the marine Action Area between EHW and -30 m MLLW is within the Chinook salmon critical habitat area.

Figure 2. Final designated critical habitat (red) for Puget Sound Chinook salmon in Elliott Bay; the yellow star denotes the Berths 6 & 8 project site (ERMA 2021).



4.2.2 Coastal-Puget Sound Bull Trout Critical Habitat

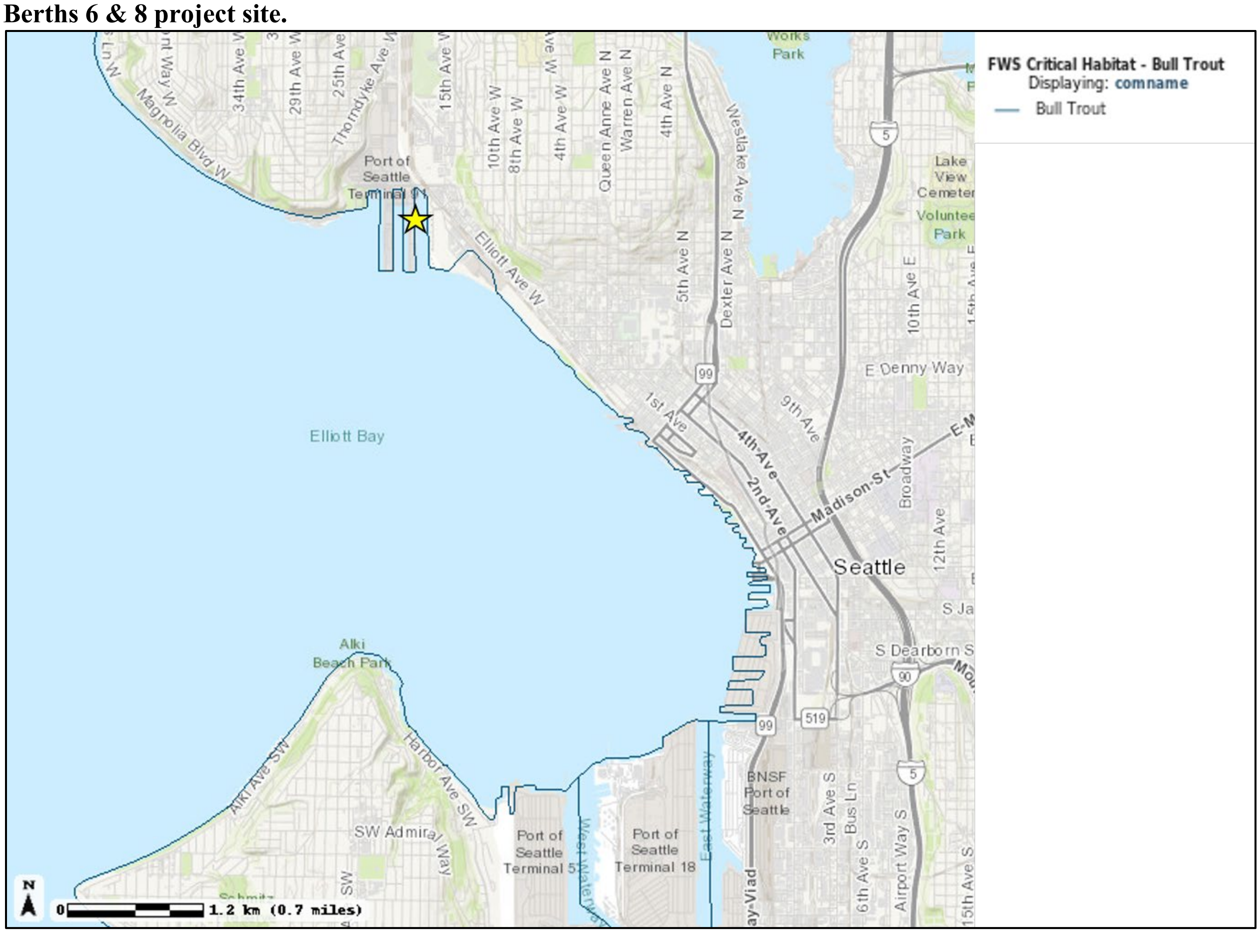
On October 18, 2010, the USFWS revised designated critical habitat for bull trout (USFWS 2010). There are 32 Critical Habitat Units (CHUs) designated for the protection of bull trout critical habitat. CHU 1 (Olympic Peninsula) and CHU 2 (Puget Sound) are critical habitat for the Coastal-Puget Sound bull trout population, the only population in the state with an amphidromous life history form (USFWS 2010). The Strait of Juan de Fuca Critical Habitat Subunit (CHSU) is a subunit of CHU 1, which encompasses 465 miles of streams, 329 miles of shoreline, and 7,572 acres of lakes and reservoirs. The Puget Sound CHU, which includes the Green River, Lake Washington, and Puget Sound Marine CHSUs, encompasses 1,143.5 miles of streams, 425 miles of marine shorelines, and 40,181.5 acres of lakes and reservoirs (USFWS 2010).

Designated critical habitat includes bankfull width of the rivers, and estuarine areas from MHHW to -30 ft MLLW, but does not include adjacent shoreline riparian areas or uplands. Bull trout have specific habitat requirements: Cold, Clean, Complex, and Connected. Bull trout prefer cold, clean water less than 54 degrees Fahrenheit, complex stream habitat with deep pools, overhanging banks and large woody debris, and connected upstream spawning/rearing and downstream foraging, migration, and overwintering habitats (USFWS 2015a).

The Puget Sound CHU plays an important role in maintaining distribution of amphidromous bull trout in Washington. Within the Puget Sound CHU, the Lake Washington and Lower Green River CHSUs support fish that may be found in the Action Area. Both CHSUs are important feeding, migration, and overwintering (FMO) habitat for bull trout, though neither contain natal populations. The Lake Washington CHSU connects to Puget Sound through the Lake Washington Ship Canal. The Lower Green River CHSU, which includes the Duwamish and Green River stocks, discharges into Elliott Bay opposite the Project Area. The amphidromous fish utilizing this CHSU are likely from various core areas within Puget Sound, including the Puyallup and Snohomish-Skykomish Rivers (USFWS 2010).

These subunits have been identified as critical habitat for foraging, migration, and overwintering, but not spawning. In addition to determining effects of the proposed Project on bull trout, potential effects on their critical habitat also must be addressed. Based on the critical habitat designation, waters between MHHW and -30 ft MLLW in the Action Area are within the bull trout critical habitat area (Figure 3).

Figure 3. Final designated critical habitat for bull trout in Elliott Bay (CHU 2); the yellow star denotes the Berths 6 & 8 project site.

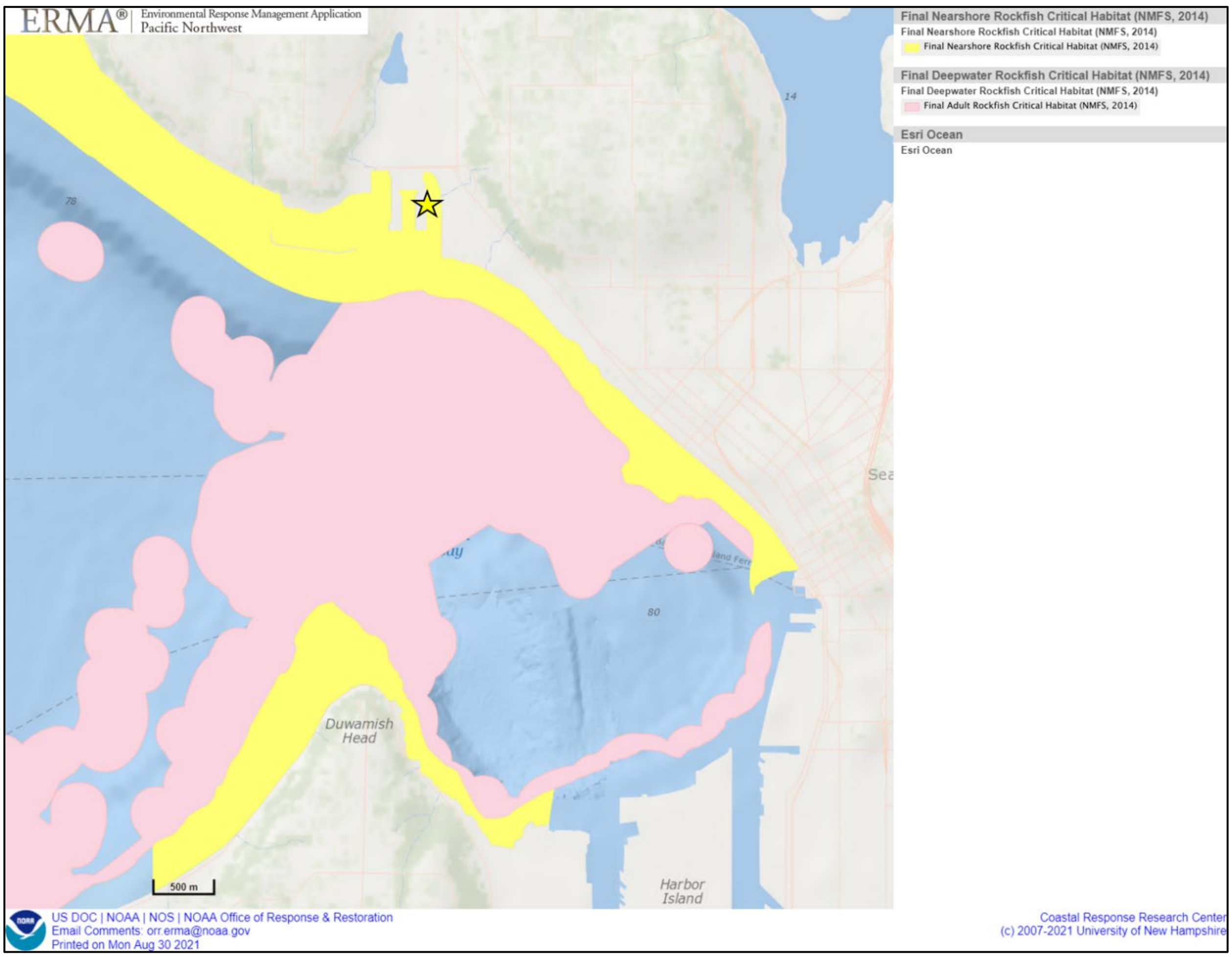


4.2.3 Puget Sound Rockfish Critical Habitat

NOAA fisheries designated critical habitat for all three species of listed rockfish on November 13, 2014 (NOAA 2014b). NOAA designated two separate areas of critical habitat to cover both juvenile and adult life history stages of the listed rockfish species. Deep water critical habitat consists of benthic habitats or sites deeper than -30 meters (-98 feet) MLLW that possess or are adjacent to areas of complex bathymetry consisting of rock and/or highly rugose habitat. Deep water critical habitat is considered essential for adult rockfish (all species) and juvenile yelloweye rockfish to promote growth, survival, reproduction and feeding opportunities.

Nearshore critical habitat for juvenile bocaccio consists of settlement habitats located in the nearshore with substrates such as sand, rock and/or cobble compositions that also support kelp, between EHW and -30 m (98 ft) MLLW. Nearshore critical habitat provides forage opportunities and refuge from predators and enables behavioral and physiological changes needed for rockfish juveniles to occupy deeper adult habitats. Both deepwater and nearshore critical habitat for Puget Sound rockfish have been designated in the Action Area in Elliott Bay (Figure 4).

Figure 4. Final designated nearshore (juvenile; yellow) and deepwater (adult; pink) critical habitat for bocaccio and yelloweye rockfish in Elliott Bay (ERMA 2021); the yellow star denotes the Berths 6 & 8 project site.

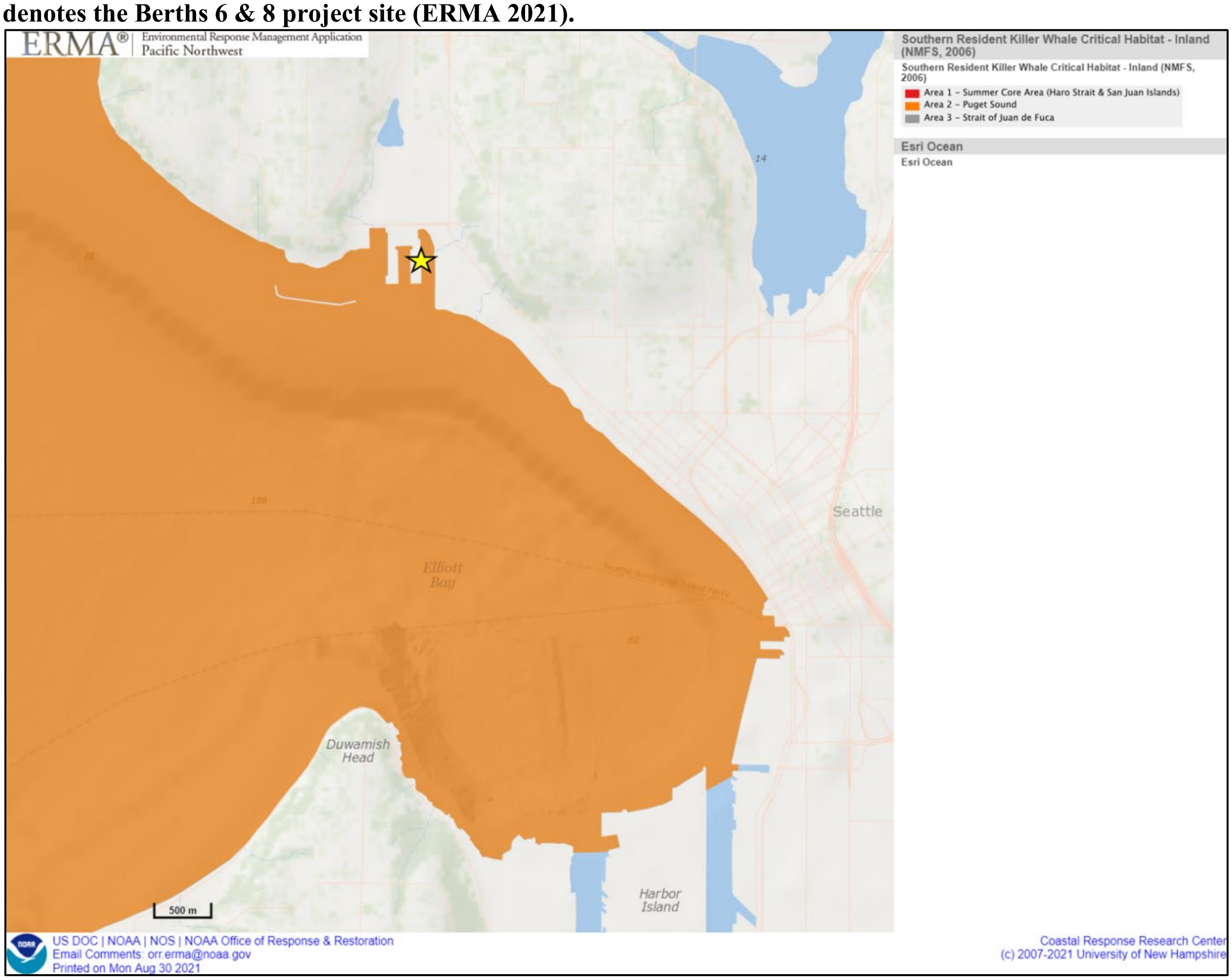


4.2.4 Southern Resident Killer Whale Critical Habitat

On November 29, 2006, NOAA Fisheries designated critical habitat for Southern Resident Killer Whale (NOAA 2006a). Three areas have been designated as critical habitat: Area 1: the Core Summer Area in Haro Strait and waters around the San Juan Islands; Area 2: all of Puget Sound; and Area 3: the Strait of Juan de Fuca. The Action Area is in Area 2, which includes all waters south from the Deception Pass Bridge, the entrance to Admiralty Inlet, and the Hood Canal Bridge, and Elliott Bay (Figure 8; NOAA 2006b).

Designated critical habitat includes all waters within the areas listed above except for waters shallower than 20 ft relative to extreme high water (NOAA 2006a). Marine habitat deeper than -20 ft EHW is present in the Action Area, but SRKWs are not likely to be present in this area.

Figure 5. Final designated critical habitat for Southern Resident killer whales in Elliott Bay; the yellow star denotes the Berths 6 & 8 project site (ERMA 2021).



5. EFFECTS OF THE PROJECT

The primary effects of the Project are anticipated to be construction noise associated with pile installation, temporary minor increases in turbidity during pile removal and pile driving, and increased potential for water quality impacts during construction.

5.1 Pile Removal/Driving Activities

The Port proposes to cut approximately 2,300 existing creosote-treated timber piles at the mudline and install 288 24-inch octagonal concrete pile, 90 20-inch steel fender pile, and four (4) 18-inch steel guide pile. Additionally, the Port proposes to install 780 linear ft of steel sheet pile at the top of the bank as part of this project.

5.1.1 Pile Installation

Concrete pile will be impact driven with an estimated production rate of approximately three (3) pile per day and 1,000 strikes per pile over approximately 100 work days. Steel fender and guide pile will be primarily installed using a vibratory hammer, though impact driving may be required to achieve final tip elevation. The production rate for the steel pile is estimated at eight (8) pile per day over approximately 14 work days. Installation of the new sheet pile wall will be conducted primarily using a vibratory hammer, though impact driving may be required to achieve final depths. The sheet pile wall will be installed at +5.5 feet MLLW; thus, pile installation will be conducted in the dry whenever possible. The estimated production rate is approximately 20 LF of wall per day for approximately 42 work days.

The Services are concerned about potential effects of elevated underwater sound for the following species in Puget Sound/Elliott Bay: listed salmonids, listed rockfish, marbled murrelet, SRKW, and humpback whale. Standard thresholds against which potential effects are evaluated are presented in Table 4. These thresholds are dependent upon the nature of the sound: impulsive (impact pile driving) or continuous (vibratory pile driving), and the injury type: instantaneous barotrauma/permanent hearing threshold shifts (PTS) or cumulative injury.

Instantaneous, single-strike impulses that exceed thresholds can cause barotrauma in fish or PTS in marine mammals or marbled murrelet; these are thought to result from the rapid rise times and fluctuations in over- versus under-pressure. Both cumulative injury and PTS cause a reduction in hearing sensitivity of the receiving organism due to repeated, sub-injurious sound. This can occur from impact pile driving or from continuous vibratory pile driving. Vibratory pile installation has not been linked to potential impacts to salmonids, rockfish, or marbled murrelets and is not discussed further relative to these species. Vibratory pile driving has, however, been linked to disturbance to marine mammals[2].

Similarly, impact driving of concrete pile has not been observed to generate underwater sound at the same intensity level as impact driving steel piles. Intensity of underwater sound generated by impact pile driving is influenced by a variety of factors, including water depth, substrate firmness, pile material, pile diameter, and hammer type (Nedwell and Edwards 2002). The current

[2] Collectively, ESA-listed marine mammals addressed herein will be referred to as "cetaceans" since the only ESA-listed species that may occur in the Action Areas are whales.

understanding of sound intensity associated with impact pile driving is that rise time of the sound pressure wave plays a significant role in the intensity of the sound (Nedwell and Edwards 2002), with steel pile generating waves with the fastest rise time and most intense sound. Installation of concrete and wood piles have not resulted in known injury or mortality to aquatic organisms (NMFS 2019b).

For behavioral or disturbance thresholds, the value upon which an applicant consults is the level below which the Services would expect *no effect* of sound on the listed species. Sound at or above that threshold value is evaluated on a site- and project-specific basis to determine whether potential behavioral effects could occur, and whether it may adversely affect individuals experiencing that sound. Behavioral disturbance levels have been established that assess instantaneous sound, cumulative impulsive sound, and continuous vibratory sound.

5.1.1.1 Sound Modeling

Underwater sound propagation is dependent on many factors including bathymetry, substrate, and salinity (ICF International and Illingworth and Rodkin Inc. 2020; WSDOT 2020). Due to the complex nature of the interaction between these factors and others, the development of site-specific models that accurately predict sound propagation is impractical. Estimates of sound propagation rely on empirical data gathered as part of past projects and simplified exponential decay spreading models in an attempt to estimate the effects of projects. This spreading model equation is described in the analysis by Ewald 2011, rev. Grette Associates 2021, and has three commonly used variants: the Spherical Spreading Model, the Practical Spreading Loss Model, and the Cylindrical Spreading Model. These models differ primarily in how they estimate how rapidly sound attenuates in water. The Port will rely on the Practical Spreading Loss Model for its analysis, consistent with the recommendations of NOAA, Caltrans, and WSDOT. For more discussion on the modeling of sound propagation, please see Ewald 2011, rev. Grette Associates 2021.

5.1.1.2 Conservative Assumptions

The analysis of potential impacts related to pile driving includes several assumptions that result in a highly conservative analysis. These conservative assumptions include:

- The use of the Practical Spreading Loss Model to estimate sound propagation (see *Sound Modeling* below), which conservatively ignores linear scattering and absorption loss (WSDOT 2020), resulting in a much longer distance to attenuation.

- The use of species-specific injury and disturbance thresholds that, considering the uncertainty surrounding the effects of sound on species and the complexity of the potential impacts, are established to err on the side of caution.

- A conservative estimate of the amount and duration of impact driving that may be necessary for this project.

- A conservative estimate of the effectiveness of a bubble curtain in attenuating sound during impact driving of steel pile. Various kinds of bubble curtains have demonstrated attenuation values up to 38 dB, depending on the type and assuming proper installation.

However, the Port has selected a conservative estimate of 9 dB attenuation from a bubble curtain. This attenuation value most likely underestimates the amount of attenuation that will be achieved in the field.

5.1.1.3 Thresholds

For listed fish, injury thresholds are based on cumulative sound exposure, which accounts for impact pile driving over an entire work day. Cumulative sound exposure is calculated using the NOAA Fisheries Stationary Fish Model[3]. When assessing the extent of sound at or above injury threshold due to impact pile driving, the distance is calculated for both single strike based on dB_{peak} and cumulative sound based on sound exposure level (dB_{SEL}) and the more conservative value (greater distance) is applied. For marbled murrelets, USFWS has established an injury and disturbance threshold as well as a calculator to determine distance to attenuation. The calculator is based on the Practical Spreading Loss Model.

Table 4. Sound impact threshold summary by species.

Species	Effect type	Threshold
Pulsed Sound Impact Hammer Thresholds		
All listed fish	Injury, cumulative sound (≥ 2 g)	187 dB_{SEL}
	Injury, cumulative sound (< 2 g[1])	183 dB_{SEL}
	Injury, single strike	206 dB_{peak}
	Behavioral disruption	150 dB_{RMS}
Marbled murrelets	Barotrauma	208 dB_{SEL}
	Auditory injury	202 dB_{SEL}
	Behavioral disruption	150 dB_{RMS}
Low-frequency hearing group cetaceans (humpback whale)	PTS, single-strike	219 dB_{peak}
	PTS, cumulative sound (impulse)	183 dB_{SEL_CUM}
	Behavioral disruption, pulsed sound	160 dB_{RMS}
Mid-frequency hearing group cetaceans (SRKW)	PTS, single-strike	230 dB_{peak}
	PTS, cumulative sound (impulse)	185 dB_{SEL_CUM}
	Behavioral disruption, pulsed sound	160 dB_{RMS}
Continuous Sound (Vibratory Hammer Operation) Threshold		
Low-frequency hearing group cetaceans (humpback whale)	PTS, cumulative sound (vibratory)	199 dB_{SEL_CUM}
	Behavioral disruption, continuous sound	120 dB_{RMS}
Mid-frequency hearing group cetaceans (SRKW)	PTS, cumulative sound (vibratory)	198 dB_{SEL_CUM}
	Behavioral disruption, continuous sound	120 dB_{RMS}

The Practical Spreading Loss and Stationary Fish Models were completed to determine the extent of underwater sound above which behavioral or disturbance effects should be evaluated based on species specific thresholds found in Table 4. For cumulative impulsive sound, the Stationary Fish Model also requires the total number of pile strikes occurring in a single day. The assumptions

[3] Available for download: https://wsdot.wa.gov/sites/default/files/2017/12/12/ENV-FW-BA-NMFSpileDrivCalcs.xls

applied to this analysis are presented below. These calculations were used to determine the extent of underwater sound above which potential for injury may exist.

Pile removal and installation would occur within the in-water work window approved by the Corps and WDFW as part of this application. All impact hammer use on steel pipe pile would occur using a bubble curtain.

The following assumptions have been used to run the Practical Spreading Loss calculation and Stationary Fish Model to predict distance for sound attenuation to the Services effects thresholds:

- Reference sound data were selected from projects that were similar to the proposed conditions, to the extent possible.
- Unattenuated impact driving has been estimated to produce the sound pressure levels (SPLs) depicted in Table 5 (below).
- Impact driving of concrete pile is not considered to produce sounds of a type or level that are harmful to the species of concern (NMFS 2019b).
- Use of a confined bubble curtain is assumed to result in at least 9 dB of sound attenuation at the source. Bubble curtains often achieve much higher rates of attenuation. However, the assumption of a 9 dB attenuation at 10 meters is a typical conservative estimate.
- Vibratory pile driving/removal has been estimated to produce the SPLs depicted in Table 6 (below).
- Sound in water does not transmit through landmasses and is assumed to stop where it meets the shore.
- The maximum number of pile to be driven per day at a given location is eight (8; per Port project managers and engineers).
- The estimated number of pile strikes needed to proof a pile when using an impact hammer is conservatively estimated to be 400.
- The estimated number of pile strikes needed to install a concrete pile when using an impact hammer is conservatively estimated to be 1,000.
- Ambient noise level is assumed to be 120 dB_{RMS} based on a recent study and analysis by WSDOT[4] (Laughlin 2020).

[4] The study measured ambient sound levels at the Seattle Ferry Terminal over 72-hours, then reported the data as a continuous decibel level (119 dB_{RMS}) and a daytime-only level (120 dB_{RMS}). Since the proposed work would occur during daytime hours only, the daytime-only level was considered most applicable.

Table 5. Assumed sound pressure levels (SPLs) from impact pile driving, by pile size/type (Ewald 2011, rev. Grette Associates 2021).

Pile Type	dB_{PEAK}	dB_{RMS}	dB_{SEL}	Citation
18" Steel Pipe	195	169	166	Laughlin 2010a (Wahkiakum)
20" Steel Pipe	208	187	176	ICF Int'l/ Illingworth and Rodkin, Inc. 2020
24" Steel AZ Steel Sheet	205	190	180	ICF Int'l/ Illingworth and Rodkin, Inc. 2020
24" Concrete Octagonal	184	170	159	Laughlin 2007 (Mukilteo)

Table 6. Assumed sound pressure levels (SPLs) from vibratory pile driving/removal, by pile size/type[1] (Ewald 2011, rev. Grette Associates 2021).

Pile Type	dB_{PEAK}	dB_{RMS}	dB_{SEL}	Citation
18" Steel Pipe	196	158	158	ICF Int'l/ Illingworth and Rodkin, Inc. 2020
20" Steel[1] Pipe	191	170	159	ICF J&S/Illingworth and Rodkin, Inc. 2012[1]
24" Steel Sheet Pile-Typ	175	160	160	ICF J&S/Illingworth & Rodkin, Inc. 2015
24" Steel Sheet Pile-Loud	182	165	165	ICF J&S/Illingworth and Rodkin, Inc. 2015

[1] Due to lack of data, the same values for vibratory installation were assumed for vibratory removal.

A total of 288 24-inch octagonal concrete pile, 90 20-inch steel pipe fender pile, 4 18-inch steel pipe guide pile, and 780 linear feet of steel sheet pile will be installed as part of this project. Approximately 2,300 12-inch creosote-treated timber pile will be removed.

Pile be driven with a vibratory hammer whenever practicable. Impact driving may be necessary for proofing of structural pile to verify load bearing capacity or to reach target tip elevations. Because of the location of the project at the northern end of the waterway, impact pile driving noise would largely be contained within the waterway, with possible attenuation in a narrow strip into Elliott Bay as shown in the Action Area figure (Figure 1).

Concrete pile will be impact driven with an estimated installation production rate of approximately three (3) pile per day and 1,000 strikes per pile, over approximately 100 work days. Impact pile driving of concrete pile has not been associated with injury to species of concern.

Up to eight (8) steel pipe pile may be driven in a single day, each conservatively estimated to require up to 60 minutes of vibing to drive and 400 strikes to proof. Steel pipe pile driving is expected to take 14 days. This results in up to 3,200 strikes each day.

Up to 20 linear feet of steel sheet pile may be vibratory-driven per work day, for a total of approximately 42 work days. Each 24-inch section may require up to 60 minutes for vibratory installation. Sheet pile is to be installed at approximately +5.5 feet MLLW, and thus, pile driving will be conducted in the dry whenever possible.

This represents the "maximum impact" scenario. Given the assumptions discussed above, this equates to up to 14 days of steel pipe impact pile driving over the 215 days of the work window. This scenario is the subject of the following analysis.

5.1.1.4 Impact Pile Driving

<u>Salmonids</u>

To minimize the potential for impacts to salmonids, the Project would occur within the approved in-water work period. As described in Section 4.1, the Action Area is primarily used as rearing habitat for listed salmonids (Puget Sound Chinook and Puget Sound steelhead). Any juvenile Chinook present would likely be close to shore. Juvenile steelhead are less likely to be present in Elliott Bay and, if present, less likely to be shoreline-dependent given their tendency to move through Elliott Bay and offshore rapidly upon outmigration (see Section 4.1.2). Based on very low usage of and lack of a spawning population in the Green/Duwamish system by bull trout, only adult bull trout from other systems could be present in the Action Area (see Section 4.1.3). Further, effects of pile driving are generally limited to juvenile bull trout. Since only adult bull trout and not juveniles could have a reasonable potential of presence in the Action Area, it is extremely unlikely that pile driving would adversely affect bull trout. Thus, they are not discussed further in this analysis.

Concrete pile will be impact driven and steel fender and guide pile will be installed with a vibratory hammer to the greatest extent possible. Structural pile may be proofed with an impact hammer to verify loadbearing capacity. Because the majority of pile to be driven are concrete pile (which have not been associated with injury to salmonids) and steel pile would be driven using a vibratory hammer, pile driving sound potentially exceeding injury thresholds is anticipated to be very limited.

Potential effects on salmonids from impact hammer operation noise are discussed below relative to each potential effect type and threshold.

Single-Strike Injury

Based on existing data, of the proposed pile likely to require impact proofing, 20-inch steel is expected to generate the highest SPL of all proposed pile[5] (Table 5; 208 dB_{PEAK}). Assuming a 9 dB reduction from the use of a bubble curtain, 20-inch diameter steel pipe pile is expected to generate an SPL of 199 dB_{PEAK} at 10 meters from the source. This “maximum impact scenario” is below the threshold for single-strike injury of 206 dB_{PEAK}. SPLs associated with all other pile types are lower than this. For this reason, no exceedances of the salmonid single-strike injury threshold, and thus, no potential of instantaneous injury to salmonids is anticipated.

Cumulative Injury

The potential for cumulative injury threshold exceedance from impact hammer operation is limited to proofing, which would occur in limited quantity. As mentioned above, the most impactful scenario would be eight 20-inch diameter steel pile proofed in one day.

Assuming that a 20-inch diameter steel pile (highest potential SEL) would generate 176 dB_{SEL} (Table 5), and eight pile would require up to 3,200 strikes to drive as discussed above, the Stationary Fish Model predicts that sound would attenuate to below the cumulative injury

[5] Bubble curtains generally cannot be used effectively with sheet pile due to their linear, continuous nature. Thus, steel sheet pile might generate higher SPLs than 20-inch steel pipe pile. However, sheet pile would be driven with a vibratory hammer rather than an impact hammer.

threshold within 136 m (446 ft)[6] of active impact hammer operation at any given location (Table 7).

This model assumes that an individual fish experiences all impact hammer sound over an entire pile work day, which means that fish would have to be present within 136 m for the entirety of the installation of each of the eight pile in a given day. Further, this assumes that eight pile would be proofed at the same location in one day. This scenario is unlikely, and would be even less likely for juvenile steelhead, as they are larger at outmigration, less shoreline-dependent, and spend less time in Elliott Bay upon outmigration than juvenile Chinook.

Please see Table 7 for a full list of injury threshold distances for each pile size and type for this project, and see Figure 6 for the potential area of cumulative injury threshold exceedance for 18- and 20-inch steel pipe pile. The extent of the noise exceeding cumulative impact thresholds constitutes a very small portion of Elliott Bay and leaves ample shoreline unaffected by noise. As mentioned above, the location and orientation of the project in the upper portion of the waterway greatly reduces the extent of noise propagation.

The majority of the pile to be installed for the proposed project are concrete (which have not been associated with injury to salmonids). Steel pile will be driven using a vibratory hammer, further reducing the risk of injury to salmonids. Finally, the work will be timed to occur when juvenile salmonids are absent or scarce. For these reasons, it is unlikely that the modeled cumulative effects would be experienced by juvenile Chinook, and even less likely for juvenile steelhead.

Disturbance

The Services use a sound pressure level (SPL) of 150 dB_{RMS} as a guideline for the lower limit of when potential for behavioral effects should be evaluated. At levels below this threshold the Services expect underwater sound to be audible but not to cause behavioral disturbance. At levels above this threshold the Services evaluate individual projects based on site- and project-specific considerations for potential behavioral effects of underwater sound above background levels.

The Practical Spreading Loss calculation predicts that impact hammering SPLs from 20-inch diameter steel pile would attenuate to below 150 dB_{RMS} within 736 m (2,415 ft) of active hammering (Table 7). Impact driving of concrete pile would produce sound at a much lower level; this sound would would attenuate at a distance of 215 m (705 ft). Please see Table 7 and Figure 6 for distances to attenuation to the disturbance threshold for all steel pile sizes.

150 dB_{RMS} is a conservative threshold that is applied in most Biological Opinions to evaluate when impact pile driving/proofing could result in temporary behavioral changes that could in turn result in reduced predator avoidance and reduction in foraging efficiency (ICF International and Illingworth and Rodkin 2020). Because of a paucity of data, whether behavioral effects actually occur and then subsequently result in injury through behavioral changes or significant disruption of normal behavioral patterns is unknown, and thus a conservative threshold is applied.

As described above, SPL potentially exceeding listed disturbance thresholds for impact pile driving of steel pipe pile would occur for up to 3,200 strikes per day over 14 days. If juvenile or

[6] To be conservative, data for fish smaller than 2g. This distance would be 101 m for fish greater than 2g.

adult fish are present in this area during impact hammering, their foraging, distribution, or migratory behavior may be temporarily altered. Due to the project location at the innermost part of an industrial waterway, juvenile salmonids are unlikely to be present. Should any juvenile salmonids be present in Elliott Bay, there is ample more suitable rearing habitat that would be outside of the area of sound exceeding the disturbance threshold. Juvenile steelhead are less likely to be present in Elliott Bay at all, and if present, would not likely be shoreline-oriented.

Finally, impact hammering will occur outside of the peak migration period for juvenile salmonids, minimizing the likelihood of presence in the Action Area (Section 3.6). Adults could be present in the Action Area at any time, but because work is timed to avoid the typical upstream spawning migration period this likelihood also is minimized.

Overall, based on adherence to approved in-water work windows, the preference for concrete over steel pile for the majority of pile, and the preference for vibratory pile installation for steel pile over impact driving, behavioral effects on listed juvenile Chinook is unlikely to occur, and on juvenile steelhead is extremely unlikely to occur.

Table 7. Estimated SPL/SEL generated by impact pile driving, distances to salmonid injury/disturbance thresholds (Ewald 2011 rev. Grette Associates 2021).

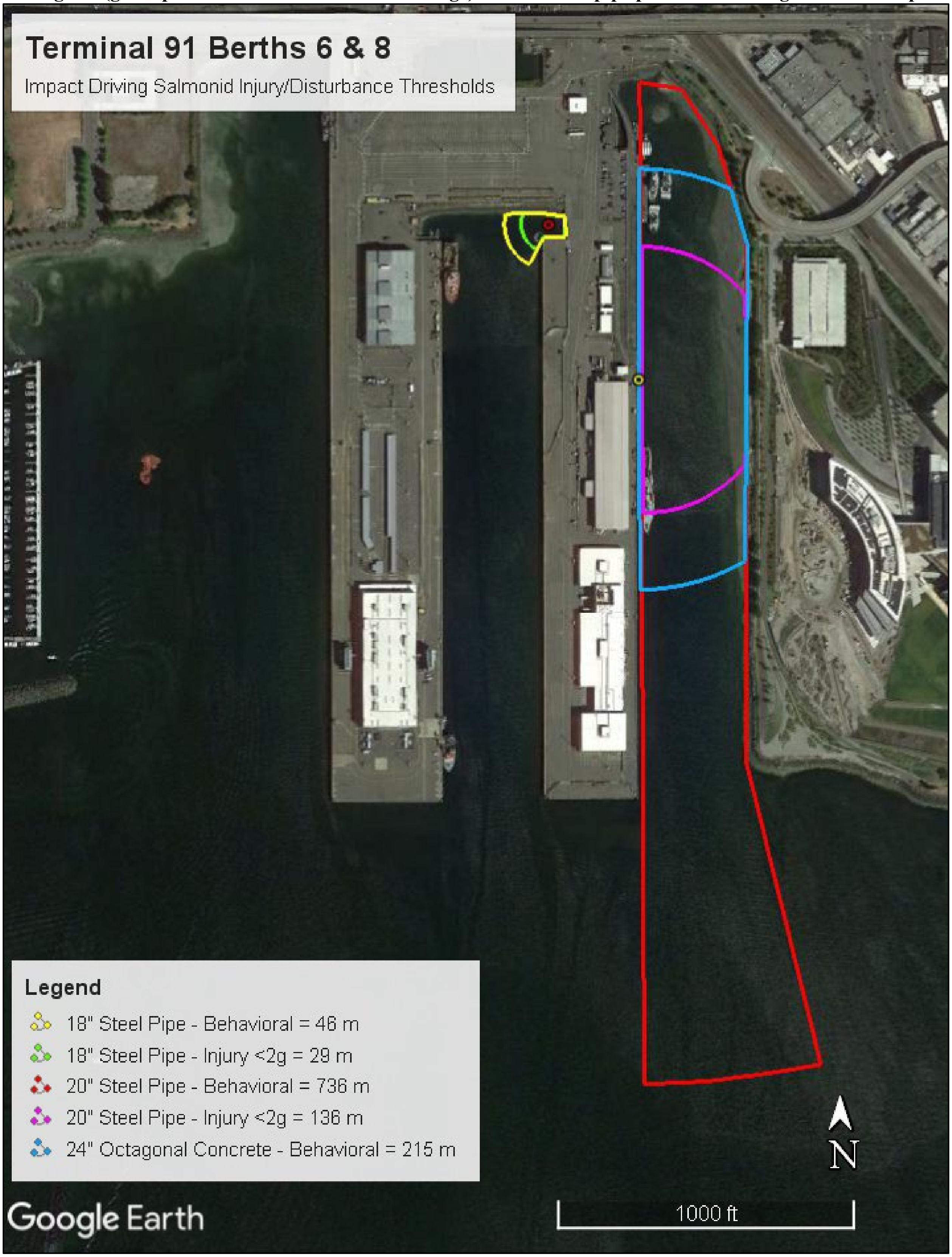
Pile Size/Type	dB_{PEAK}	dB_{RMS}	dB_{SEL}	Dist. to Ambient (m)[1]	Dist. to salmonid peak injury	Dist. to salmonid cum. SEL injury - mass <2g (m)	Dist. to salmonid cum. SEL injury - mass >2g (m)	Dist. to salmonid behavioral (m)
18” Steel Pipe [3]	195	169	166	4,642	-	29	22	46
20” Steel Pipe [3]	208	187	176	73,564	-	136	101	736
24” Steel AZ Sheet Pile[2]	*205*	*190*	*180*	*464,158*	-	*1000*	*741*	*4,642*
24” Octagonal Concrete Pile[2]	184	170	159	21,544	-	-	-	215

[1] Ambient noise level of 120 dB_{RMS} is assumed.

[2] No attenuation from bubble curtain is assumed as a bubble curtain cannot be used with sheet pile and are not used with concrete pile. However, it is assumed that sheet pile would be driven with a vibratory hammer rather than an impact hammer as they would not be weight-bearing. Thus, these SPL levels would not be generated.

[3] Attenuation from bubble curtain is assumed to be 9dB; thus has been applied to distance to threshold estimates.

Figure 6. Distances to salmonid injury (steel pile only) and behavioral disturbance thresholds for impact pile driving 18" (guide pile for relocated small boat storage) and 20" steel pipe pile and 24" octagonal concrete pile.



Rockfish

In the absence of more specific information, and since rockfish—like salmonids—possess a swim bladder that would increase the potential for barotraumatic injury, potential effect analyses described above for salmonids may also be applied to rockfish. However, as discussed in Section 4.1, rockfish use of the Action Area in Elliott Bay is likely less than salmonids due to their preference for deeper water and rocky substrate.

Larval rockfish are typically present in the water column in the spring (Palsson et al. 2009). Although they are less likely to be present during the work period, there is potential for their presence year-round. However, though no studies have been conducted directly on larval rockfish, a peak SPL and cumulative barotrauma study conducted on other larval fish bearing swim-bladders found no difference in mortality between control and exposed individuals (Bolle et al. 2014). Based on similar structural composition, Popper et al (2019) indicate that this study may be an appropriate surrogate for rockfish. Based on this information, it is extremely unlikely that pile driving would affect larval rockfish.

Juvenile rockfish could be present in Elliott Bay year-round, though rearing conditions in Elliott Bay are not ideal (Sections 4.1.4 and 4.1.5). Eelgrass is present on the west side of Terminal 90, but this area will not be affected by the proposed project. The Action Area does not provide suitable habitat for juvenile rockfish.

Thus, though the pile driving impact mechanism is similar for rockfish and salmonids, the potential for effects on rockfish are likely lower than for salmonids. Overall, the potential for direct effects on rockfish through pile driving is negligible and discountable.

Marbled Murrelet

Underwater Effects

Marbled murrelets are believed to be infrequent in the Action Area. Impact pile driving has the potential to affect marbled murrelets should any be present. Concern over impact pile driving effects on murrelets is primarily focused on foraging individuals that are actively diving during pile driving. The current threshold established by USFWS for injury to marbled murrelets is 208 dB_{SEL} for barotrauma and 202 dB_{SEL} for auditory injury, and the behavioral threshold is 150 dB_{RMS} (USFWS 2014). As described in Section 5.1 and Table 5, impact pile driving of 20-inch steel pile is anticipated to result in sound pressure levels (SPL) of 208 dB_{PEAK}, 187 dB_{RMS}, and 176 dB_{SEL}, or 199 dB_{PEAK}, 178 dB_{RMS}, and 167 dB_{SEL} with the use of a bubble curtain.

Using a pile driving noise calculator created by USFWS to assess impacts on marbled murrelets, pile driving of 20-inch diameter steel pile would attenuate to below auditory injury thresholds within 10 m (33 ft), below barotrauma thresholds within 4 m (13 ft), and to below behavioral thresholds within 736 m (2,414 ft). For the latter, the landmass across the waterway would absorb much of the sound. Impact driving of concrete pile will produce sound at a much lower level than steel pile and of a type that is not considered harmful to murrelets. The behavioral disturbance threshold exceedance for 24-inch concrete pile is 215 m (705 ft). Please see Table 8 for a full list of threshold distances for each pile type, and see Figure 7 for the potential area of behavioral disturbance threshold exceedance for 18- and 20-inch steel pipe pile and 24-inch octagonal concrete pile.

Overall, due to the infrequent use of Elliott Bay by murrelets, the planned use of concrete over steel pile for the majority of pile, the preference for vibratory pile driving, and the relatively few days of potentially injurious pile driving, impacts to marbled murrelets from pile driving are unlikely. Nevertheless, the Port proposes to conduct an appropriate level of biological monitoring for the protection of marbled murrelets during impact proofing. The Port proposes to discuss details of the monitoring program with USFWS prior to and during the consultation process to arrive at a mutually agreed upon monitoring plan.

In-Air Effects

Impact pile driving has the potential to mask the auditory capability of murrelets foraging above water (USFWS 2013). This is a concern for impact driving of pile with larger than a 24-inch diameter (USFWS 2013). Masking is not anticipated to occur for intermittent impact pile driving—such as proofing pile—regardless of pile size (Corum pers. comm.). The proposed project will neither impact drive steel pile nor utilize pile greater than 24 inches in diameter.

Table 8. Estimated SPL/SEL generated by impact pile driving, distances to marbled murrelet injury/disturbance thresholds (Ewald 2011, rev. Grette Associates 2021).

Pile Type/Size	dB_{PEAK}	dB_{RMS}	dB_{SEL}	Dist. to Ambient[1] (m)	Dist. to murrelet auditory injury (m)[2]	Dist. to murrelet barotrauma (m)[2]	Dist. to murrelet behavioral (m)	Dist. to in-air masking (m)[3]
18" Steel Pipe[4]	195	169	166	4,642	2	1	46	-
20" Steel Pipe[4]	208	187	176	73,564	10	4	736	-
24" Steel AZ Sheet Pile[5]	*205*	*190*	*180*	*464,158*	*74*	*30*	*4,642*	-
24" Octagonal Concrete Pile[5]	184	170	159	21,544	-	-	215	-

[1] Ambient noise level of 120 dB_{RMS} is assumed.
[2] Because these radii are so small, they are not depicted in figures in this document.
[3] Masking is only expected to occur for pile fully impact-driven steel pile; when vibed/proofed, masking is not expected to occur (Corum pers. comm.).
[4] Attenuation from bubble curtain is assumed to be 9dB; thus has been applied to distance to threshold estimates.
[5] No attenuation from bubble curtain is assumed as a bubble curtain cannot be used with sheet pile. However, it is assumed that sheet pile would be driven with a vibratory hammer rather than an impact hammer as they would not be weight-bearing. Thus, these SPL levels would not be generated.

Figure 7. Distances to marbled murrelet behavioral disturbance thresholds for impact pile driving 18" (guide pile for relocated small boat storage) and 20" steel pipe pile and 24" octagonal concrete pile.

Cetaceans

ESA-listed SRKWs and humpback whales are uncommon in the Action Area. NMFS recognizes PTS thresholds for single-strike, cumulative injury threshold, and behavioral thresholds for cetaceans. NMFS further divides cetaceans into hearing groups based on the frequency of their hearing sensitivity, with different injury thresholds for each group. Humpback whales are within the low-frequency group and SRKWs are within the mid-frequency group. NMFS also recognizes a high-frequency group, a phocid pinniped, and an otariid pinniped group. However, no marine mammals within these groups are both listed under the ESA and potentially present in the Action Area; thus, these hearing groups are not assessed. Behavioral thresholds are common to all marine mammals. Current thresholds are presented in Table 9.

Table 9. Current marine mammal[1] injury and behavioral effects thresholds from impact pile driving

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans
SEL_{cum} threshold	183 dB_{SEL_CUM}	185 dB_{SEL_CUM}
Single-strike (dB_{peak}) threshold	219 dB_{peak}	230 dB_{peak}
Behavioral threshold (dB_{RMS})	160 dB_{RMS}	

[1] High frequency cetaceans, phocid pinnipeds, and otariid pinnipeds are excluded from this table due to the lack of ESA-listed marine mammals from these groups within the Action Area.

Single-Strike

Even with the largest proposed pile (20-inch steel), the single-strike cetacean injury threshold would not be expected to be exceeded for either the low- or mid-frequency hearing group (219 and 230 dB_{peak}, resp.; 20-inch steel pipe pile = 208 dB_{peak}). Based on Table 10, no pile would generate SPL exceeding the cetacean injury threshold.

Cumulative Injury

For 20-inch diameter steel pile, the cumulative injury threshold would be exceeded within 217 m (712 ft) for humpback whales (low-frequency cetaceans), and within 8 m (26 ft) for mid-frequency cetaceans (SRKW). It is extremely unlikely that either ESA-listed cetacean would approach this close to a shoreline where active pile driving is occurring. Further, this radius would be injurious only if a single individual remained within that radius for the entire duration of a day's pile driving (eight pile). This is also extremely unlikely, as lingering in one relatively small radius near to shore would constitute unusual behavior for these species, particularly in a highly active area like Elliott Bay. Thus, the potential for cetaceans to be injured by impact pile driving is discountable due to the implausible injury scenario that includes few pile with the potential to exceed the threshold, a very small exceedance radius, and the extreme unlikelihood of whales approaching and remaining within this radius of active pile driving. Marine mammal monitoring that pauses work if ESA-listed cetaceans were in the area would further reduce this already low likelihood.

Please see Table 10 for a full list of injury threshold distances for each pile type for this project, and see Figure 8 for the map depicting the potential area of cumulative injury threshold exceedance for these species.

Disturbance

The disturbance threshold of 150 dB_{RMS} would be exceeded by impact driving of 20-inch steel pile within 158 m (518 ft). This zone does not extend beyond the mouth of the waterway. Please see Table 10 for a full list of behavioral threshold distances for impact driving for each pile size and type, and see Figure 8 for a map depicting the potential area of behavioral disturbance threshold exceedance for humpback whales and SRKWs.

Impact driving of concrete pile would produce sound at a much lower level than steel pile, and would produce sound of a type that is not considered harmful to cetaceans. While it is possible that ESA-listed cetaceans would be present within these areas, there would be ample area that is unaffected, such that passage would not be affected. Due to the infrequent use of Elliott Bay and this portion of Puget Sound by ESA-listed cetaceans, and due to the relatively small injury/disturbance thresholds, the potential for impact driving to affect these species is discountable. Were any cetaceans present, the potential impacts would be negligible due to the anticipated level of sound.

Table 10. Estimated SPL/SEL generated by impact pile driving, distances to ESA-listed cetacean injury/disturbance thresholds (Ewald 2011, rev. Grette Associates 2021).

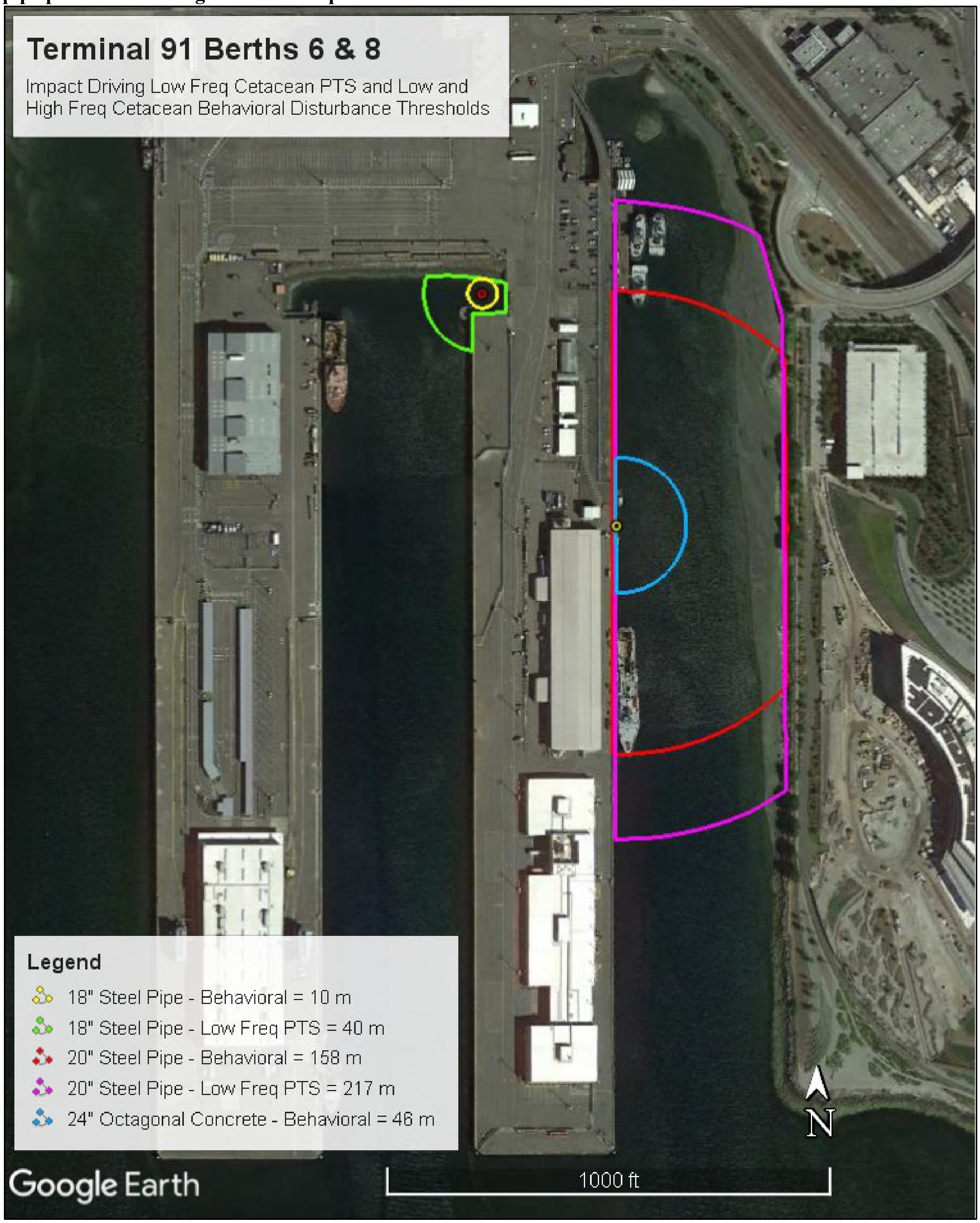
Pile Size/Type	dB_{PEAK}	dB_{RMS}	dB_{SEL}	Dist to Ambient (m)	Dist to low-freq cetaceans cumulative PTS (m)	Dist to mid-freq cetaceans cumulative PTS (m)[1]	Dist to marine mammal behavioral (m)
24" Steel AZ Sheet Pile[2]	*205*	*190*	*180*	*464,158*	*1,363*	*49*	*1,000*
18" Steel Pipe[3]	195	169	166	4,642	40	1	10
20" Steel Pipe[3]	208	187	176	73,564	217	8	158
24" Octagonal Concrete Pile[2]	184	170	159	21,544	-	-	46

[1] Because these radii are so small, they are not depicted in figures in this document.

[2] No attenuation from bubble curtain is assumed as a bubble curtain cannot be used with sheet pile. However, it is assumed that sheet pile would be driven with a vibratory hammer rather than an impact hammer as they would not be weight-bearing. Thus, these SPL levels would not be generated.

[3] Attenuation from bubble curtain is assumed to be 9dB; this has been applied to distance to threshold estimates.

Figure 8. Distances to humpback whale PTS (steel pile) and humpback whale and SRKW behavioral disturbance thresholds for impact pile driving 18" (guide pile for relocated small boat storage) and 20" steel pipe pile and 24" octagonal concrete pile.



5.1.1.5 Vibratory Pile Driving/Removal

Cetaceans

Continuous noise is a source of behavioral disturbance for cetaceans. NMFS has established an injury threshold for PTS from continuous noise at levels of 199 and 198 dB_{SEL_CUM} for low- and mid-frequency hearing group cetaceans, respectively—any cetacean within the resulting isopleth would suffer PTS if present for the entire day's vibratory driving. The continuous sound disturbance threshold for all marine mammals is 120 dB_{RMS}. Vibratory pile removal and driving is considered a continuous noise source, and both are anticipated to generate continuous SPL in excess of this threshold.

Cumulative PTS

Vibratory driving of 20-inch steel pile is anticipated to generate continuous noise up to 170 dB_{RMS}. Using NMFS' Marine Mammal Calculator for Vibratory Pile Driving, PTS is possible within 127 m (416 ft) and 11 m (37 ft) of vibratory pile driving for low- and mid-frequency hearing group cetaceans, respectively. However, this would require an individual cetacean to be within this distance of eight pile in one day for the entire 60-minute driving duration for each pile (8 hours total). This is so unlikely to occur that this scenario is unreasonable to assume. Thus, there is no expectation of PTS to occur to cetaceans from vibratory pile driving. Further, proposed marine mammal monitoring would stop work well in advance of an individual cetacean approaching this close to the work. Thus, the likelihood of this injury mechanism occurring is discountable.

Behavioral Effects

Using the Practical Spreading Loss Model, noise from vibratory driving 20-inch steel pile would attenuate to 120 dB_{RMS} within 21,544 m (70,682 ft). The sound would not pass beyond the land masses of Elliott Bay and the pier structure at Terminal 91. Please see Table 11 for a complete list of assumed SPLs generated by vibratory driving, and see Figure 9 for a map depicting the potential area of behavioral disturbance threshold exceedance for pile to be used in the proposed Project. Little data exists for vibratory removal. If vibratory pile remove is necessary, for the purposes of this assessment, it is assumed to be comparable to the values for vibratory driving of the same type/size pile.

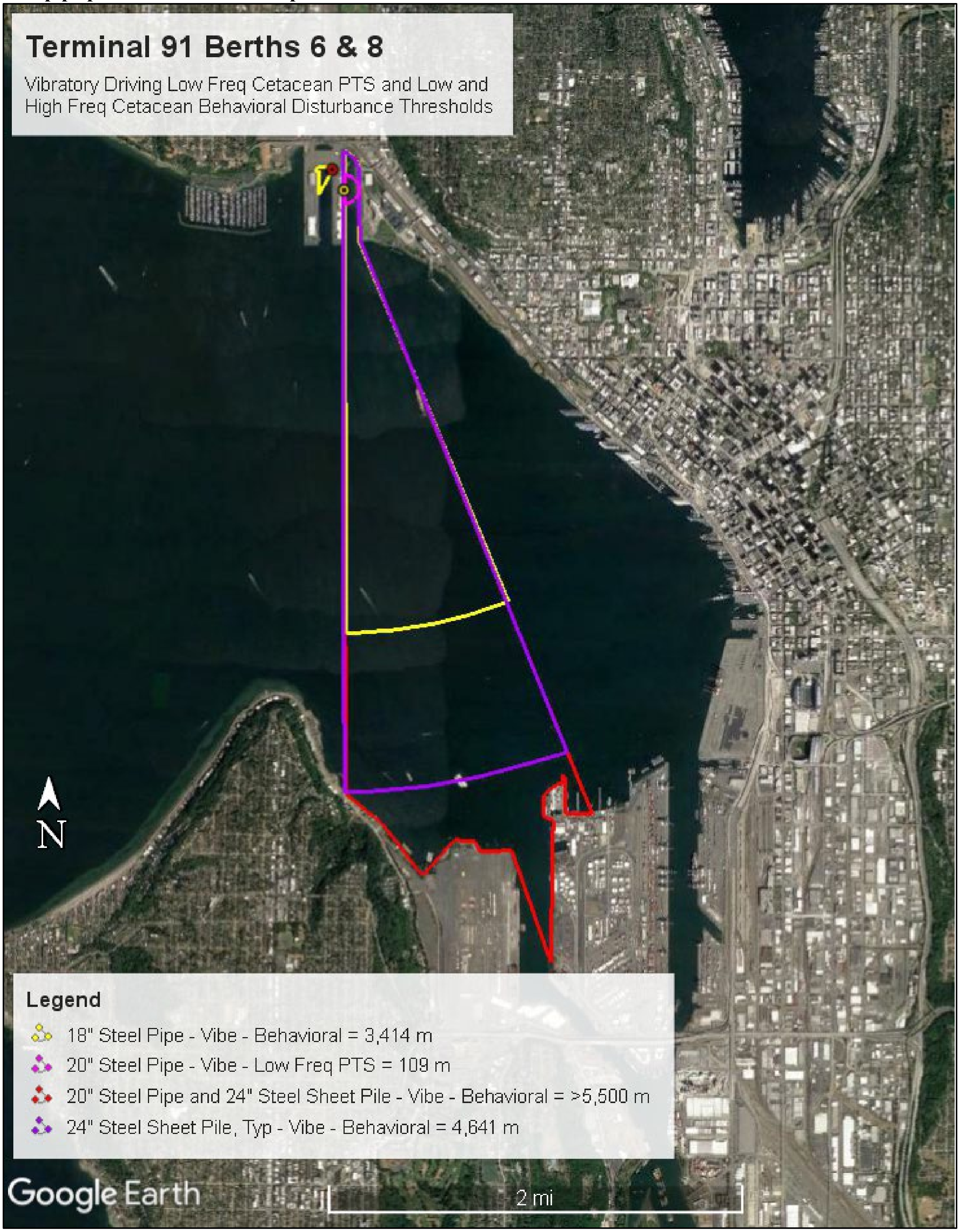
Table 11. Estimated distance to injury or disturbance level for vibratory pile driving (Ewald 2011 rev. Grette Associates 2021)

Pile	dB_{RMS}	Dist to low freq cumulative PTS 199 dB_{SEL_CUM} (m)[1]	Dist to mid freq cumulative PTS 198 dB_{SEL_CUM} (m)[1]	Dist to marine mammal disturbance/ ambient 120 dB_{RMS} (m)
18" Steel	158	17	2	3,414
20" Steel	170	109	10	21,544
24" Steel Sheet Pile – Typ.	160	23	2	4,641
24" Steel Sheet Pile – Loudest	165	51	5	10,000

[1] Because these radii are so small, they are not depicted in figures in this document.

The Port of Seattle is proposing to conduct marine mammal monitoring. Visual monitoring by biologists would be conducted during all pile driving and removal activities. The proposed monitoring plan is attached to this application.

Figure 9. Distances to humpback whale PTS (steel pile) and humpback whale and SRKW behavioral disturbance thresholds for vibratory pile driving 18" (guide pile for relocated small boat storage) and 20" steel pipe pile and 24" steel sheet pile.



5.1.2 Pile Removal

Existing timber piles will be removed by cutting the piles at the mudline. The cut-off portions below mudline will remain in place to preserve slope stability. Because piles will be cut rather than vibed out, continuous noise typically associated with pile removal will not occur. Saw-cutting is addressed as construction noise and disturbance (Section 5.1.3).

5.1.3 Water Quality – Construction

5.1.3.1 Turbidity from Dredging/Excavating the Slope

Dredging the armor material beneath the pier would generate turbidity. The potential effects of increased turbidity on salmonids have been investigated by a number of studies (Servizi and Martens 1987 and 1992, Emmett et al. 1988, Noggle 1978, Simenstad 1988, Redding et al. 1987, Mortensen et al. 1976, Berg and Northcote 1985). Other in situ studies have focused on the turbidity plumes that are created during dredging and how they spread and dissipate (Palermo et al. 1990, Havis 1988, LaSalle 1988). The potential mechanisms by which turbidity could affect salmonids include direct mortality, sublethal effects (stress, gill damage, and increased susceptibility to disease), and behavioral responses (disruptions to feeding or migration).

No mortality or sublethal effects are anticipated from turbidity associated with Project activities. Turbidity is expected to be localized and short-term, and concentrations of suspended sediments are expected to be the same as typically encountered near excavation operations (50 to 150 mg/l at 150 ft), below levels of concern for salmonids. Based on the results of a number of detailed studies (Stober et al. 1981, Salo et al. 1980, LeGore and DesVoigne 1973), the risk of mortality to juvenile salmonids from exposure to suspended sediment concentrations near dredge excavation sites is expected to be negligible. Suspended sediment concentrations near dredge excavation activity would not be expected to cause gill damage or stress in salmonids. (Servizi and Martens 1992, Redding et al. 1987, Stober et al. 1981).

Behavioral responses to elevated levels of suspended sediment include feeding disruption, changes in migratory behavior, swimming near the surface and avoidance behavior (Servizi 1988, Martin et al. 1977). Several studies (Bisson and Bilby 1982, Berg and Northcote 1985, Redding et al. 1987) indicate the threshold at which feeding effectiveness is impaired greatly exceeds the upper limit of expected suspended solid concentrations during dredge excavation. Furthermore, there is no evidence that suspended sediment concentrations typically encountered near dredging operations (50 to 150 mg/l at 150 ft) cause juvenile salmonids to rise to the surface. However, juvenile salmonids are afforded protection from this potential impact primarily by in-water work closure periods during their peak outmigration period.

In summary, based on the results of a number of detailed studies and because this project does not propose to conduct dredging in the channel and is only using the method to excavate the slope, it can be concluded that typical suspended sediment concentrations associated with dredging (approximately 50 to 150 mg/l at 150 ft) will not result in direct mortality, gill damage, stress or increased susceptibility to disease. Based on the nature of sediments in the Project Area, dredging would most likely result in a temporary and localized sediment plume likely to settle quickly. Overall, the characteristics of the sediments to be dredged (shoreline armoring materials) and the timing of construction indicate that direct impacts on salmonids are not expected from the effects of dredging on water quality. It is acknowledged that small numbers of juvenile, sub-adult, and adult Chinook salmon, steelhead and bull trout could have feeding opportunities reduced during construction.

Armoring and fish mix placement is expected to generate less turbidity than excavation due to the rocky composition of the proposed material. Furthermore, controlled release and placement of materials would minimize the potential for turbidity impacts during construction. The extent of turbidity during construction will be controlled by adhering to the Water Quality Certification and the Short-Term Modification to the Water Quality Standards issued by the Department of Ecology. The provisions of the permit will specify turbidity limits and define a mixing zone for the Project. The permit will also specify corrective actions that are to be taken should turbidity exceed the short-term standards during Project construction. These corrective actions typically include determining which activities may be causing the temporary exceedance and modifying the activity accordingly, modifying dredging activity by reducing production rates, or stopping the dredging activity to allow the temporary exceedance to dissipate.

5.1.3.2 Turbidity from Pile Cutting

Pile cutting will temporarily increase turbidity resulting from suspended sediments. It is likely that cutting pile at or below the mudline will generate higher levels of turbidity than pulling piles. It is likely that pile cutting would generate similar levels of turbidity to dredging. Potential for turbidity and suspended sediment would be further limited through implementation of minimization measures, including but not limited to:

- Where possible, extraction equipment for vibratory extraction or lifting of cut pile will be kept out of the water to avoid "pinching" pile below the water line in order to minimize creosote release during extraction.
- The work surface on barge deck or pier shall include a containment basin for pile and any sediment removed during pulling. Any sediment collected in the containment basin will be disposed of at an appropriate upland facility, as will all components of the basin (e.g., straw bales, geotextile fabric) and all pile removed.
- All pile removed will be disposed of at an appropriate upland facility.

5.1.3.3 Potential for Spills

There is minor potential for accidental spills from machinery during construction. However, to minimize the potential for an accidental spill during construction, a number of BMPs will be incorporated into the Project (see Section 7). Best Management Practices to be implemented during Project construction include keeping construction equipment well maintained, inspecting construction equipment daily for leaks, developing a spill prevention containment, and control plan and keeping oil absorbent material on-site during construction. Overall, the risk of an accidental spill is negligible.

Replacement of the pier apron could potentially allow debris to fall into the water during demolition and construction. It is possible that, during cutting of creosote-treated piles, a sheen would develop from the pile. Pile cutting would also generate sawdust in the water. To contain debris or creosote pile sheen, a floating debris boom would be in place around the work area during in-water pile and structure removal work. This will contain debris to within a small area immediately surrounding the work area and prevent its spread to greater Elliott Bay. Implementing appropriate BMPs and scheduling in-water construction to occur during the in-water work window, there is negligible potential for adverse impacts to ESA-listed species during structure and pile removal.

Overall, the Project would result in long-term improvements to water quality and minor, short-term effects on water quality though temporary and minor increases in turbidity during pile removal.

5.1.4 General Construction Disturbance

Construction disturbance entails the physical effects of operation of machinery in the process of completing the Project. This could include noise from work skiff engines, saw-cutting of timber piles, or noise incidental to pile repairs or general construction. Noise levels of these activities are anticipated to be minimal, and generally in line with the type of noise that occurs regularly on the Elliott Bay waterfront, including current boat traffic at the site. Underwater saw cutting is anticipated to generate underwater noise levels around 140 dB (Greenbusch Group Inc. 2019), which could exceed the behavioral effects threshold for marine mammals within 706 ft of the cutting. However, saw cutting is not similar to vibratory pile diving in that cutting of individual piles would be very short duration (at most a few minutes per pile), and likely to be infrequent and sporadic. For these reasons, it is anticipated that noise of this type would be inconsequential to marine mammals.

5.2 LONG-TERM EFFECTS

5.2.1 Substrate

The Project would replace the existing substrate beneath the pier with riprap armoring topped with fish mix. Currently, the substrate on the under-pier slope is highly degraded as is typical of an under-pier slope of this era, and includes riprap armoring, derelict piles, metal debris, and concrete debris.

The proposed surface would include three (3) feet of heavy riprap, one (1) foot of quarry spalls, and fish mix placed on top and in the interstices. Fish mix will result in a more productive surface substrate than the current surface. However, due to the dark under-pier environment, primary productivity will be relatively low regardless of substrate.

The existing (baseline) conditions in the Project and Action Area are described in Section 3.5. The Project Area is entirely underneath the existing pier and experiences constant exposure to deep, propeller-generated hydraulic forces generated by tug and large vessel propulsion systems as vessels arrive and depart from the Pier 91 berths. These forces, combined with low light levels (due to depth and under-pier location) and coarse riprap substrate, all contribute to a relatively low productivity environment. Macroalgae, if present, is expected to be minimal. Sessile organisms, fish, and invertebrates are present, but in relatively low numbers compared to areas with better physical and biological habitat conditions. Overall, the existing condition results in a lower quality habitat resource for marine organisms, including listed species, compared to subtidal habitats that are not under-pier and/or exposed to regular and strong propeller-generated hydraulic forces.

Mobile organisms may begin to move back into the Project area from the adjacent slope immediately following construction. It is anticipated that sessile organisms will recolonize the Project area in a period of months following construction, beginning with early colonizers during spring months. Early colonizers would be followed by larger, slower growing, longer-lived species, during a recovery period that may last two to three years. During this time, mobile organisms will continue to move back into and use the Project area. After previous Port projects, including pile repair at Terminal 91 and elsewhere in Elliott Bay, new structures including polyethylene and high molecular weight plastic materials (e.g., piling wraps and inert wharf fender systems) have been re-populated with sessile organisms and mobile invertebrates during a similar recovery period. Therefore, the Project area is expected to return to a condition comparable with the existing condition within a matter of two to three years. Because the existing condition is already a relatively low-quality habitat, the displacement and recovery period will be negligible with respect to habitat function for all listed species in the action area.

The Project will replace the existing armoring with riprap, quarry spalls, and fish mix. Use of crushed rock is intended to do two things: fill interstices to reduce potential predator habitat and provide finer substrate to support a more abundant and diverse invertebrate assemblage, which supports foraging for smaller fish. Based on depth, under-pier location, and regular and strong propeller disturbance, this Project area is unlikely to provide significant forage opportunity or rearing function for juvenile listed salmonids or listed rockfish. Its contribution to foraging or habitat for adult listed fish, listed cetaceans, marbled murrelets, and leatherback sea turtles is negligible. However, with respect to habitat function for listed species, efforts will be made to improve conditions through inclusion of fish mix in project design.

5.2.2 Water Quality

Over the long-term, the Project would improve water quality in the Action Area by removing approximately 2,300 creosote-treated timber pile from the aquatic environment. This would contribute to the removal of a potential source of PAH from Puget Sound.

5.2.3 Pile Numbers

The Project would generally improve all critical habitat in Elliott Bay by reducing total numbers of pile by approximately 1,900. The Project would be a continuation of a long-term trend of gradual improvement of aquatic habitat in the vicinity of the Port of Seattle through various redevelopment projects, which has resulted in a substantial reduction of pile, particularly treated timber pile, within Port of Seattle properties.

5.2.4 Changes in Overwater Coverage

The Project includes removal of 66,230 sq ft of pier area and installation of 60,710 sq ft of pre-cast concrete decking, for a net reduction of approximately 5,520 sq ft of overwater coverage. Reduced replacement overwater coverage would occur within the same footprint.

Productivity can be lower in areas shaded by overwater structures than in unshaded areas (Carrasquero 2001). The decrease in overwater structure proposed for this project would result in an increased stock of primary producers (phytoplankton and macrophyte) which can in turn influence the epibenthic community on which salmonids and other organisms depend.

Overall, the reduction in square footage of overwater coverage may provide long-term benefits for ESA-listed species.

6. EFFECTS ON CRITICAL HABITAT

Critical habitat for Puget Sound Chinook salmon, Coastal-Puget Sound bull trout, Puget Sound rockfish, and SRKW are present in the Project's Action Areas. The Project would generally improve all critical habitat in Elliott Bay by reducing total numbers of pile by approximately 1,900 as well as permanently removing hundreds of tons of creosote (approximately 2,300 creosote-treated timber pile) from the aquatic environment. The Project would be a continuation of a long-term trend of gradual improvement of aquatic habitat in the vicinity of the Port of Seattle through various redevelopment projects, which has resulted in a substantial reduction of pile within the Port of Seattle. Additionally, the square footage of overwater coverage will be reduced by approximately 5,520 sq ft. Effects on critical habitat are discussed below by critical habitat type, due to the similar effects in all zones.

6.1 Puget Sound Chinook Salmon Critical Habitat

NOAA Fisheries (2005b) identified six primary constituent elements (PCEs) (i.e., physical and biological features) essential to the conservation of Chinook salmon, listed below. Each PCE addresses a particular habitat type: PCE 5 addresses nearshore marine habitat and is relevant to this project. PCEs 1 through 4 and 6 address freshwater, estuarine, and offshore marine areas and thus are not applicable to this project. All PCEs are presented below in italics, with applicable PCEs in bold. Effects to all PCEs are essentially the same, and thus are discussed together below.

PCE 1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

PCE 2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams 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 supporting juvenile and adult mobility and survival.

PCE 4. Estuarine areas free of obstruction and excessive predation with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

PCE 5. Nearshore marine areas free of obstruction and excessive predation with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as 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.

As discussed in Section 5.2.3, pile number would be reduced in the Project Area and thus in PCE 5. The Project would result in a net reduction of pile by approximately 1,900 (approximately 700 square feet total pile footprint removed, considering the fender pile with the facing included [24-inch diameter]) within Chinook salmon critical habitat. This would result in a net removal of approximately 14,000 cubic feet of in-water structure. The reduction would improve passage and habitat conditions in PCE 5 by reducing the number of obstacles and the general level of anthropogenic development.

In the short-term, the Project may reduce water quality from increased turbidity associated with pile driving/removal. However, this would be localized, temporary, and very minor. Over the long-term, water quality would be improved through the removal of 2,300 creosote-treated timber pile.

Pile removal would also increase available lateral area within the water column, totaling approximately 700 square feet.

The Project results in a reduction in overwater coverage of 5,520 square feet. Decreasing overwater coverage can benefit productivity of the habitat and the quality of migratory corridors.

No natural cover would be affected by the project, since this project only proposes replacement of existing structures in a highly-developed area.

Overall, the Project will result in long-term benefits to Puget Sound Chinook salmon critical habitat in PCE 5—nearshore marine habitat. The Project will result in no long-term adverse impacts to critical habitat.

6.2 COASTAL-PUGET SOUND BULL TROUT CRITICAL HABITAT

On October 18, 2010, USFWS revised designated critical habitat for Coastal-Puget Sound bull trout (USFWS 2010a). The Action Area is within the Coastal Recovery Unit's Unit 2, Puget Sound Critical Habitat Unit (CHU). The PCEs are listed below in italics; those applicable to the Project are in bold. Discussion of the Project's effects on each PCE is below the PCE.

PCE 1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

Not applicable.

PCE 2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

Bull trout migratory habitat is primarily located in the Duwamish Waterway and in the Lake Washington Ship Canal, though as discussed in Section 4.1.3, these areas are little used by bull trout. The Project is set back from likely migratory routes, so improvements to the Project Area will not likely have a great impact on bull trout critical habitat. Nevertheless, the project may improve migratory habitat through the reduction of minor impediments (pile) and the improvement of water quality over the long-term (removal of creosote-treated timber pile). Temporary turbidity may be generated during pile driving/removal, but this would be minor and localized.

The Project results in a reduction in overwater coverage of 5,520 square feet. Decreasing overwater coverage can benefit productivity of the habitat and the quality of migratory corridors. Overall, the Project will benefit PCE 2.

PCE 3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

The Project would result in improved conditions for bull trout food base, including forage fish and macroinvertebrates through the removal of creosote-treated timber pile, the general reduction of pile numbers, reduction in overwater coverage, and adding fish mix to the slope. Short-term water quality impacts would not have noticeable effects on bull trout food base.

PCE 4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

The aquatic habitat in the Action Area of the Project generally does not contain these complex shoreline environments. Further, shoreline development in the Action Area has largely eliminated the natural processes that create these features. However, removal of anthropogenic shoreline development such as pile will only improve shoreline habitat. The Project would have no negative effects on these features.

PCE 5. Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

This PCE applies mainly to stream habitat, in particular spawning and rearing habitat, and is not applicable to the project's Action Area. Further, the Project would not affect water temperature.

PCE 6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

Not applicable.

PCE 7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

Not applicable.

PCE 8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

The Project would result in short-term water quality impacts through increased turbidity during pile driving/removal. However, these would be minor, temporary, and localized. Removal of creosote-treated timber pile would improve water quality over the long-term by removing on-going sources of contaminants to the water.

As discussed in Section 5.2.3, pile number would be reduced in the Project Area and thus water quantity as outlined in PCE 8. The Project would result in a net reduction of pile by approximately 1,900 (approximately 700 square feet total pile footprint removed, considering the fender pile with the facing included [24-inch diameter]) within bull trout critical habitat. This would result in a net removal of approximately 14,000 cubic feet of in-water structure. The reduction would improve water quality (through creosote removal) and quantity (through a net reduction in square and cubic footage of pile).

PCE 9. Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

The Project would have negligible effects on the status of species detrimental to bull trout such as those listed above.

Overall, the Project would result in a long-term benefit to bull trout critical habitat.

6.3 Rockfish Critical Habitat

On November 13, 2014, NOAA Fisheries designated critical habitat for the ESA-listed rockfish species, bocaccio and yelloweye rockfish. Two types of habitat have been included in the critical habitat designation—Nearshore and Deepwater critical habitat. Nearshore critical habitat focuses on juvenile rearing habitat, and Deepwater critical habitat focuses on areas that support adult rockfish. Nearshore rockfish critical habitat occurs in the Project Area. Deepwater critical habitat is not present in the Project Area but is present in the Action Area.

NOAA has identified two primary "essential attributes" of Nearshore critical habitat that are vital to the conservation of bocaccio juveniles. Settlement habitats are typically located in the nearshore with substrate such as sand, rock, and/or cobble compositions that also support kelp. Juvenile/nearshore critical habitat for bocaccio rockfish is defined by the following essential attributes (NOAA 2013):

- *Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities*

- *Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities*

The effects of the Project on these "essential attributes" are presented in detail below.

6.3.1 Nearshore Critical Habitat

Nearshore critical habitat is present in the Project Area. An analysis of the effects of the Project on the essential attributes of Nearshore critical habitat is discussed below.

Quantity, Quality and Availability of Prey Species

As discussed in Section 4.2.3, juvenile rockfish are planktivores. There is no indication that sound from pile removal or driving would have any effect on the delivery of planktonic prey items. Turbidity associated with pile removal may temporarily inhibit foraging success for individuals within the plume. However, turbidity is expected to be very minimal, short-term, and localized, and managed with BMPs that limit the extent of the mixing zone. Over the long-term, primary productivity may be improved, as the Project involves a reduction in overwater coverage.

The Project results in a reduction in overwater coverage. This can improve productivity of the habitat and thus prey production.

The Project has no mechanism to measurably affect the quality of prey species.

The Project would also have no direct effects on the availability of prey species. The Project would result in a net reduction of pile by approximately 1,900 (approximately 700 square feet total pile footprint removed, considering the fender pile with the facing included [24-inch diameter]) within nearshore rockfish critical habitat. This would result in a net removal of approximately 39,000 cubic feet of structure within the water column, which would result in a modest increase in foraging area or prey availability, as less area would be occupied by pile.

Overall, the Project would have negligible effects on this essential attribute of rockfish critical habitat.

Water Quality and Dissolved Oxygen

Potential effects of the Project on water quality and resulting effects on rockfish would arise from turbidity generated by pile removal. However, these would be minimal, short-term, and localized, and managed with BMPs that limit the extent of the mixing zone. Water quality would be improved by the removal of up to 2,300 creosote-treated timber pile. There is the potential for incidental discharges of fuel, oil, or other materials during construction, but these would be minimized and managed through standard BMPs for work in aquatic areas (Section 7). The Project would have no effect on levels of dissolved oxygen in the Action Area.

The Project would have a minor long-term benefit, and negligible temporary impacts to this essential attribute of rockfish critical habitat.

6.3.2 Deepwater Critical Habitat

Deepwater critical habitat is not present in the Project Area, but is in the Action Area. The only Project element that would affect deepwater critical habitat would be pile driving noise (see

Section 5.1). The potential effects of this pile driving noise on the essential elements of deepwater critical habitat are discussed below.

Quantity, Quality and Availability of Prey Species

As discussed in sections 4.1.4 and 4.1.5, respectively, adult bocaccio rockfish are piscivorous, and adult yelloweye rockfish feed on a wider range of prey. It is possible that pile proofing would cause behavioral effects on rockfish prey species, such as hiding in response to noise. Should this occur, there is potential that prey species may be less available for adult rockfish during pile proofing. However, there is no definitive evidence that this would occur, particularly at such distances from the source and within an already relatively noisy environment of Elliott Bay. Even if it did occur, as discussed in Section 5.1, pile driving noise would be very limited. Thus, the potential effect on rockfish prey would be brief. Potential effects of pile proofing on prey species are negligible and discountable.

Water Quality and Dissolved Oxygen

Potential effects of the Project on water quality are addressed in Section 5.1.2. As discussed, the Project would potentially result in minor, short-term water quality impacts that would be managed with BMPs, and long-term water quality benefits through the removal of approximately 2,300 creosote-treated timber pile. However, these water quality effects would not directly occur within Deepwater critical habitat; rather, they would have at most a minor, indirect and general effect on water quality within in Deepwater critical habitat.

The Project would have no effect on levels of dissolved oxygen in the Action Area.

Rugose Structure

Since the Project footprint is not within Deepwater critical habitat, it will not affect the physical environment, including any topographic relief areas or rugose structures that may be present in Deepwater critical habitat within the Action Area. The Project would not affect this essential attribute of rockfish critical habitat.

Overall, this Project will have negligible and discountable effects on Puget Sound rockfish critical habitat.

6.4 SOUTHERN RESIDENT KILLER WHALE CRITICAL HABITAT

SRKW critical habitat is designated in the Action Area (Figure 5). This analysis evaluates the potential effects of the Project on SRKW critical habitat by means of the primary constituent elements (PCEs) of critical habitat presented in the Federal Register (NOAA 2006a). NMFS identified three PCEs (i.e., physical and biological features) essential to the conservation of SRKW (NOAA 2006a). The effects of the Project on the PCEs are discussed below. The PCEs are below in bold italics; responses are below the PCE in plain font.

PCE 1. Water quality to support growth and development

Removal of creosote-treated timber pile would improve water quality over the long-term by removing on-going sources of contaminants to the water. The Project would result in short-term water quality impacts through increased turbidity during pile driving/removal. However, these would be minor, temporary, and localized.

PCE 2. Prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth

SRKW prey heavily on salmon (NOAA 2006a). As discussed above, the Project's effects on salmon would be negligible due to proposed conservation measures/best management practices (Section 7) to be implemented during pile driving (e.g. bubble curtain, preferential use of vibratory installation, etc.), and timing of the Project to minimize the potential for salmonids to be present during pile driving. The net reduction of pile number and the removal of creosote-treated timber pile would benefit salmonids. Overall, the Project would have negligible effect on PCE 2.

PCE 3. Passage conditions to allow for migration, resting, and foraging.

Due to the location of the pile in relatively shallow, nearshore water at the upper end of a waterway that is heavily developed and highly active, the work areas are generally not accessible by SRKW. While the net reduction of pile would generally be a benefit for passage conditions, the pile that would be removed are not in a location to benefit passage conditions for SRKW. Thus, the Project would have a negligible positive effect on this PCE.

Overall, the Project would result in minor improvements to SRKW critical habitat. No long-term adverse impacts are anticipated.

7. CONSERVATION MEASURES/BEST MANAGEMENT PRACTICES

7.1 General Measures

- In-water work will occur during the designated work window when juvenile salmonids are absent or present in very low numbers.
- Care will be taken to prevent any petroleum products, chemicals, or other toxic or deleterious materials from entering the water. Fuel hoses, oil drums, oil or fuel transfer valves and fittings, etc., will be checked regularly for drips or leaks, and shall be maintained and stored properly to prevent spills into waters. Proper security shall also be maintained to prevent vandalism.
- Vegetable-based hydraulic fluid will be used in pile driving equipment.
- The contractor will have a spill containment kit, including oil-absorbent materials, on site to be used in the event of a spill or if any oil product is observed in the water.
- If a spill were to occur, work would be stopped immediately, steps would be taken to contain the material, and appropriate agency notifications would be made. The contractor is responsible for the preparation of spill response and hazardous material control plans to be used for the duration of Project construction.
- Spills and/or conditions resulting in distressed or dying fish shall be reported immediately to Ecology's Northwest Regional Spill Response Office at (425) 649-7000 (a 24-hour phone number), the Washington Emergency Management Division at 1-800-OILS-911, and the National Response Center at 1-800-424-8802.
- If fish are observed in distress or a fish kill occurs, work would be stopped immediately. WDFW, Ecology and other necessary agencies would be contacted and work would not resume until further approval is given.

7.2 Pile Removal/Installation Water Quality Measures

- The Port's contract specifications for pile removal and disposal incorporate the highly protective *Best Management Practices for Pile Removal and Placement in Washington State* (2016) promulgated by the EPA.
- No pile treated with creosote, pentachloraphenol, or coal tar will be used. The project would result in a significant net reduction of creosote-treated timber pile.
- A boom will be installed around the work area prior to removal of the timber piling and related structures to contain and collect debris. Debris will be disposed of at an approved upland location.
- Hydraulic water jets will not be used to remove or place piling.
- Every effort will be made to minimize release of adhering sediments when extracting fender piling that are pulled from the water and placed on receiving barge or on the adjacent concrete cargo pier deck.
- All treated wood will be contained on land or barge during and after removal to preclude sediments and any contaminated material from re-entering the aquatic environment.
- Treated piling will be fully extracted or cut at the mudline; holes or piling stubs will be covered with a new riprap layer.
- Piling will be replaced in same general location, and pile will not extend beyond the footprint of existing structure.

7.3 PILE REMOVAL/INSTALLATION NOISE ABATEMENT

- Vibratory hammer installation is the preferred method to minimize the generation of potentially injurious sound. Impact pile driving would be limited to proofing of structural pile.
- Noise attenuation measures will be employed for impact-driving of all steel pile.
- Pile caps will be used for all driving of concrete pile.
- For projects that produce underwater noise within the range known to cause 'disturbance' of cetaceans, qualified biologists will be stationed at appropriate points to ensure that work is stopped if listed cetaceans enter the mapped Action Area.
- The Port proposes to conduct an appropriate level of biological monitoring for the protection of marbled murrelets during impact proofing. The Port proposes to discuss details of the monitoring program with USFWS prior to and during the consultation process to arrive at a mutually agreed upon monitoring plan.

8. CONCLUSIONS AND DETERMINATIONS

8.1 PUGET SOUND CHINOOK SALMON

Potential effects of this Project on Chinook were discussed in Sections 5.1.1, 5.1.3, 5.2.2, and 5.2.4. Puget Sound Chinook salmon utilize the Elliott Bay Action Area; outmigrating juveniles and adults migrating to spawning areas could both be present. Pile driving presents the most likely scenario for take to Chinook salmon through potential for injury to juveniles; adults are not susceptible to pile driving injuries as are juveniles. However, based on the minimization measures to be implemented (e.g., minimizing impact hammer usage, limiting pile sizes, timing of work during the in-water work window), the anticipated low levels of pile driving sound, and low likelihood of individual Chinook being present for long enough duration to experience injurious cumulative sound, take is not expected for this project.

In the very unlikely event that some take occurs, the number of adults and juveniles that could be injured or killed is too low to cause a measurable effect on the long-term abundance or productivity of the Puget Sound Chinook salmon population or appreciably reduce the likelihood of survival or recovery. Based on this analysis, it is determined that the likelihood of any individuals being taken by Project activities is low. Thus, it is concluded that this Project ***may affect,*** but is ***not likely to adversely affect***, Puget Sound Chinook salmon.

8.2 PUGET SOUND CHINOOK SALMON CRITICAL HABITAT

Potential effects of the project on Puget Sound Chinook salmon critical habitat was assessed in Section 6.1. It was concluded that the Project would have negligible, short-term effects, and would result in a long-term benefits to critical habitat. The Project proposes a reduction in overwater coverage and pile area and removal of a considerable volume of creosote from Puget Sound Chinook salmon critical habitat. Based on this analysis, it is concluded that the Project ***may affect***, but is ***not likely to adversely affect*** Puget Sound Chinook salmon critical habitat.

8.3 PUGET SOUND STEELHEAD

Potential effects of this Project on Chinook were discussed in Sections 5.1.1, 5.1.3, 5.2.2, and 5.2.4. Puget Sound steelhead utilize the Elliott Bay Action Area; outmigrating juveniles are most likely to be present, and adults could be present when migrating to spawning areas. Pile driving presents the most likely scenario for take to steelhead, through potential injury to juveniles; adults are not susceptible to pile driving injuries as are juveniles. However, it is understood that juvenile steelhead outmigrate at a larger size than Chinook salmon, move through estuarine and nearshore areas rapidly during outmigration, and move offshore rapidly. Further, based on the minimization measures to be implemented (e.g., minimizing impact hammer usage, limiting pile sizes, timing of work during the in-water work window), the anticipated low levels of pile driving sound, and the extremely low likelihood of individual steelhead being present for long enough duration to experience injurious cumulative sound, take is not expected in any of the four work zones.

In the very unlikely event that some take occurs, the number of adults and juveniles that could be injured or killed is too low to cause a measurable effect on the long-term abundance or productivity of the Puget Sound steelhead population or appreciably reduce the likelihood of survival or recovery. Based on this analysis, it is determined that the likelihood of any individuals being taken by Project activities is low. Thus, it is concluded that this Project ***may affect,*** but is ***not likely to adversely affect***, Puget Sound steelhead.

8.4 COASTAL-PUGET SOUND BULL TROUT

Potential effects of this Project on Coastal-Puget Sound bull trout were discussed in Sections 5.1.1 and 5.1.3. Bull trout presence is extremely unlikely in the Elliott Bay Action Area. Further, it is most likely that any individuals present would be adults, and thus not susceptible to injury from pile driving as are juvenile fish. Finally, based on the minimization measures to be implemented (e.g., minimizing impact hammer usage, limiting pile sizes, timing of work during the in-water work window), the anticipated low levels of pile driving sound, and the extremely low likelihood of individual bull trout being present for significant duration, take is not expected in any of the four work zones. Thus, it is concluded that this Project ***may affect,*** but is ***not likely to adversely affect***, Coastal-Puget Sound bull trout.

8.5 COASTAL-PUGET SOUND BULL TROUT CRITICAL HABITAT

Coastal-Puget Sound bull trout critical habitat was assessed in Section 6.2. It was concluded that the Project would have negligible effects, and would result in a long-term benefit on critical habitat. The Project proposes a reduction in overwater coverage and pile area and removal of a considerable volume of creosote from Coastal-Puget Sound bull trout critical habitat. Based on this analysis, it is concluded that the Project ***may affect***, but is ***not likely to adversely affect*** Coastal-Puget Sound bull trout critical habitat.

8.6 BOCACCIO AND YELLOWEYE ROCKFISH

Bocaccio and yelloweye rockfish may utilize the Elliott Bay Action Area, but are extremely unlikely to be present in the Project Area. Potential effects of this Project on listed rockfish species were discussed in Sections 5.1.1 and 5.2.1. Rearing juveniles and foraging adults could both be present in the Action Area, though likely at low densities. Larval rockfish could be anywhere in Puget Sound. Pile driving presents the most likely scenario for take to rockfish, primarily to juveniles. However, very little appropriate rearing habitat is available in the Action Area. Larval rockfish are not considered susceptible to barotrauma. However, based on the minimization measures to be implemented (e.g., minimizing impact hammer usage, limiting pile sizes, timing of work during the in-water work window), the anticipated low levels of anticipated pile driving sound, and the likely low density of rockfish in Elliott Bay, take is not expected for this project.

In the very unlikely event that some take occurs, the number of adults and juveniles that could be injured or killed is too low to cause a measurable effect on the long-term abundance or productivity of the two ESA-listed rockfish populations or appreciably reduce the likelihood of survival or recovery. It is concluded that the Project may affect, but is not likely to adversely affect, rockfish in the Action Area. Based on this analysis, it is concluded that this Project ***may affect,*** but is ***not likely to adversely affect***, bocaccio and yelloweye rockfish.

8.7 BOCACCIO AND YELLOWEYE ROCKFISH CRITICAL HABITAT

Rockfish critical habitat was assessed in Section 6.3. It was concluded that the Project would have negligible effects and would result in a long-term benefit on critical habitat. Based on this analysis, it is concluded that the Project ***may affect***, but is ***not likely to adversely affect*** rockfish critical habitat.

8.8 Southern Resident Killer Whale, and Humpback Whale

SRKW and humpback whale are potentially present in the Action Area. Potential effects of this Project on listed cetaceans were discussed in Sections 5.1.1 and 5.2.1. Impact and vibratory pile driving are the most likely impact mechanisms. While the Project is expected to generate underwater noise in excess of cumulative effects thresholds for both impact and vibratory driving, the radii of such impacts are so small as to render the actual effects on cetaceans extremely unlikely. Vibratory pile driving would generate underwater sound in excess of behavioral thresholds; however, monitoring would be conducted to stop work should ESA-listed cetaceans approach the area of potential disturbance.

It is concluded that the Project may affect, but is not likely to adversely affect, ESA-listed cetaceans. Based on this analysis, it is concluded that this Project ***may affect,*** but is ***not likely to adversely affect***, Southern Resident killer whale, and humpback whale.

8.9 Southern Resident Killer Whale Critical Habitat

Southern Resident killer whale critical habitat was assessed in Section 6.4. It was concluded that the Project would have negligible effects, and would result in a long-term benefit on Southern Resident killer whale critical habitat. Based on this analysis, it is concluded that the Project ***may affect***, but is ***not likely to adversely affect*** Southern Resident killer whale critical habitat.

8.10 Marbled Murrelet

Marbled murrelet may be present in the Action Area, but are rare visitors. Potential effects of this Project on marbled murrelet were discussed in Section 5.1.1 and 5.2.1. Pile driving is the most likely effect mechanism; however, potential injury radii are extremely small. Further, biological monitoring will be conducted to stop work should murrelets approach the area of injurious sound. Based on these analyses and with proposed biological monitoring, it is concluded that this Project ***may affect,*** but is ***not likely to adversely affect***, marbled murrelet.

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PORT OF SEATTLE
TERMINAL 91 BERTHS 6 & 8 REDEVELOPMENT

BIOLOGICAL EVALUATION APPENDIX A:
ESSENTIAL FISH HABITAT (EFH) ASSESSMENT

PREPARED FOR:

PORT OF SEATTLE
P.O. BOX 1209
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SEPTEMBER 2021

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1. ESSENTIAL FISH HABITAT DESIGNATIONS

Pursuant to the MSFCMA and the 1996 SFA, an Essential Fish Habitat (EFH) evaluation of impacts is necessary for the actions that are associated with this Project. EFH is defined by the MSFCMA in 50 CFR 600.905-930 as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

Estuaries of Washington State, including Puget Sound and the Pacific Ocean off the mouth of these estuaries, are designated as EFH for various groundfish, coastal pelagic and salmonid species (NMFS 1998; PFMC 1998a, 1998b, and 1999). EFH and life history stages for groundfish, pelagic and salmonid species commonly found in Puget Sound estuaries are listed in Table 1 (NMFS 1998; WDF 1992).

Table 1. Species of fishes and life-history stages with designated EFH in the marine waters of Puget Sound[1].

Guild / Common Name	Species Name	Adults	Eggs	Juveniles	Larvae
Groundfish[1]					
Big skate	*Raja binoculata*	x	x	x	
Black rockfish	*Sebastes melanops*	x		x	
Blue rockfish	*Sebastes mystinus*	x		x	x
Bocaccio	*Sebastes paucispinis*	x		x	x
Brown rockfish	*Sebastes auriculatus*	x		x	
Butter sole	*Isopsetta isolepis*	x	x	x	x
Cabezon	*Scorpaenichthys marmoratus*	x	x	x	x
China rockfish	*Sebastes nebulosus*	x		x	
Copper rockfish	*Sebastes caurinus*	x		x	
Dover sole	*Microstomus pacificus*	x	x	x	x
English sole	*Parophrys vetulus*	x	x	x	
Flathead sole	*Hippoglossoides elassodon*	x		x	
Greenstriped rockfish	*Sebastes elongatus*	x		x	x
Kelp greenling	*Hexagrammos decagrammus*	x	x	x	x
Lingcod	*Ophiodon elongatus*			x	x
Longnose skate	*Raja rhina*	x	x	x	
Pacific cod	*Gadus macrocephalus*	x			
Pacific hake	*Merluccius productus*	x		x	
Pacific sanddab	*Citharichthys sordidus*	x	x	x	x
Petrale sole	*Eopsetta jordani*	x		x	
Quillback rockfish	*Sebastes maliger*	x		x	x
Redstripe rockfish	*Sebastes proriger*	x		x	x
Rex sole	*Glyptocephalus zachirus*	x		x	
Rock sole	*Lepidopsetta bilineata*	x	x	x	x
Sablefish	*Anoplopoma fimbria*	x	x	x	x
Sand sole	*Psettichthys melanostictus*	x	x	x	x
Spiny dogfish	*Squalus acanthias*	x		x	
Splitnose rockfish	*Sebastes diploproa*	x		x	x
Spotted ratfish	*Hydrolagus colliei*	x	x	x	

Guild / Common Name	Species Name	Adults	Eggs	Juveniles	Larvae
Starry flounder	*Platichthys stellatus*	x	x	x	x
Tiger rockfish	*Sebastes nigrocinctus*	x		x	x
Widow rockfish	*Sebastes entomelas*	x		x	x
Yelloweye rockfish	*Sebastes ruberrimus*	x			x
Yellowtail rockfish	*Sebastes flavidus*	x		x	
Pacific Salmon[2]					
Chinook	*Oncorhynchus tshawytscha*	x		x	
Coho	*Oncorhynchus kisutch*	x		x	
Puget Sound pink	*Oncorhynchus gorbuscha*	x		x	
Coastal Pelagics[2]					
Northern anchovy	*Engraulis mordax*	x	x	x	x
Pacific sardine	*Sardinops sagax caerulea*	x			
Pacific mackerel	*Scomber japonicus*	x			
Market squid	*Loligo opalescens*	x			

[1] Table modified from the West Coast Region EFH website, https://www.fisheries.noaa.gov/west-coast/habitat-conservation/essential-fish-habitat-west-coast).

All three of the Pacific salmon management unit species (Chinook, coho and pink salmon) may be present within the Elliot Bay Action Area (NOAA Fisheries Essential Fish Habitat Mapper, https://www.habitat.noaa.gov/apps/efhmapper/ queried August 26, 2021). Spawning and rearing of these species does not occur in the Elliott Bay Action Area, although all three species may use the Action Area for adult migration and juvenile out-migration.

Many of the ground fish species that occur in Puget Sound may also occur within the Action Area. West coast pelagic fishes are primarily associated with open ocean and coastal areas (PFMC 1998a), and are therefore not likely to occur within the Elliott Bay Action Area.

2. ANALYSIS OF THE EFFECTS ON EFH

The assessment of potential impacts from the proposed Project to the species' EFH is based on information in the above-referenced documents (NMFS 1998; PFMC 1998a, 1998b, and 1999).

The specific elements of the project that could potentially impact groundfish, pelagic and salmonid species EFH, impact mechanisms, and conservation measures that avoid and minimize impacts are identified in Table 2.

Table 2. Affected EFH by project element and proposed conservation measures.

Project Element	Affected EFH	Impact Mechanism	Applicable Conservation Measures (see list below)
Pile Removal and Driving	Groundfish, pelagic and salmonid EFH	The project will result in a net decrease in pile number and footprint.	--
		Pile removal and driving will result in temporary increases in turbidity, but there will be no long-term effect on turbidity in the vicinity of the project. Based on experience with similar projects in the area, pile removal, pile driving and other construction activities are expected to generate turbidity only in localized areas.	1, 2, 3, 4 (for salmonid EFH), 5, 6, 7 and 8
		Sessile invertebrates and marine algae may be removed by the removal of existing timber piling, resulting in a temporary loss in primary productivity and food resources. However, creosote-treated timber will be removed from the EFH.	1, 2, 3, 4 (for salmonid EFH), 5, 6, 7, and 8
		Pile driving (including sheet pile) and demolition/construction machinery would temporarily elevate noise levels within all EFH.	2, 3, 4 (for salmonid EFH), 5, and 6
Slope Excavation/Dredging	Groundfish and salmon EFH (water and substrate)	Sessile invertebrates and marine algae may be removed by the removal of the existing degraded riprap slope. This area currently provides little habitat function as it is under the pier and unvegetated (shoreline and aquatic). Fish mix will result in a more productive surface substrate than the current surface and will reduce the availability of potential predatory habitat.	1, 3, 4 (for salmonid EFH), 5, 6, and 7
		Slope excavation will result in temporary, localized increases in turbidity, but there will be no long-term effect on turbidity in the vicinity of the project.	1, 3, 4 (for salmonid EFH), 5, 6, and 7
Sheet pile Installation	Groundfish and salmon EFH (Substrate)	Installation of a sheet pile wall waterward immediately adjacent to the existing creosote wall will result in a small loss of aquatic habitat. This area provides little habitat function as it is primarily unvegetated (shoreline and aquatic) and is along the top of the armored slope. The existing creosote-treated timber bulkhead will be removed/isolated from the aquatic environment which will offset this small loss.	1, 3, 4 (for salmonid EFH), 5, 6, and 7

Project Element	Affected EFH	Impact Mechanism	Applicable Conservation Measures (see list below)
Construction Activities	Groundfish, pelagic, and salmon EFH (water and substrate)	Construction in aquatic areas can result in habitat impacts through mechanisms such as unintentional release of fuel, lubricants, or hydraulic fluid from equipment; construction debris, etc.	1, 2, 3, 4 (for salmonid EFH), 5, 6 and 7

List of Applicable Conservation Measures

1. Compliance with applicable State water quality standards (WAC 173-201A).
2. Compliance with Corps/EPA pile removal BMPs.
3. Compliance with Port of Seattle Construction BMPs.
4. Compliance with WDFW HPA conditions.
5. Timing restrictions specifying that in-water work must occur when juvenile salmonids are absent or present in very low numbers.
6. Compliance with the State's standards will ensure that fish and aquatic life will be protected to the extent feasible and practicable.
7. Care will be taken to prevent any petroleum products, chemicals, or other toxic or deleterious materials from entering the water. If a spill were to occur, work would be stopped immediately, steps would be taken to contain the material, and appropriate agency notifications would be made. The contractor is responsible for the preparation of spill response and hazardous material control plans to be used for the duration of project construction.
8. Removal of creosote-treated timber will positively affect all EFH by improving water quality.

3. CONCLUSIONS AND DETERMINATIONS OF EFFECTS

Based on the above analyses, it is expected that implementation of the proposed project ***will not adversely affect*** the EFH for groundfish, coastal pelagics, and salmonid species. Conservation measures that avoid and minimize impacts to EFH are incorporated into the Project design, and with the implementation of these measures and the habitat improvements resulting from removal of creosote-treated materials and reduction of square footage of overwater coverage, the Project is expected to result in long-term, beneficial effects to groundfish, pelagic and salmonid species EFH.

3.1 GROUNDFISH EFH

The impacts of the project on groundfish habitat are shown in Table 2. The impact of reduced primary productivity and food resources due to removal of macroalgae and invertebrate-colonized piling is expected to be short-term and minimal, as these organisms will recolonize the new substrate within weeks (Parametrix, Inc. 1985). The Project will result in a reduction in pile number and footprint and square footage of overwater coverage. Effects of removing the creosote-treated timbers are expected to be beneficial to the EFH of groundfish. Overall, based on the temporary impacts of the project, the project ***will not adversely affect*** groundfish EFH.

3.2 COASTAL PELAGIC EFH

Spills from pile driving equipment associated with the Project could temporarily adversely affect water column EFH for pelagic species. Conservation measures, such as operational BMPs that include the contractor's spill response and hazardous material control plans, will avoid or minimize impacts to pelagic species EFH. The Project will result in a reduction in pile number and footprint and square footage of overwater coverage. Effects of removing the creosote-treated timbers from the area are expected to be beneficial to the EFH of coastal pelagic fish. Based on the temporary effects of the Project on water column EFH, the project ***will not adversely affect*** coastal pelagic EFH.

3.3 SALMONID EFH

The impacts of the Project on salmonid habitat are shown in Table 2. The effect of reduced primary productivity and food resources due to removal of sessile invertebrates and macroalgae from timber piling is expected to be short-term and minimal, as these organisms will recolonize the new materials within weeks (Parametrix, Inc. 1985). The Project will result in a reduction in pile number and footprint and square footage of overwater coverage. Further, the removal of creosote-treated timber piles is expected to provide an overall improvement in salmonid habitat within in the vicinity of the project. Overall, based on the analysis completed herein, the project ***will not adversely affect*** salmonid EFH.

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Appendix C

HISTORIC/CULTURAL RESOURCES ANALYSIS

Draft—Cultural Resources Assessment Technical Report for the Terminal 91 Berths 6 and 8 Redevelopment, Seattle, King County, Washington

Submitted to:
EA Engineering Science and Technology Inc.
Port of Seattle

Submitted by:
Historical Research Associates, Inc.
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Chrisanne Beckner, MA
Brian Durkin, MS

Seattle, Washington
June 28, 2021

Historical
Research
Associates, Inc.

This project was implemented by HRA Principal Investigators Chrisanne Beckner, MA, and Brian Durkin, MS, who meet the Secretary of the Interior's professional qualifications and standards for architectural history and archaeology, respectively. This report is intended for the exclusive use of the Client and its representatives. It contains professional conclusions and recommendations concerning the potential for project-related impacts to cultural resources based on the results of HRA's investigation. It should not be considered to constitute project clearance with regard to the treatment of cultural resources or permission to proceed with the project described in lieu of review by the appropriate reviewing or permitting agency. This report should be submitted to the appropriate state and local review agencies for their comments prior to the commencement of the project.

Executive Summary

EA Engineering Science and Technology, Inc. (EA), and the Port of Seattle (Port) contracted with Historical Research Associates, Inc. (HRA), to provide cultural resources support for the proposed Terminal 91 Berths 6 and 8 Redevelopment Project (Project) located within Smith Cove, Seattle, Washington. The project is located in Township 25 North, Range 3 East, Section 26, Willamette Meridian, U.S. Geological Survey (USGS) Shilshole Bay quadrangle topographic maps.

The in-water work of the Project requires a U.S. Army Corps of Engineers (USACE) permit, and is subject to Section 106 of the National Historic Preservation Act. The USACE has delegated lead agency responsibilities for Section 106 to the project proponent, Port of Seattle. This report is intended to partially fulfill the requirements of Section 106 for the Project. Additionally, the upland work of the Project will require compliance with the State Environmental Policy Act (SEPA), which creates a process to understand the impacts to the environment, including cultural resources, that result from decisions made by Washington State (Revised Code of Washington [RCW] 197-11). Compliance with the Port's best practices policies, as well as RCW 27.44 (Indian Graves and Records) and RCW 27.53 (Archaeological Sites and Resources) is required.

HRA completed archival research on the area of potential effects (APE) and vicinity, developed a cultural and environmental context, and developed an expectation for archaeological materials. HRA's archaeologist visited the site on June 6, 2020, to assess any potential archaeological resources within the APE. The archaeologist observed a historic-period wooden structure and recorded it as archaeological site HRA-3306.01-1; the site is recommended not eligible for listing in the National Register of Historic Places (NRHP). HRA recommends a Monitoring and Inadvertent Discovery Plan (MIDP) be developed and followed during the removal of pavement in the vicinity of the railroad grade along the west side of Pier 90. The MIDP will include protocols for the treatment of any features (ties or rails) related to the railroad if they are found.

HRA identified two architectural resources within the project area: Pier 90 and the Pier 90 Railroad Spur. Due to extensive alterations, HRA recommends these two resources not eligible for listing in the NRHP due to an irretrievable loss of integrity.

No other cultural resource study for the rest of the project is recommended at this time. HRA recommends a finding of *no effect to historic properties* for the project, as no historic properties appear to be present.

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1. Introduction

EA Engineering Science and Technology, Inc. (EA), and the Port of Seattle (Port) contracted with Historical Research Associates, Inc. (HRA), to provide cultural resources support for the proposed Terminal 91 Berths 6 and 8 Redevelopment Project (Project) located within Smith Cove, Seattle, Washington. The project is located in Township 25 North, Range 3 East, Section 26, Willamette Meridian, U.S. Geological Survey (USGS) Shilshole Bay quadrangle topographic maps (Figure 1-1).

1.1 Project Description

Berths 6 and 8 are the last remaining original timber pier structures at Terminal 91 and are at the end of their service life. Approximately 30 percent of the apron is currently condemned, and the remaining sections are posted with severe load limits. Originally built as one of the Port's first facilities in 1913, this section of the terminal was last rehabilitated in 1985. Redevelopment of Berths 6 and 8 is critical to ensuring the long-term viability of the Port as the home to the North Pacific Fishing Fleet.

The work of this project is limited to replacement of the timber apron portions of Berths 6 and 8 and only modification of terminal elements immediately adjacent to the pier. The proposed improvements to Berths 6 and 8 include:

- Demolition of approximately 62,250 square feet of timber pier and apron structure;
- Demolition of the existing two-story building (ca. 1985) on the timber pier;
- Demolition and replacement of existing high-mast light poles;
- Removal of existing debris on the slope and installation of new slope armoring;
- Relocation of the existing small boat storage and float system;
- Installation of Deep Soil Mixing (DSM) ground improvement;
- Installation of a new sheet pile cut-off wall at the top of the slope;
- Construction of a new wharf structure including concrete piles, cast-in-place concrete pile caps, precast concrete deck, bull rail, fendering system, isolation joint with the existing apron structure to remain, bollards, and utility vaults;
- Electrical distribution to the pier, outlets, lighting and equipment, and communications conduit;
- On-pier water service connections;
- Stormwater conveyance, treatment, and discharge to existing outfall locations;
- Asphalt paving over concrete pier deck and upland area; and
- Relocation of existing upland modular building structures and associated utility connections.

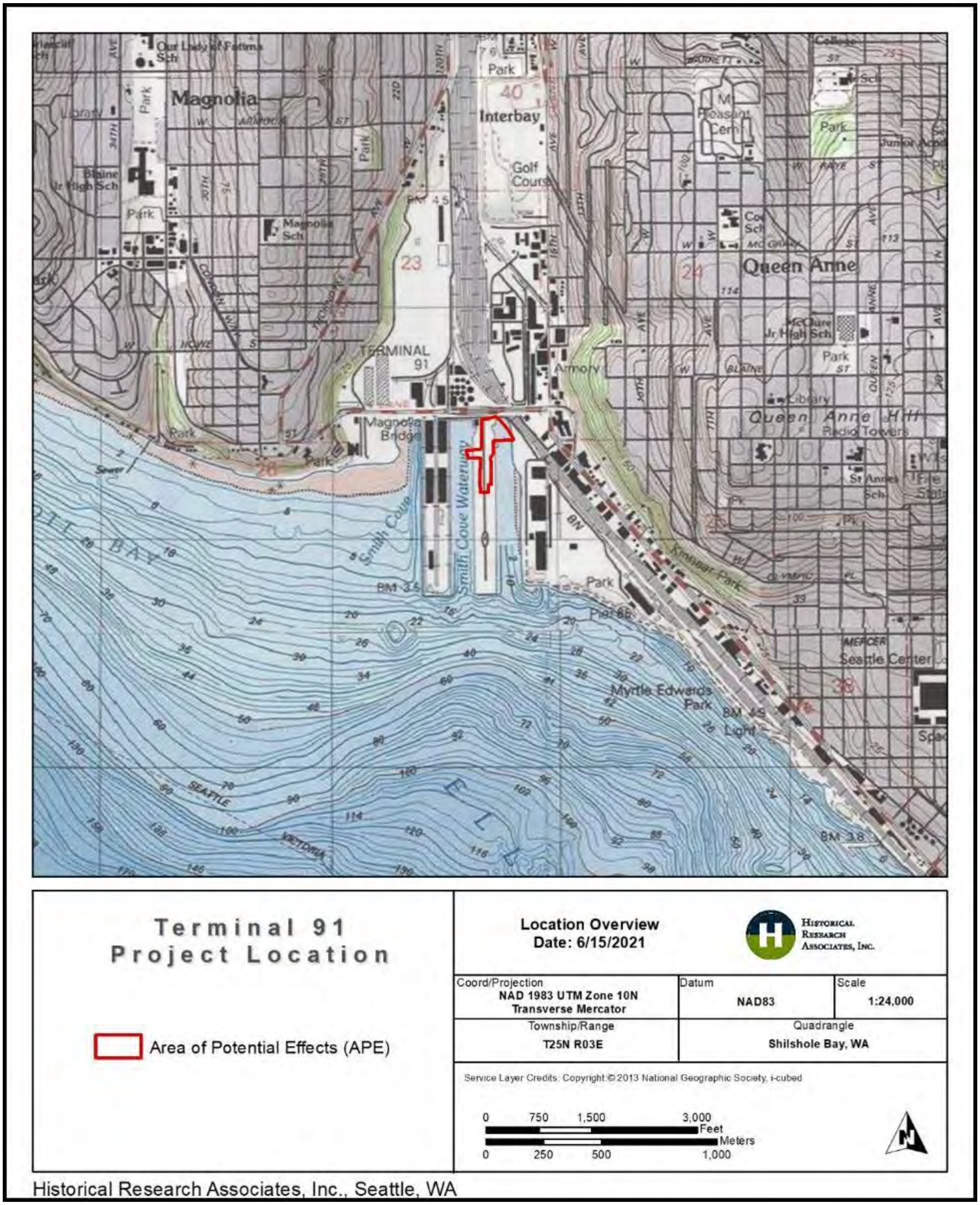

Figure 1-1. Project location.

1.2 Regulatory Context

The in-water work of the Project requires a U.S. Army Corps of Engineers (USACE) permit, and is subject to Section 106 of the National Historic Preservation Act. The USACE has delegated lead agency responsibilities for Section 106 to the project proponent, Port of Seattle. This report is intended to partially fulfill the requirements of Section 106 for the Project.

Additionally, the upland work of the Project will require compliance with the State Environmental Policy Act (SEPA), which creates a process to understand the impacts to the environment, including cultural resources, that result from decisions made by Washington State (Revised Code of Washington [RCW] 197-11). Compliance with the Port's best practices policies, as well as RCW 27.44 (Indian Graves and Records) and RCW 27.53 (Archaeological Sites and Resources) is required.

1.3 Area of Potential Effects

For the purposes of this study, HRA has proposed an area of potential effects (APE) that encompasses the project footprint, including the area around Berths 6 and 8 on Pier 90, as well as places where in-water work such as dredging will occur (Figure 1-2).

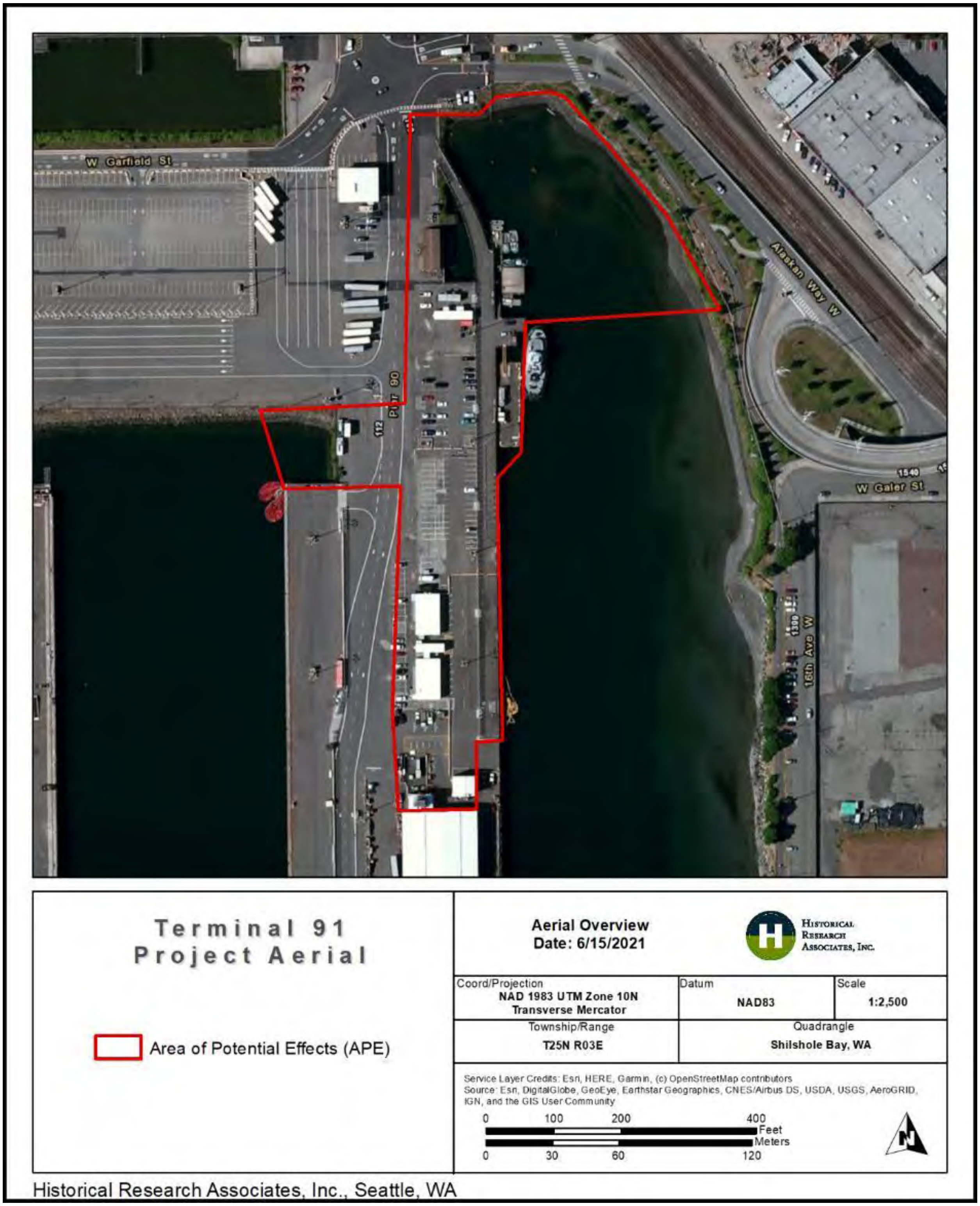

Figure 1-2. Aerial overview of area of potential effects (APE).

2. Background Research

2.1 Research Methods

HRA Archaeologist Brian Durkin, MS, conducted background research for the Project using a research radius of 0.25 mile (mi). Durkin searched the Washington Department of Archaeology and Historic Preservation (DAHP) online database (Washington Information System for Architectural and Archaeological Records [WISAARD]) for previous cultural resources studies, archaeological site records, cemetery records, and historic properties listed in the National Register of Historic Places (NRHP) or the Washington Heritage Register (WHR) within the research radius. He also reviewed the statewide predictive model layer on WISAARD for probability estimates for archaeological resources within the research radius.

Durkin searched HRA's in-house library for information on the environmental, archaeological, and historical context of the APE and vicinity. He reviewed ethnographic sources (e.g., Hilbert et al. 2001) for information regarding place names, burials, and land-use practices. He also reviewed historic-period plats from the U.S. Surveyor General's (USSG) General Land Office (GLO) for the presence of structures and features that might be extant within the APE, as well as indicators of potential archaeological sites and past land-use patterns. Durkin consulted other online historic-period map archives to determine the history of land use in the APE.

HRA Architectural Historian Lauren Waldroop, MHP, conducted additional archival research, reviewing HRA's in-house library, previously conducted cultural resources surveys, King County assessor records, the WISAARD and Seattle Landmarks databases, and additional online sources, including local histories, newspaper archives, and historical maps and aerials. In preparation for field survey, HRA identified architectural resources within the APE constructed in 1976 or earlier (i.e., resources 45 years or older) as these resources might reach the 50-year age threshold for NRHP eligibility before the project is completed.

2.2 Research Results

2.2.1 Previous Cultural Resources Studies

Ten previous cultural resources studies have been completed within 0.25 mi of the APE (Table 2-1). Three cultural resources studies have been conducted within the APE, all of which relate to Pier 91. Two of these were cultural context overviews of Pier 91, did not involve survey, and only provided cultural contexts of the pier (Abbot and Larson 1984; Windward 2017). In 2006, BOLA completed a historic property inventory for a cruise terminal relocation project at Pier 91; the architectural survey recorded several buildings north of the current APE (BOLA 2006).

The submerged area around Pier 91 has been previously surveyed for cultural resources. In 2011, USACE completed an underwater archaeological survey within Smith Cove adjacent to Pier 91 as part of a munitions cleanup project in the cove; USACE recorded archaeological site 45KI1033 that consists of those munitions (Kanaby 2011a). A cultural resources study was also completed for a berth dredging project on the west side of Pier 91. The study relied on archival research and recent geotechnical probe data to recommend monitoring during dredging operations (Hodges 2007a).

During monitoring, modern cultural materials were observed and the sediments overall appeared to be previously disturbed by dredging activities (Hodges 2007b, 2007c).

Other studies within 0.25 mi of the APE but not related to Pier 91 include archaeological monitoring during the construction of the South Magnolia Combined Sewer Overflow facility and resulted in recording historic-period archaeological site 45KI1200 (Valentino et al. 2015). Another study was completed along the existing railroad less than 0.1 mi north of the APE, and no cultural resources were identified near the existing APE. Another study was completed for a telecommunication tower 0.1 mi east of the APE and recorded two historic properties (Askin 2013).

Table 2-1. Previous Cultural Resources Studies within 0.25 mi of the APE.

Reference	**NADB**	**Title**	**Distance and Direction from APE**	**Archaeological Materials Identified Within the APE**
Abbot and Larson 1984	1330257	*Archaeological And Historical Cultural Resources Survey of the Pier 90 and 91 Terminals at Smith Cove*	Within	None
Juell 2006	1348189	*Archaeological Site Assessment of Sound Transit's Sounder: Everett to Seattle Commuter Rail System, King and Snohomish Counties*	< 0.1 mi east	None
BOLA 2006	1349423	*Port of Seattle Terminal 30 Pier 91 DEIS: Historic and Cultural Resource*	Within	None
Hodges 2007a	1349406	*Technical Memorandum: Archaeological Resources Assessment for the Proposed Pier 91 Berth Dredging, Smith Cove*	0.1 mi west	None
Hodges 2007b	1349570	*Letter to Jason Jordan Regarding Results of Archaeological Fieldwork, Pier 91 Berth Dredging, Seattle*	0.1 mi west	None
Hodges 2007c	1349894	*Results of Archaeological Fieldwork, Berth M Apron Replacement, Seattle*	0.1 mi west	None
Kanaby 2011a	1681295	*Cultural Resources Survey for Pier 90 and 91 Munitions Response Project, Seattle, Washington*	Within	None
Valentino et al. 2016	1687901	*South Magnolia CSO Project, Seattle, King County, Washington: Results of Data Recovery at 45-KI-1200.*	0.25 mi west	None
Askin 2013	1683681	*Historic Properties Survey of Farwest Liquidation Site Telecom Installation 1461-1465 Elliott Ave W, Seattle*	0.1 mi east	None
Windward 2017	-	*T-91 Historical Review Report*	Within	None

2.2.2 Previously Recorded Archaeological Sites

Two previously recorded archaeological sites are located within 0.25 mi of the APE, none of which are located within the APE. Archaeological site 45KI1033, located within the water adjacent to the APE, is a submerged historic-period debris scatter consisting of munitions associated with the previous use of Pier 91 as a naval supply depot. The site was recorded as part of the USACE Munitions Response Project for Pier 90 and 91 and consisted of a total of 224 pieces of military debris and discarded military munitions located on the seafloor surrounding Pier 91. The cultural materials were associated with the U.S Navy's supply depot at this location during World War II to 1976 (Kanaby 2011b). No determination has been made on the site's eligibility for listing in the NRHP.

The second archaeological site is 45KI1200, located 0.25 mi west of the APE. This historic-period debris scatter and associated structures were recorded in 2014 during the South Magnolia CSO Storage Tank Project. The cultural materials from the site are associated with a "low-income, multi-ethnic community that occupied the Smith Cove tide flats between approximately 1911 and 1942" (Valentino 2015:B-4). The artifacts recorded within the site include glass bottles, ceramics, leather shoes, furniture fragments and construction materials with a total of 2,600 total artifacts. No determination has been made on the site's eligibility for listing in the NRHP.

2.2.3 Previously Recorded Architectural Resources

Fifty-three previously recorded architectural resources are located within 0.25 mi of the APE. Five of these resources have been determined eligible for listing in the NRHP, and four have been determined not eligible for listing in the NRHP (Table 2-2). The Seattle Landmarks list notes the Admiral's House, which was listed in the NHRP in 2013, is located approximately 0.35 mi west of the APE. No Seattle Landmarks are located within the APE.

According to WISAARD, one recorded but unevaluated resource is located within the APE, the Texas Company Oil Pump House addressed as 2001 W Garfield St. However, this appears to be an error, as the location of the Texas Company Oil Pump House (DAHP ID 87108) is actually north of the APE at 2001 W Garfield Street. Therefore, no previously recorded architectural resources are located within the APE.

Table 2-2. Previously Recorded Architectural Resources within 0.25 mi of the APE.

Address or Location	Name	Date of Construction	NRHP Listing Status	DAHP ID
1461 Elliott Ave. W, Seattle, WA 98119	American Cracker Company	ca. 1937	Determined not eligible	670591
2001 W Garfield St., Seattle, WA 98119	Texas Co. Casket Drum/Oil Warehouse	1925	Recommended eligible, no determination	42455
1435 Elliott Ave. W, Seattle, WA 98119	Bell'Occhio Home	ca. 1934	No determination	337240
1415 W Garfield St., Seattle, WA 98119	Interbay Post Office	ca. 1940	No determination	337253

Table 2-2. Previously Recorded Architectural Resources within 0.25 mi of the APE.

Address or Location	Name	Date of Construction	NRHP Listing Status	DAHP ID
1460 Elliott Ave. W, Seattle, WA 98119	Commercial Building	ca. 1969	No determination	337703
1515 15th Ave. W, Seattle, WA 98119	Turner & Pease Warehouse	ca. 1946	No determination	342486
1465 Elliott Ave. W, Seattle, WA 98119	—	1937	Determined not eligible	209430
1805 15th Ave. W, Seattle, WA 98119	Warehouse	ca. 1947	No determination	342147
1405 Elliott Ave. W, Seattle, WA 98119	Williams & Company Building*	ca. 1932	No determination	43269
1524 and 1526 Elliott Ave. W, N and adjacent to 1516 15th Ave. W, Seattle, WA 98119	Fool's Gold Tavern	ca. 1935	No determination	43272
16th Ave. W, Pier 70, Seattle, WA 98119	Elliott Bay Park	ca. 1975	No determination	45511
1408 Van Buren Ave. W, Seattle, WA 98119	—	—	Determined not eligible	86544
2001 W Garfield St., Seattle, WA 98199	U.S. Navy - Building 40	1942	No determination	87103
1523 W Garfield St., Seattle, WA 98119	King County Metro Pumping Station	ca. 1967	No determination	87104
2001 W Garfield St., Seattle, WA 98119	—	ca. 1942	No determination	87105
1819 15th Ave. W, Seattle, WA 98119	—	ca. 1925	No determination	87106
1617 15th Ave. W, Seattle, WA 98119	Evergreen Trailways Bus Service Garage	ca. 1956	No determination	87107
2001 W Garfield St., Seattle, WA 98199	Texas Company Oil Pump House	ca. 1929	No determination	87108***
2201 W Garfield St., Seattle, WA 98199	Texas Company Warehouse	ca. 1929	No determination	87109
2001 W Garfield St., Seattle, WA 98199	—	ca. 1940	No determination	87112
2001 W Garfield St., Seattle, WA 98199	—	ca. 1930	No determination	87113

Table 2-2. Previously Recorded Architectural Resources within 0.25 mi of the APE.

Address or Location	Name	Date of Construction	NRHP Listing Status	DAHP ID
2001 W Garfield St., Seattle, WA 98121	Texas Company Garage	ca. 1925	No determination	87115
1280 16th Ave. W, Seattle, WA 98119	ID Building Company	ca. 1965	No determination	87117
1450–1461 Elliott Ave. W, Seattle, WA 98119	Western Pacific Chemical Company Building	1930	Determined eligible	43271/38508/ 47791**
1634 15th Ave. W, Seattle, WA 98119	Davidsen Furniture Manufacturing Company	ca. 1912	Determined not eligible	38476/47788**
1123a Elliott Ave. W, Seattle, WA 98119	Ace Tank and Equipment Company	1945	Determined eligible	38477
1123b Elliott Ave. W, Seattle, WA 98119	Ace Tank and Equipment Company	1945	Determined eligible	38501
1123c Elliott Ave. W, Seattle, WA 98119	Ace Tank and Equipment Company	1945	Determined eligible	38502
1641a 15th Ave. W, Seattle, WA 98119	Auto Wrecking Garage	1917	Determined eligible	38519
1403 W Howe St., Seattle, WA 98119	Telephone Company Garage	ca. 1951	No determination	43706
1405 Elliott Ave. W, Seattle, WA 98119	Harlan Fairbanks Company	1931	No determination	47794
1400 E Galer St., Seattle, WA 98119	Volunteer Park Horticulture and Grounds Maintenance Facility	1909	No determination	43447
1400 E Galer St., Seattle, WA 98119	Volunteer Park Cottage	1909	No determination	43448
1400 E Galer St., Seattle, WA 98119	Volunteer Park Conservatory	1912	No determination	43449
1408 Elliott Ave. W, Seattle, WA 98119	Commercial Building	ca. 1938	No determination	720114
1154 Elliott Ave. W, Seattle, WA 98119	Commercial Building	ca. 1969	No determination	720115
1501 W Garfield St., Seattle, WA 98119	Elliott Plaza	ca. 1978	No determination	720117
1523 15th Ave. W, Seattle, WA 98119	Elliott Plaza	ca. 1978	No determination	720118
1400 Elliott Ave. W, Seattle, WA 98119	Eidem Plywood & Lumber	ca. 1952	No determination	720120

Table 2-2. Previously Recorded Architectural Resources within 0.25 mi of the APE.

Address or Location	Name	Date of Construction	NRHP Listing Status	DAHP ID
1401 W Garfield St., Seattle, WA 98119	Fenton Steel Works	ca. 1935	No determination	720123
1516 15th Ave. W, Seattle, WA 98119	Builder's Hardware & Supply Company	ca. 1931	No determination	720125
1501 Elliott Ave. W, Seattle, WA 98119	Gas Station	ca. 1958	No determination	720149
1617 15th Ave. W, Seattle, WA 98119	Service Garage	ca. 1956	No determination	720151
1419 Elliott Ave. W, Seattle, WA 98119	Warehouse	ca. 1979	No determination	720159
1425 Elliott Ave. W, Seattle, WA 98119	Commercial Building	ca. 1941	No determination	720163
1532 15th Ave. W, Seattle, WA 98119	Lighthouse Uniforms Store	ca. 1956	No determination	720169
1445 Elliott Ave. W, Seattle, WA 98119	Commercial Building	ca. 1940	No determination	720232
1418 Elliott Ave. W, Seattle, WA 98119	Commercial Building	ca. 1972	No determination	720249
1414 Elliott Ave. W, Seattle, WA 98119	Commercial Building	ca. 1969	No determination	720250
Near W Garfield St., Seattle, WA 98119	Interbay Rail Yard Footbridge	ca. 1968	No determination	721367
1524 15th Ave. W, Seattle, WA 98119	L&R Investors	ca. 1934	No determination	337296
1470 Elliott Ave. W, Seattle, WA 98119	Commercial Building	ca. 1906	No determination	720126
S Lander St., Seattle, WA 98134	Seattle & Walla Walla Railroad/Puget Sound Shore Railroad Company/Seattle, Lake Shore & Eastern Railroad/Northern Pacific Railway Black River Junction to the Lake Washington Ship Canal	1876	No determination	708606
Adjacent to Alaskan Way W, Seattle, WA 98119	Seattle & Montana Railway/Great Northern Railway Seattle to Everett Mainline Milepost 0 to 4.9	1890	No determination	720984

* Building has been demolished.
** Building was recorded under multiple DAHP IDs.
*** Building is misplotted in WISAARD.

2.2.4 Cemeteries

There are no cemeteries within 0.25 mi of the APE.

2.2.5 Historic-Period Maps and Aerial Photographs

The Seattle waterfront, including the APE, has been depicted on numerous historic period maps related to the development of Seattle and Smith Cove (Appendix A; Table 2-3). Government surveys expeditions and nautical charts of Elliott Bay and Smith Cove provide the earliest detailed depiction of the APE and show the transition from an unoccupied tidal flat to heavily developed modern terminal. An 1854 H-Sheet, mapping what is now Elliott Bay and Smith Cove, depicts the cove as an undeveloped tidal flat with a single house located along the shoreline (U.S. Coast and Geodetic Survey 1854). Based on the 1855 and 1863 GLO plat, the shoreline of Smith Cove was part of E.M. Smither's homestead (USSG 1855, 1863). The 1899 and 1901 T-sheets of Elliott Bay, which include the APE, depict the tide flats but also railroads running along the shoreline, a single railroad track extending into the cove near the APE, and two piers extending from the tide flats into Elliott Bay east of the APE. The map indicates a single railroad supplied a coal bunker and the piers were associated with the Great Northern Railroad and supplied a grain elevators (U.S. Coast and Geodetic Survey 1899, 1901). The 1894 topographic map of the Seattle quadrangle also depicts these railroads extending out into the cove near the APE (USGS 1894). By the late 1910s the coastal survey maps depict three piers extending out from the tide flats of Smith Cove, the two previously described and a former single track as a pier containing three tracks (U.S. Coast and Geodetic Survey 1917, 1918). The 1949 coastal survey maps depict Smith Cove and the APE in a similar configuration as today, with Pier 90 and 91 with a railroad and multiple buildings (U.S. Coast and Geodetic Survey 1949a, 1949b)

Historic-period King County atlases also provide depictions of features within and in the vicinity of the APE. The earliest depicted development within Smith Cove comes from an 1889 King County Atlas that depicts a single railroad running out into the cove and a railroad running along the eastern shoreline of Elliott Bay (Anderson 1889). The 1907 and 1912 King County Atlases do not provide any information on features within Smith Cove but do indicate the land to the north of the shoreline was owned by E. M. Smithers and the land around Smith Cove was being purchased and developed (Anderson 1907; Kroll 1912). Finally, the 1936 King County Atlas depicts Smith Cove and the APE as substantially more developed, with Pier 90 constructed and referred to as "Port of Seattle Pier A," Pier 91 as "Port of Seattle Pier B," and the Great Northern piers to the east of the APE (Metsker 1936).

Real estate maps, including the Sanborn Fire Insurance Maps, provide a detailed depiction of the APE and vicinity, including the building locations on the pier. At the turn of the century, the development over the tidelands included piers associated with the Great Northern Railway to the east of the APE and extending into Smith Cove (Sanborn 1904–1905). Maps between 1910 and 1918 depict the tidelands continuing to be filled in by development, roads, and the construction of piers (Baist 1912; Bogue 1911; Sanborn 1917). Baist's Real Estate Atlas from 1912 provides the most detail on the APE and vicinity, depicting a spur of the Northern Pacific Railroad running along what is now Pier 90, and Bridge Street, which spanned the waterways within Smith Cove (Baist 1912).

Table 2-3. Historic-Period Maps Depicting the APE.

Map Title	Reference	Description of features depicted within and around the APE
1854 Preliminary Survey of Duwamish Bay W.T.	U.S. Coast and Geodetic Survey 1854	Smith Cove is depicted as tidal flats with a house along the shoreline.
1855 GLO	USSG 1855	Land at northern end of Smith Cove owned by E. M. Smithers, with creek feeding into the cove and a farm to the northeast of the APE.
1863 GLO	USSG 1863	Land at northern end of Smith Cove owned by E. M. Smithers.
1889 Township Plats of King County, Washington Territory - Page 09, Township 25N, Range 3E	Anderson 1889	Land at northern end of Smith Cove owned by E. M. Smithers, with two railroads running into the bay.
1891 Proposed Route of Canal to Connect Lakes Union and Washington with Puget Sound	USACE 1891	Two railroads extending into Smith Cove to the west of the APE.
1894 Seattle Quadrangle	USGS 1894	First time the cove is referred to as Smith Cove. Buildings are depicted around the shoreline of the cove with a railroad extending into the tidal flats.
1897 Seattle, WA Quadrangle	USGS 1897	Railroads running along the shoreline of the cove.
1899 T-Sheet of Seattle Bay and City Washington	U.S. Coast and Geodetic Survey 1899	Railroad extending into the cove with two piers to the east of the APE.
1901 Seattle Harbor Washington	U.S. Coast and Geodetic Survey 1901	Railroad extending into the cove with two piers to the east of the APE.
1905 Sanborn Fire Insurance Map	Sanborn 1904–1905	No development within the APE but piers associated with the Great Northern Railway are to the east of the APE.
1907 Anderson Map Co's King Co. Atlas - Page 07, Township 25N, Range 3E	Anderson 1907	Landowners around Smith Cove still include E. M. Smithers.
1909 Seattle, WA Quadrangle	USGS 1909	No railroads extending into Smith Cove with Great Northern railway pier to the east.
1911 Municipal Plans Commission of the City of Seattle map showing Central Waterfront District, a portion of Smith's Cove-West Point District and Railroad Avenue	Bogue 1911	The pier is depicted with no buildings.

Table 2-3. Historic-Period Maps Depicting the APE.

Map Title	**Reference**	**Description of features depicted within and around the APE**
1912 Baist's Real Estate Atlas	Baist 1912	The pier is depicted with a railroad extending to the end of it, but no buildings are on the pier.
Kroll's Atlas of King County, 1912 - Page 07, Township 25N, Range 3E	Kroll 1912	Smith Cove with no development within cove; E. M. Smithers land claim is depicted to the north of the APE.
1917 Sanborn fire Insurance Map	Sanborn 1917	Within the APE is the pier and railroad with trestles extending on the east and west side of the pier. A restaurant is located on the pier within the APE.
1917 Smith Cove and Vicinity, King County, WA	U.S. Coast and Geodetic Survey 1917	Within the APE is the pier and railroad with a trestle extending on the west side of the pier. A shipwreck is depicted southwest of the APE.
1918 Seattle Harbor	U.S. Coast and Geodetic Survey 1918	Within the APE is the pier and railroad with trestles extending on the east and west side of the pier. A shipwreck is depicted southwest of the APE.
1930 Sanborn Fire Insurance Map	Sanborn 1930	Pier is referred to as "Pier 40," with trestles farther south and fewer buildings on the pier than those identified in this 2021 survey.
Township 25 N., Range 3 E., Seattle - Northwest, Fort Lawton, Interbay, Ballard	Metsker 1936	The pier is labeled "Port of Seattle Pier A" with the Port of Seattle Pier B to the west and the Great Northern docks to the east.
1937 King County Aerial Survey	King County 1937	Depicts the pier in a similar configuration to the 1917 Sanborn, with small buildings or storage on the pier.
1942 Sanborn Fire Insurance Map	Sanborn 1942	The pier is in a similar configuration as the modern pier, with the trestles on the east and west side of the pier and a large warehouse on the pier and within the APE.
1949 Lake Washington Ship Canal	U.S. Coast and Geodetic Survey 1949a	The pier labeled "Pier 90" is in a similar configuration as the modern pier with railroad trestles and buildings covering the majority of the pier.

Table 2-3. Historic-Period Maps Depicting the APE.

Map Title	Reference	Description of features depicted within and around the APE
1949 Seattle to Bremerton	U.S. Coast and Geodetic Survey 1949b	"Pier 90" is in a similar configuration as the modern pier with railroad trestles and buildings covering the majority of the pier.
1949 Shilshole Bay Quadrangle	USGS 1949	The pier is labeled "Pier 40" and has a railroad and buildings covering the pier.
1968 Aerial Photograph	USGS 1968	Navy Ships along the pier with trestles present on east and west side and large warehouses covering the majority of the pier.
1977 Aerial Photograph	USGS 1977	The pier has fewer buildings, the trestles are present, and the surface of the pier appears to be paved.

2.2.6 DAHP Predictive Model

The DAHP predictive model for archaeological sites is based on statewide information, using large-scale factors. Information on geology, soils, site types, landforms, and from GLO maps was used to establish or predict probabilities for archaeological resources throughout the state. The DAHP model uses five categories of prediction: Low Risk, Moderately Low Risk, Moderate Risk, High Risk, and Very High Risk. The DAHP predictive model map indicates a very high risk of encountering an archaeological deposit within the APE.

3. Environmental Context

3.1 Topography and Geology

The APE is located within the Southern Puget Sound Basin, a portion of the Puget Trough Physiographic Province (Franklin and Dyrness 1973). The north–south trough of the Puget Lowland separates the Olympic Mountains to the west from the Cascade Range on the east. The lowland was carved out during the last major glaciation of western Washington which ended approximately 16,000 years before present (B.P.) (Alt and Hyndman 1995; Booth et al. 2005; Dethier et al. 1995; Easterbrook and Rahm 1970:49; Galster and Laprade 1991:249). Subduction of tectonic plates and processes of coastal uplift provided a back and forth effect that raised the Coastal Range, which includes the Olympic Mountains, and lowered the interior areas, forming the Puget Lowland or Puget Trough. Glacial activity, and the resulting floods when the glaciers melted, caused the area to be scoured and carved (Orr and Orr 2002:263). This resulted in the formation of north–south trending ridges interspersed with drainages in the Puget Sound area (Porter and Swanson 1998). Glacial outwash materials accumulated in thick layers atop older bedrock. Human occupation could have occurred in the project area after the retreat of the glaciers, by approximately 14,000 years ago.

The surface geology of the APE is described as Tidal Flat Deposit (Qft). The deposit is part of the Fraser glaciation during the Pleistocene. The deposit is described as a "silt, sand, organic sediments and detritus, with some shells" (Booth et al. 2005:1). Based on the historic-period context, the seafloor within the APE has been heavily disturbed by historic-period and modern dredging activities.

3.2 Climate and Vegetation

Between approximately 13,000 and 12,000 years ago, the region had developed a much cooler and drier climate, which supported an ecosystem characterized by lodgepole pine (*Pinus contorta*), sedges (*Cyperaceae* sp.), sage (*Artemisia*), and a variety of grasses and herbs. After 12,000 years ago, the climate warmed while continuing to dry, and Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and red alder (*Alnus rubra*) joined the developing parkland forest. By around 6,000 years ago, the climate of the region had cooled and moistened to levels comparable to today's maritime regime, producing the current western hemlock (*Tsuga heterophylla*) vegetation zone. Presently, uplands are moderately to heavily forested with Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western red cedar (*Thuja plicata*). Red alder (*Alnus rubra*) and big-leaf maple (*Acer macrophyllum*) represent secondary species in forested habitats and are dominant in disturbed areas (Barnosky 1984; Barnosky et al. 1987; Brubaker 1991; Whitlock 1992).

3.3 Fauna

Migratory elk and deer were important mammalian resources for the inhabitants of the project area vicinity. Smaller land and riverine mammals, utilized by the inhabitants of the vicinity of the proposed APE, would have included snowshoe hare (*Lepus americanus*), porcupine (*Erethizon dorsatum*), beaver (*Castor canadensis*), and river otter (*Lutra candensis*) (Kruckeberg 1991; Larrison 1967). Sea mammals, including harbor seals (*Phoca vitulina*), northern elephant seals (*Mirounga angustirostris*), humpback whale (*Megaptera novaeangliae*), and gray whale (*Euchrichius glaucus*), would have also provided valuable material for food and tools (i.e., bone tools, seal fur, and whale blubber). The burrowing bivalves, butter clam (*Saxidomus giganteus*), horse clam (*Schizothaerus nutallii*), and littleneck clam (*Protothaca staminea*), were all collected from gravelly to sandier beaches; so too were bay mussel (*Mytilus edulis*), and basket cockle (*Clinocardium nuttallii*). Many more invertebrate species, including crabs, sea urchins, and barnacles, were also collected (Suttles and Lane 1990; Wessen 1990).

Perhaps the most important class of food resource to Native peoples in the area would be the anadromous fish that seasonally migrated up the rivers in the vicinity of the proposed APE. Today, these rivers support spring and summer–fall runs of Chinook (*Oncorhynchus tschawytscha*), Coho (*O. kisutch*), "odd-year" pink (*O. gorbushcha*), and chum (*O. keta*) salmon (Williams et al. 1975:18–401).

4. Cultural Context

The precontact, ethnohistoric, and historic-period context has generally been established for King County by Kopperl and colleagues (2016) for the precontact period and Boswell (2017) for the historic-period context. The following context briefly summarizes these contexts, as well as provides an ethnohistoric context for the intervening years.

4.1 Precontact Context

Evidence for late Pleistocene occupation of western North America comes from a small number of archaeological sites. Excavations at the Bear Creek Site obtained a radiocarbon date of 10,780 ± 60 radiocarbon years B.P. associated with occupational strata (Kopperl et al. 2015:117). This site contained a diverse stone tool kit including unfluted concave base points. The site has been interpreted as a short-term occupation site and has yielded evidence of mammal, fish, and plant exploitation (Kopperl et al. 2010). The Bear Creek Sites demonstrate the implementation of diverse tool kits and subsistence strategies, indicating their occupants' working knowledge of the landscapes and available resources.

The Early to Middle Holocene has often been seen as an enigmatic period in the archaeological record of the Pacific Northwest (e.g., Ames and Maschner 1999; Butler 1961) probably in part due to how sea level rise has obscured sites (Elder et al. 2014). Culture historians classified assemblages from sites dating to this period under a number of regionally specific titles (e.g., Old Cordilleran [Butler 1961] or Olcott [Kidd 1964]). Ames and Maschner's (1999) Archaic period covers the time period from the late-Pleistocene to about 6500 B.P. and provides the broadest frame of reference for trends in land use and lifeways in the Pacific Northwest. In essence, current research suggests that people hunted game and lived in small highly mobile egalitarian groups, as foragers (*sensu* Binford 1980). Microblades and leaf shaped projectile points have been used to argue for Archaic period occupation across Washington (e.g., Chatters et al. 2011; Greengo and Houston 1965). Identifiable faunal remains are rare at Archaic period sites, making inferences about subsistence difficult, but mammal and fish remains have been reported from Archaic period sites in the Puget Sound region (Chatters et al. 2011; Stilson and Chatters 1981).

The middle and late Holocene in the Puget Sound is characterized by an increasing number of archaeological sites (Kopperl et al. 2015, 2016; Larson and Lewarch 1995; Wessen 1988). From the perspective of the archaeological record, marine resources become more heavily used and groups appear in increasingly larger settlements for longer periods of time. Larson and Lewarch's (1995) excavations at West Point illustrate the cultural sequence during this middle and late Holocene. The site function is not static, but we see a shift from a base camp to a resource extraction location over the approximately 5,000-year period this location was in use. The presence of personal adornment items in earlier deposits may indicate differentiation in status within groups. Certainly, by the late-Holocene, status differentiation and complex social hierarchies are developed in the region (Ames and Maschner 1999). Increased reliance on stored foods and controlled access to resources also develop during the later Holocene. Salmon harvesting, berry processing, and even shellfish gathering require a great deal of well-developed social organization to implement on the scale of what is observed through the archaeological record (e.g., Duwamish No. 1 [Campbell 1981]).

During the latest Holocene, the general ethnographic pattern appears to have developed (Ames and Maschner 1999). Although this "pattern" is thought to have been somewhat modified by the appearance of Euroamerican goods and practices, it was one of resource intensification (e.g., salmon mass capture and storage), collector-like settlement patterns with winter village occupation, and complex social organization.

4.2 Ethnohistoric Context

The APE is in the traditional territory of the Duwamish Indians who are considered members of the Puget Sound Coast Salish culture. Peoples moving through the project area spoke various dialects of the Coast Salish Lushootseed language. Characteristic of the groups within the Coast Salish culture were seasonal settlement patterns, economies based on salmon as a staple, and a stratified society (Suttles and Lane 1990). The Cilcol-a'bc, a Duwamish band whose name means "dwellers of Shilshole," lived along the shores of what is now referred to as Salmon Bay, located approximately 2 mi from the APE (Hilbert et al 2001:46).

Ethnographic studies place the Duwamish within the Puget Sound Coast Salish culture. The people utilizing the area within the APE spoke various dialects of the Coast Salish Lushootseed language. Characteristic of the groups within the Coast Salish culture were seasonal settlement patterns, economies based on salmon as a staple, and a stratified society (Miss and Campbell 1991).

Coast Salish groups made use of a variety of environments and resources located along the coastline, waterways, and upland areas (Haeberlin and Gunther 1930). These groups of people typically maintained a permanent winter residence and then became more mobile during the spring, summer, and fall months. During the winter, Coast Salish (including the Duwamish) lived in permanent villages located close to a major source of water (e.g., the sea or a lake). Winter villages varied in size from a single, large potlach house to up to 10 large houses (Haeberlin and Gunther 1930; Kopperl et al. 2016; Suttles and Lane 1990). Several families would occupy each house, storing their belongings and dried food in a specific section of the house. Families often used houses for many years and passed them down from father to son (Haeberlin and Gunther 1930).

Coast Salish groups oriented settlement and subsistence systems toward saltwater, riverine, and inland environments in their territories (Haeberlin and Gunther 1930). Over the winter, Coast Salish groups including the Duwamish inhabited permanent villages, usually located close to a major source of water (i.e., the sea or lakeshore). Winter villages consisted of one or more cedar plank longhouses in which as many as eight families resided (Haeberlin and Gunther 1930; Suttles and Lane 1990).

Several ethnographically recorded place names and villages are located in the vicinity of the APE. Lushootseed orthography is used unless specifically stated. The nearest village site is known as šilšul, which translates to "threading or inserting something" and is located on Salmon Bay (Hilbert et al. 2001:58). A boulder now known as Four Mile Rock, at the foot of the Magnolia Bluff, is known as c̓əƛ̓əʔ, which translates to rock and is approximately 1.5 mi to the west of the APE. Another place is the small creek near Fort Lawton is known as Tlo'xwatL-qo (Watermann Orthography), which translates to "land otter water" (Hilbert et al. 2001:63). The closest place name is for the creek that drains into Smith Cove, which is known as sʔiləqʷucid, that translates to "talking: mouth of the edge of water" (Hilbert et al. 2001:63).

The Euroamerican influence was felt long before most Native groups met incoming settlers to the Pacific Northwest. Many populations were decimated by a series of smallpox epidemics, only one of several European diseases that traveled long distances without the aid of direct Native American/Euroamerican contact (Newcombe 1923; Ramenofsky 1987; Suttles and Lane 1990).

4.3 Historic-Period Context

European visitation to the Puget Sound region began when Spanish seafarers under the command of Lieutenant Francisco Eliza mapped much of what would become known as the San Juan Islands in 1790. In 1792, British explorer George Vancouver guided his crew through the waters of the Puget Sound, where they named many local features of land and water including the sound itself. England's Hudson's Bay Company followed in 1824, followed by American naval lieutenant Charles Wilkes in 1841. The U.S. and British governments feuded over control of the present-day northwestern United States, and in 1846 they settled on the 49th parallel as the international boundary. In 1848, President James Polk signed the act that created Oregon Territory, which included present-day Washington State. The Donation Land Claim (DLC) Act of 1850 drew settlers to lands that the Duwamish people and their neighbors had traditionally occupied. As a result of exploration and Euroamerican settlement, the native population plummeted due to repeated outbreaks of introduced diseases such as smallpox, influenza, and typhoid fever (Bagley 1916; Suttles and Lane 1990:485–502).

In 1853, Washington Territory was carved from the northern half of Oregon Territory. In 1855, members of the Duwamish and neighboring Puget Sound tribes signed the Treaty of Point Elliott, which provided for the removal of tribal members to reservations. Some Duwamish people, however, continued to live in and around Seattle, working for and trading with incoming settlers (Ruby and Brown 1992).

In 1873, the Northern Pacific Railroad (NPRR) chose Tacoma, south of Seattle, as the western terminus for its new transcontinental rail line, setting up what would become a long-time rivalry between Tacoma and Seattle (MacIntosh 1999). Seattle citizens responded by launching new railroad projects of their own to increase Seattle's trade. The Seattle & Walla Walla Railroad and Transportation Company, launched in 1874, was expected to reach across the Cascade Mountains as a transcontinental line (City of Seattle 1880).

The railway company built new wharves and coal bunkers at Elliott Bay, completed a wooden trestle over the tideflats, and built rail first to Renton in 1877 and then to Newcastle in 1878, giving the region's industrialists access to nearby coalfields. Within a few years, Seattle was shipping coal to San Francisco by steamer (Ochsner and Anderson 2003:18).

In 1881, as Seattle's business community grew restless for a transcontinental route from Seattle, Henry Villard, owner of the Oregon Transportation Company, bought the Seattle & Walla Walla and christened it the Columbia & Puget Sound Railway Company. He then constructed a spur line to NPRR railroad tracks south of Seattle. Villard built the city's first rail depot on King St. and enlarged the coal bunkers at the wharf. In response to the growing number of rail lines heading in and out of Seattle, the city established Railroad Ave. along the waterfront and provided equal access to all railways. (SWCA Environmental Consultants 2015).

Seattle's industrial base grew throughout the 1880s. Numerous new companies increased exports of lumber, coal, fish, and wheat, developing Seattle's active shipping port (Bagley 1916:115). To increase ease of transportation over Seattle's hilly topography, laborers, including Chinese workers, took on early grading projects, restructuring the city's grid and moving earth to the tide flats or to the city's wharves (SWCA Environmental Consultants 2015:19). Smith Cove began to be filled in in 1894, and would continue to be filled through 1936 (Windward 2017:7)

After Seattle's Great Fire, the City's commercial and government leaders took the opportunity to update the city's infrastructure, establish building codes, and redesign its downtown. The city also founded a permanent fire department and implemented a building inspection program (Ochsner and Andersen 2003:58). To protect against future fires, Seattle's citizens also supported a government plan to establish a city water system bringing fresh water from the Cedar River (Phelps 1978:16–18).

In 1913, the Port of Seattle acquired property at the south end of Smith Cove, which included the APE. The Port constructed piers A and B (now 90 and 91) in 1913 and 1919, respectively, which were used for loading and unloading shipped lumber, steel, coal, and other materials. The area north of West Garfield Street (at the north end of the APE), now known as the Tank Farm Lease Parcel (TFLP), was developed by the Kuhara Trading Company and Proctor & Gamble Company, each constructing aboveground tanks for storing vegetable and fish oils (Windward 2017:9).

During World War I, Seattle businesses benefited from the city's location on a port and its healthy manufacturing industry. Pacific trade and orders for ships and Boeing airplanes helped fuel the local economy, which boomed again throughout the 1920s. During the 1920s, the TFLP transitioned from storing vegetable oils to refining and storing petroleum (Windward 2017:9). A 1930 Sanborn map shows a forge and workshop building, fumigation plant, boat house, oil warehouse, and carpenter building at the north end of Pier 90, six railroad spurs that span the length of the pier, and a U-shaped transit shed at the south end of the pier (Sanborn 1930).

When Japanese fighters attacked Pearl Harbor on December 7, 1941, the United States entered the second World War, which again revived Washington's economy, boosting production of planes and ships for manufacturers along the Puget Sound. According to one historian, "Seattle ranked as one of the top three cities in the nation in war contracts per capita, and Washington state ranked as one of the top two in the nation for war contracts per capita. Airplane and ship contracts in 1943–1944 were valued at three times the total of all manufacturing in the state in 1939" (Warren 1999).

In 1942, the U.S. Navy acquired Terminal 91 through condemnation and turned it into an active naval station. They renamed the two piers Pier 90 and 91 (Windward 2017:9). The Navy expanded the width of Pier 90 at its north end and constructed the railroad spur within the APE (see Appendix A, Figures A-21 and A-22). The Navy's operations at the station consisted of "extensive naval craft mooring, repair, and deactivation activities" (Windward 2017:10). A 1942 Sanborn map shows the Navy continued to use the U-Shaped transit shed at the south end of Pier 90. Additionally, they demolished the buildings at the north end of the pier, filled and widened the north end of the pier (within the APE), constructed railroad spurs to accommodate the change in pier width, and constructed six large sheds that covered most of the pier (Sanborn 1942). The naval station also had an attack-transport training school, Women Accepted for Volunteer Emergency Service (WAVES) barracks for the civilian female workforce at the station, and the Admiral's House outside the APE . The admiral's House was constructed in 1944 for Admiral S. A. Tavvinder and continued to house the Navy's senior officer in the Puget Sound area until 2006 (Denfeld 2014). The Admiral's House was listed in the NRHP in 2013 under Criteria A and C as "one of the few remaining physical reminders of the importance of Seattle to the World War II effort" and for its embodiment of the Colonial Revival style (Sheridan 2010:8:1). The Navy continued to use Terminal 91 through the Korean War, though operations and activities slowed (Windward 2017:10).

In 1972, the Navy began leasing a portion of Terminal 91 back to the Port of Seattle, and in 1976, deeded approximately 200 acres to the Port (Windward 2017:10). Between 1976 and 1977, the Port demolished all of the transit sheds constructed by the Navy. In 1986, the Port used fill from the Pier 32 area to create the Short Fill area between Piers 90 and 91. It appears Terminal 91 was primarily used at this time for cold storage and maritime services (Windward 2017:11).

Recent tenants on Terminal 91 include City Ice Cold Storage and Distribution and Auto Services, an imported automobile distribution center. In the 2000s, a cruise ship terminal was constructed on Pier 91, which included the construction of several supporting facilities including the terminal building, waiting shelters, and parking areas (Windward 2017:11).

5. Expectation for Archaeological Resources

HRA's expectations for the likelihood of encountering archaeological materials within the APE are based on the background research (Section 2), the environmental context (Section 3), and the cultural context (Section 4). This expectation assists with the development of treatment methods of cultural materials, if they are encountered.

HRA expects a low likelihood of encountering precontact archaeological materials within the APE. Historic-period maps depict the APE within the tidal flats of Smith Cove, and while the archaeological and ethnographic context indicates that people utilized the tidal flats of Smith Cove, the cultural deposits created by those uses have been destroyed by natural (i.e., tides, sea level change) and modern activities (i.e., dredging and propeller wash).

HRA expects a high likelihood of encountering historic-period archaeological materials within the APE. The APE and vicinity were used as an access point to Elliott Bay and the Puget Sound beginning as early as 1889, when a railroad extended into Smith Cove. Since then, the APE has been continuously occupied and further developed into a modern terminal. While the development often involved the removal of the previous buildings or structures, remnants of these features such as the railroad line(s) may still exist within the APE including under the waters of Smith Cove.

6. Archaeological and Architectural Survey Methods

6.1 Archaeological Survey Methods

The surface of the entire APE is either an impervious surface, overwater, or in water; therefore, a formal pedestrian or subsurface survey of the APE was not feasible.

An HRA archaeologist visited the APE with personnel from the Port as part of a project walk-through meeting and the architectural survey. During the visit on June 6, 2021, HRA archaeologist Lynn Compas, MA visually investigated the APE for structural remnants of previous uses of the pier that had been abandoned. The archaeologist documented the pier with digital photographs and notes of the visit.

6.2 Architectural Survey Methods

In June 2021, HRA Senior Architectural Historian Chrisanne Beckner, MA, conducted field research for the project, taking digital photographs and field notes documenting materials, style, and the history of use and alteration of each resource. Survey data was used to evaluate architectural resources against criteria for listing in the NRHP.

6.3 National Register of Historic Places Criteria

The criteria for listing a property in the NRHP require that, in addition to a site, building, structure, object, or district being over 50 years of age and possessing integrity, it must meet at least one of the following criteria (NPS 1997:44), outlined in 36 CFR 60.4:

A. Property is associated with events that have made a significant contribution to the broad patterns of our history; or

B. Property is associated with the lives of persons significant in our past; or

C. Property embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction; or

D. Property has yielded, or is likely to yield, information important in prehistory or history.

In addition to possessing significance under at least one of the criteria listed above, a property must retain integrity, which is a measure of how a property conveys its significance. To retain integrity, a property must retain several if not all of the following seven aspects:

- Location: the place where the property was constructed or the place where the historic event occurred.

- Design: the combination of elements that create the form, plan, space, structure, and style of a property.
- Setting: the physical environment of a historic property.
- Materials: the physical elements that were combined or deposited during a particular period of time, and in a particular pattern or configuration, to form a historic property.
- Workmanship: the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
- Feeling: a property's expression of the aesthetic or historic sense of a particular period of time.
- Association: the direct link between an important historic event or person and a historic property.

7. Archaeological Survey Results

On June 7, 2021, HRA archeologist Lynn Compas, MA. visited the APE with the HRA architectural historian and Port personnel. Compas walked the entire APE and investigated existing potentially historic-period structures on and around the pier to determine if they were abandoned and in ruin, which would make them an archaeological site, or if they were still in use, making them a historic architectural resource. During the visit, Compas recorded a historic-period archaeological site and assigned temporary archaeological site number HRA-3306.01-1. The site is fully described in Section 7.1. No precontact archaeological material was observed.

7.1 Archaeological Site HRA-3306.01-1

Archaeological site HRA-3306.01-1 is a historic-period wooden structure (Figure 7-1). The site is located in Smith Cove on the east side of Pier 90 within the restricted access area of Terminal 91. The site can only be safely viewed from the Pier and the nearby trestle, making a detailed recordation not feasible. The area around and the within the site boundary has been heavily modified as part of the development of the pier. Below the site is riprap used to support the pier; the riprap is typically covered by tidally influenced waters. The western edge of the site is covered with overgrown blackberry thicket.

Figure 7-1. Overview of HRA-3206.01-1.

The wooden structure extends approximately 20 feet (ft) from the existing pier and is approximately 10 ft wide. The deck of the structure is made from dimensional lumber secured with wire nails to two square beams that rest on six pilings (Figure 7-2). No other cultural materials were recorded as part of the site during the visit.

Figure 7-2. Closeup of wooden structure.

The use or construction date of the structure is unknown. No buildings or structures depicted on the historic-period maps discussed in Section 2.2.4 overlap with the location of the site. The most detailed maps of the area around the site come from the Sanborn Fire Insurance Maps. The pier configuration depicted in the 1917 Sanborn map indicates the pier was narrower then today and only consisted of a "planked driveway" with "earth fill" at the archaeological site location (Sanborn 1917). The 1942 Sanborn map depicts the pier in the configuration that would continue until the 1970s (Appendix A-23). The pier is wider, and the trestle to the east of the site is depicted (Sanborn 1942).

Historic-period photographs and aerial photographs do not clearly depict a structure at the location of the site or nearby until a 1968 aerial photograph. The photograph depicts a small structure at the approximate location of Site HRA-3306.01-1 (Appendix A-27). According to the historic-period context, at this time, the pier was used as a U.S. Navy station (USGS 1968).

Evaluation

HRA recommends that Site HRA-3306.01-1 is not eligible for listing in the NRHP.
Criterion A: The structure is a small wooden pier that does not appear on any historic-period maps and first appears on a 1968 aerial photograph of Pier 90 (USGS 1968). The pier is likely associated with the U.S. Navy use of the area between 1942 and 1976, but the exact use of the pier is unknown. The site does not meet Criterion A because the small wooden pier is not strongly associated with broad patterns of history on a national, state, or local level.

Criterion B: Site HRA-3306.01-1 is not associated with any significant person who was demonstrably important within a local, state, or national historic context; therefore, it does not meet Criterion B.

Criterion C: The site is a typical pier and does not have any characteristics that are distinctive for the type, period, or method of construction; it is not the work of a master; and it does not possess high artistic value. As a result, it does not meet Criterion C.

Criterion D: The site is unlikely to yield information important to history. The location of the site has been documented and the site has been photographed and described completely. There is likely no more information this site can provide; therefore, it does not meet Criterion D.

The site's integrity is not applicable to this evaluation because the site does not meet any of the criteria for listing in the NRHP.

8. Architectural Survey Results

HRA documented two historic-period architectural resources within the APE. While the two resources (the pier and a railroad spur) are physically attached to each other, they were evaluated individually (Figure 8-1). Historic property inventory forms (HPIs) are found in Appendix C.

Figure 8-1. Surveyed historic-period resources within the APE.

8.1 Pier 90

Originally constructed in 1913, Pier 90 is one of two piers located within Terminal 91. Pier 90 is approximately 2,540 ft long and 300 ft wide, with two larger buildings at the south end (outside of the APE). Only a portion of Pier 90 is located within the APE for the Project. Within the APE, Pier 90 is paved in asphalt and is supported by wood piers and beams (Figures 8-2 and 8-3). Some areas of the substructure are concealed by corrugated metal. The eastern edge of the pier within the APE includes a former railroad spur that was abandoned and paved over (Figures 8-4 and 8-5, see Section 8.2). On the east side of the pier within the APE are two floating docks, one of which contains a metal-framed boathouse. According to Port of Seattle staff, the boathouse was constructed in 2018 to replace an earlier boathouse constructed in the 1980s (Figures 8-6 and 8-7).

Additional buildings on Pier 90 include warehouse and office buildings constructed in the 1990s and located on the edge of the APE. They are generally rectangular, clad in T1-11, with side-gabled roofs (Figure 8-8). None of these buildings are 45 years old or older.

Figure 8-2. Pier 90 within the APE, view northeast.

Figure 8-3. Pier 90 within the APE showing pier substructure, view west.

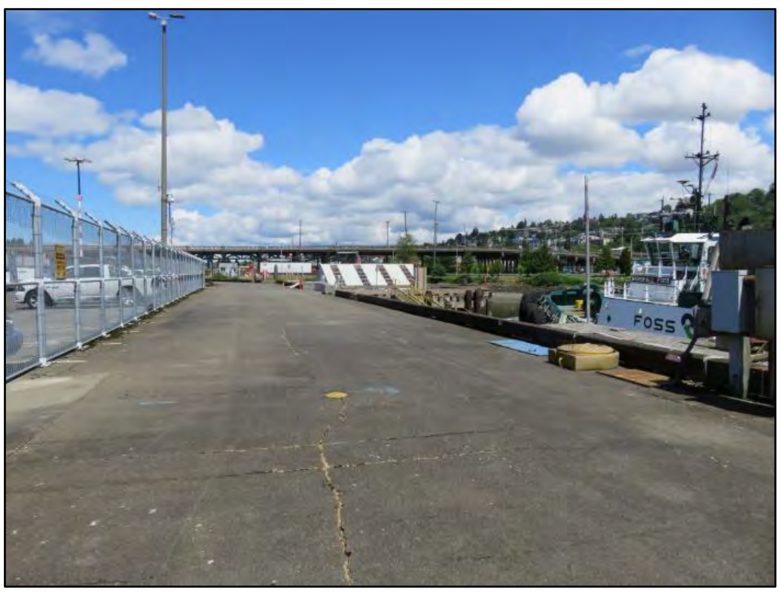

Figure 8-4. Pier 90 former railroad spur within APE, view northeast.

Figure 8-5. Pier 90 paved railroad spur within APE, view southeast.

Figure 8-6. Pier 90 floating dock within the APE, view south.

Figure 8-7. Pier 90 floating within the APE, view northeast.

Figure 8-8. Pier 90 buildings within the APE to be demolished, view northwest.

Integrity

As shown through various maps (see Appendix A), the area of Pier 90 within the APE has been substantially altered since 1913. The Navy widened the pier and constructed a new railroad spur in 1942, which was later paved. Under the Navy's ownership, buildings were removed, and new ones constructed that occupied much of the pier. These buildings have since been removed and, within the APE, seven metal-frame buildings were constructed in the late 1990s (see Figure 8-8), which are slated to be demolished as part of the project.

From its period of construction (1913), the pier features integrity of location, as it remains on its original site. The waterfront has been filled and altered with various waterfront and roadway projects associated with military operations, shipping, tourist traffic (how the pier has been used in recent years), and the pier no longer retains integrity of setting. Further, due to changes in ownership and use, the pier has undergone extensive alterations within the APE, including widening, addition of a railroad spur, abandonment of that spur, and the construction and removal of buildings. Therefore, the pier does not retain integrity of design, materials, workmanship, and feeling. Additionally, Pier 90 has changed ownership and use several times since it was constructed, and no longer retains integrity of association.

Evaluation

Pier 90 was constructed in 1913 and was primarily used for loading and unloading shipments. During World War II, the pier was used by the U.S. Navy for "extensive naval craft mooring, repair, and deactivation activities" (Windward 2017:10). While the naval station does not appear to have been associated with a significant World War II mission, it was used to supply and repair ships. The Navy sold the pier to the Port of Seattle in 1976. Pier 90 is associated as a significant contributor to World War II naval activity in the Puget Sound (Criterion A). Preliminary research did not reveal any association of the resource with the lives of significant persons (Criterion B). The resource does embody the characteristics of a city pier; however, it no longer conveys its historic use for shipping along the railway, as all railroad spurs have been removed. The resource does not embody the distinctive characteristics of period or method of construction; or represent the work of a master; or possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction (i.e., is part of a district) (Criterion C). Finally, the resource was built of common construction methods and well-known materials and is unlikely to answer important research questions or yield information about human history that can only be answered by the actual physical material, design, construction methods, or interrelation of these resources (Criterion D).

While Pier 90 is significant for its association with naval activity in the Puget Sound during World War II, due to substantial alterations the pier no longer conveys that significance. HRA recommends Pier 90 within the project APE does not retain sufficient integrity from its period of construction (1913) and does not qualify for listing in the NRHP under any criteria.

8.2 Pier 90 Railroad Spur

Built in 1942, the Pier 90 railroad spur was one of several spur lines once located on Pier 90 (Sanborn 1942). This railroad spur follows the eastern edge of the pier and is approximately 880 ft long. The Navy had paved the spur by 1969, and it is currently used to access two floating docks on the eastern edge of Pier 90 within the project APE (Figures 8-9 and 8-10). Along the spur are several wood bumpers and metal posts (Figure 8-11 and 8-12). It is unclear if the Navy fully removed the railroad tracks, and the tracks may still be in place. The wood support piers and trestle are still present (Figure 8-13).

Figure 8-9. Pier 90 Railroad Spur within the APE, view northeast.

Figure 8-10. Pier 90 Railroad Spur within the APE, view north.

Figure 8-11. Pier 90 Railroad Spur wood bumpers within APE, view north.

Figure 8-12. Pier 90 Railroad Spur metal post within APE, view northeast.

Figure 8-13. Pier 90 Railroad Spur substructure within APE, view northwest.

Integrity

From its period of construction (1942), the railroad spur features integrity of location. Pier 90 has changed ownership and use since the railroad spur was constructed, and the spur no longer retains integrity of setting and association. Further, alterations within the APE include abandonment of the spur and paving, leading to a loss of integrity of design, materials, workmanship, and feeling.

Evaluation

Pier 90 was constructed in 1942 as part of U.S. Navy improvements to Pier 90. During World War II, the pier was used by the U.S. Navy for "extensive naval craft mooring, repair, and deactivation activities" (Windward 2017:10). While the naval station does not appear to have been associated with a significant World War II mission, it was used to supply and repair ships. The railroad spurs were used to ship materials in and out of the piers. The Navy sold the pier to the Port of Seattle in 1976. Pier 90 is associated as a significant contributor to World War II naval activity in the Puget Sound (Criterion A). Preliminary research did not reveal any association of the resource with the lives of significant persons (Criterion B). Due to the abandonment of the spur and its subsequent paving, the resource does not embody the distinctive characteristics of a type, period, or method of railroad spur or trestle construction; or represent the work of a master; or possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction (i.e., is part of a district) (Criterion C). Finally, the resource was built of common construction methods and well-known materials and is unlikely to answer important research questions or yield information about human history that can only be answered by the actual physical material, design, construction methods, or interrelation of these resources (Criterion D).

While Pier 90 is significant for its association with naval activity in the Puget Sound during World War II, the railroad spur has been abandoned and paved and therefore, no longer conveys that significance. HRA recommends Pier 90 Railroad Spur within the project APE does not retain sufficient integrity from its period of construction (1942) and does not qualify for listing in the NRHP under any criteria.

9. Summary and Recommendations

HRA completed archival research on the APE and vicinity, developed a cultural and environmental context, and developed an expectation for archaeological materials. HRA archaeologist visited the site on June 6, 2020, to assess any potential archaeological resources within the APE. The archaeologist observed a historic-period wooden structure and recorded it as archaeological site HRA-3306.01-1; the site is recommended not eligible for listing in the NRHP. HRA recommends a Monitoring and Inadvertent Discovery Plan (MIDP) be developed and followed during the removal of pavement in the vicinity of the railroad grade along the west side of Pier 90. The MIDP will include protocols for the treatment of any features (ties or rails) related to the railroad if they are found.

HRA identified two architectural resources within the project area: Pier 90 and the Pier 90 Railroad Spur. Due to extensive alterations, HRA recommends these two resources not eligible for listing in the NRHP due to an irretrievable loss of integrity.

No other cultural resource study for the rest of the project is recommended at this time. HRA recommends a finding of *no effect to historic properties* for the project, as no historic properties appear to be present.

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Appendix A. Historic-Period Map Book

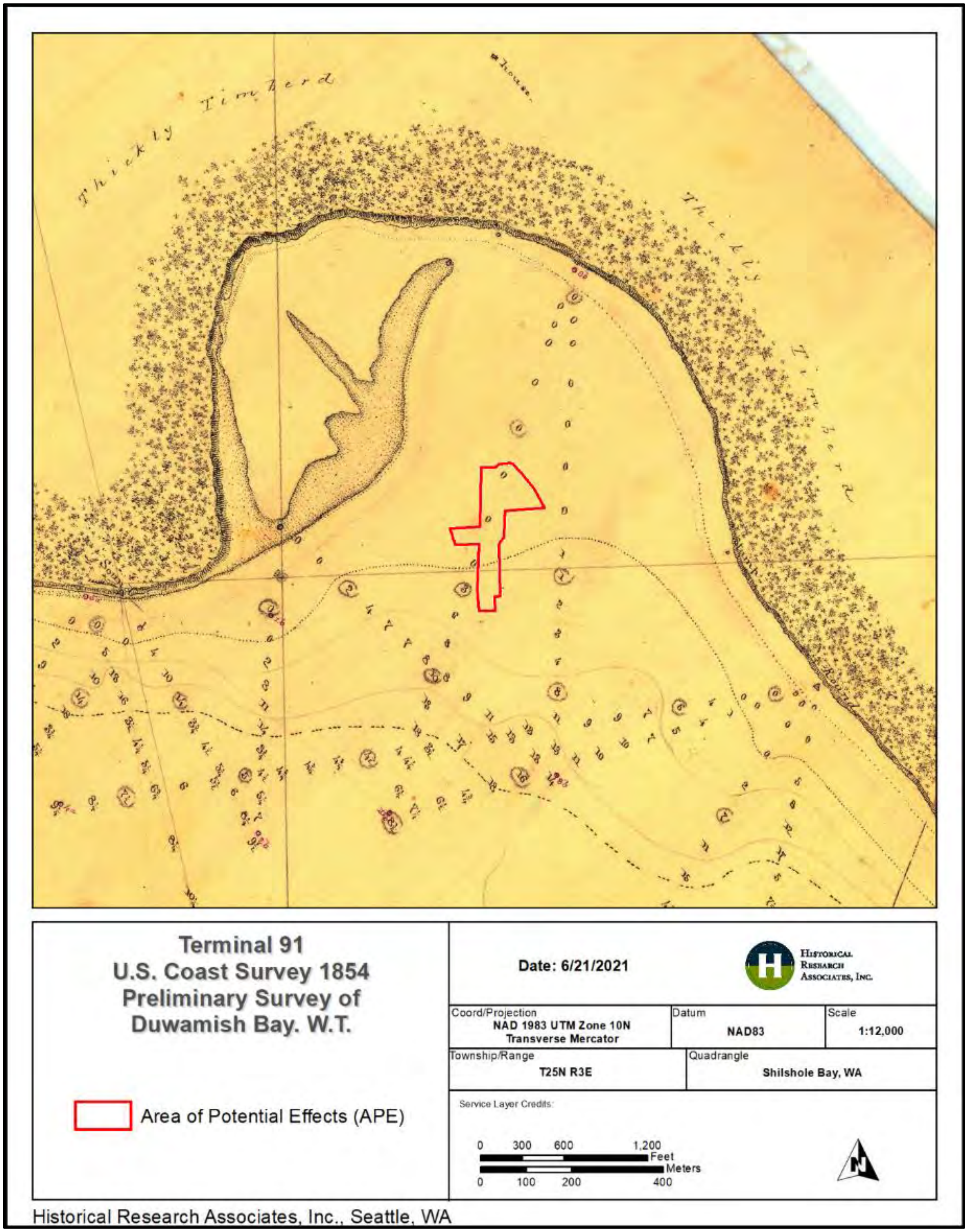

Figure A-1. 1854 Preliminary Survey of Duwamish Bay W.T.

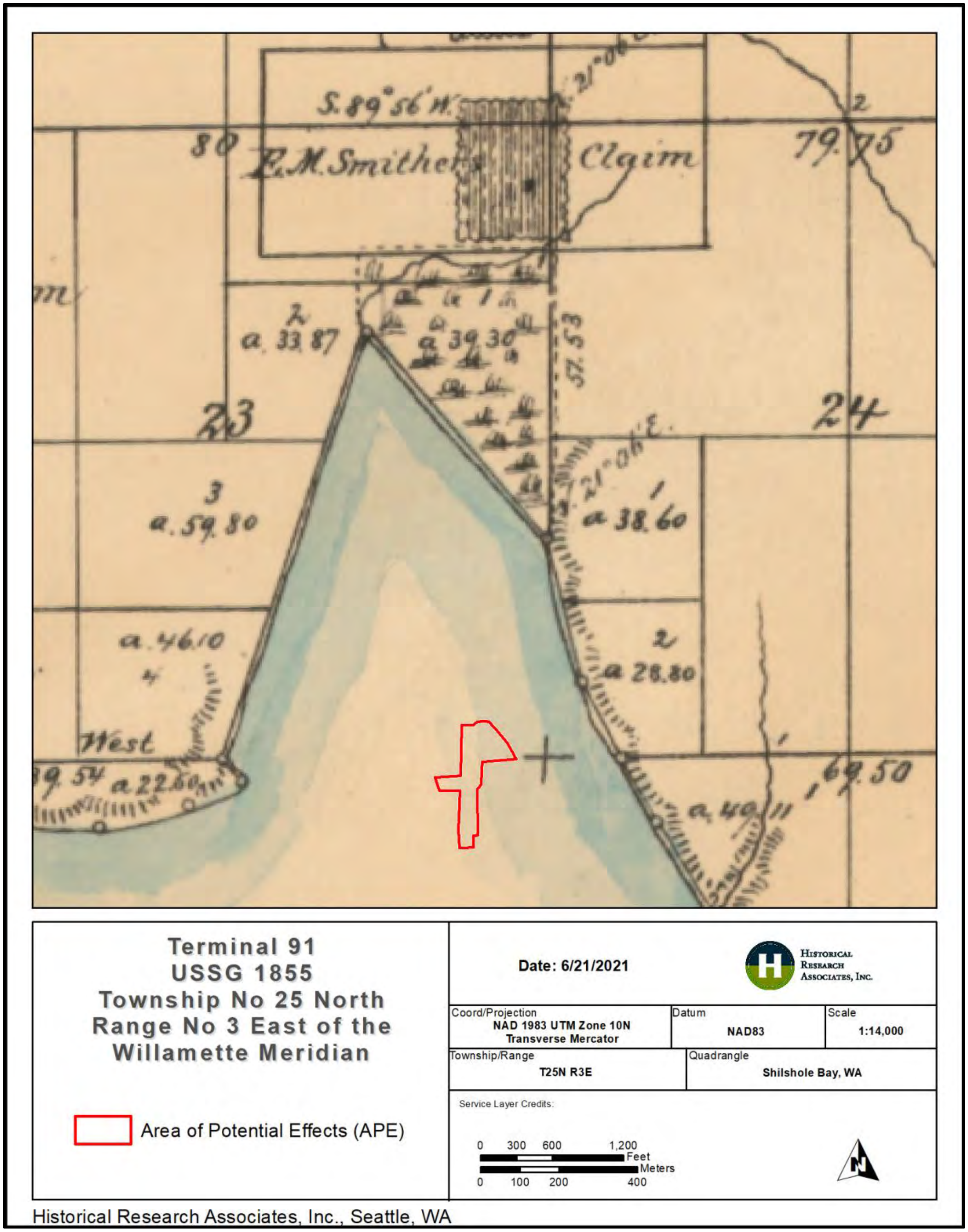

Figure A-2. 1855 GLO.

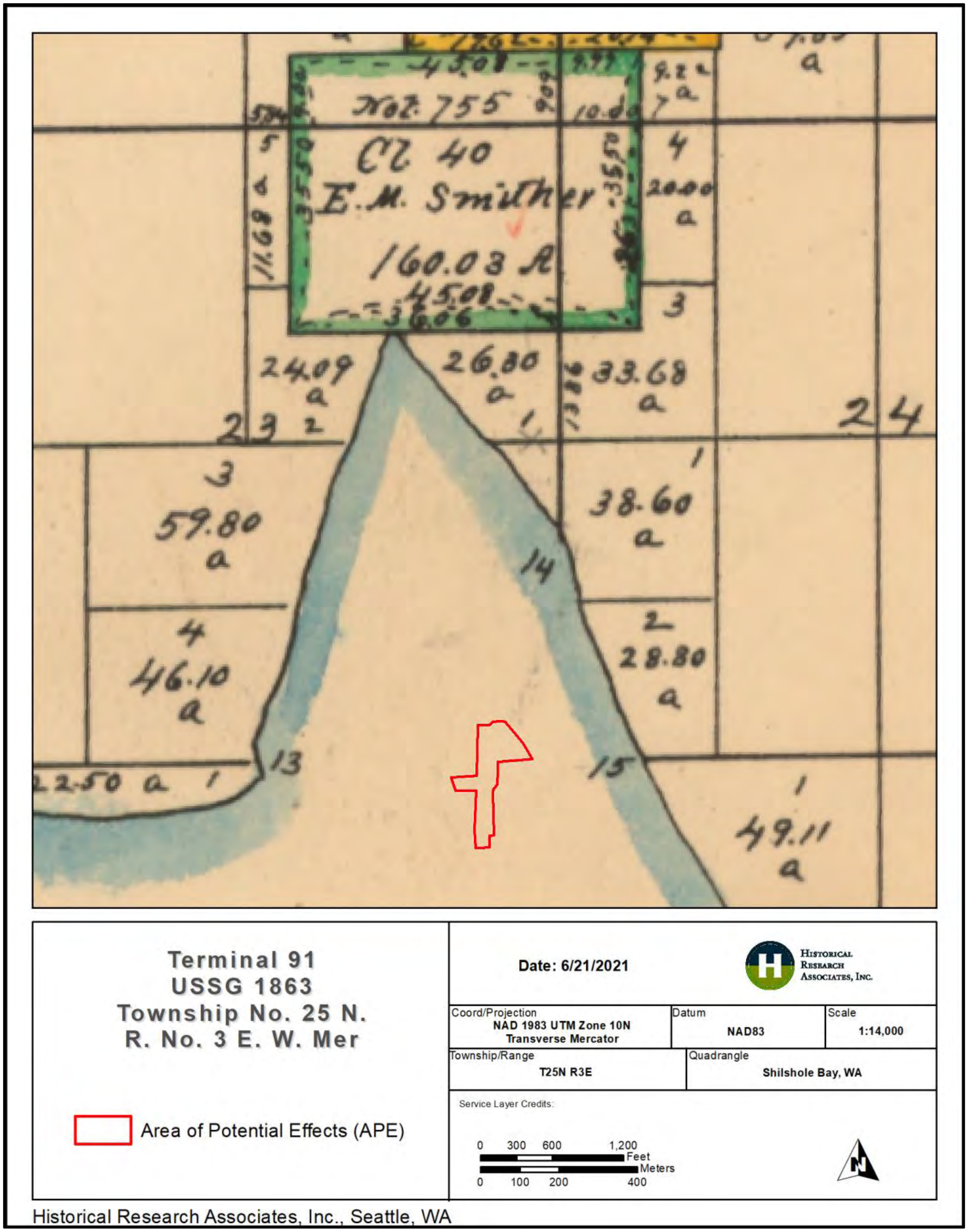

Figure A-3. 1863 GLO.

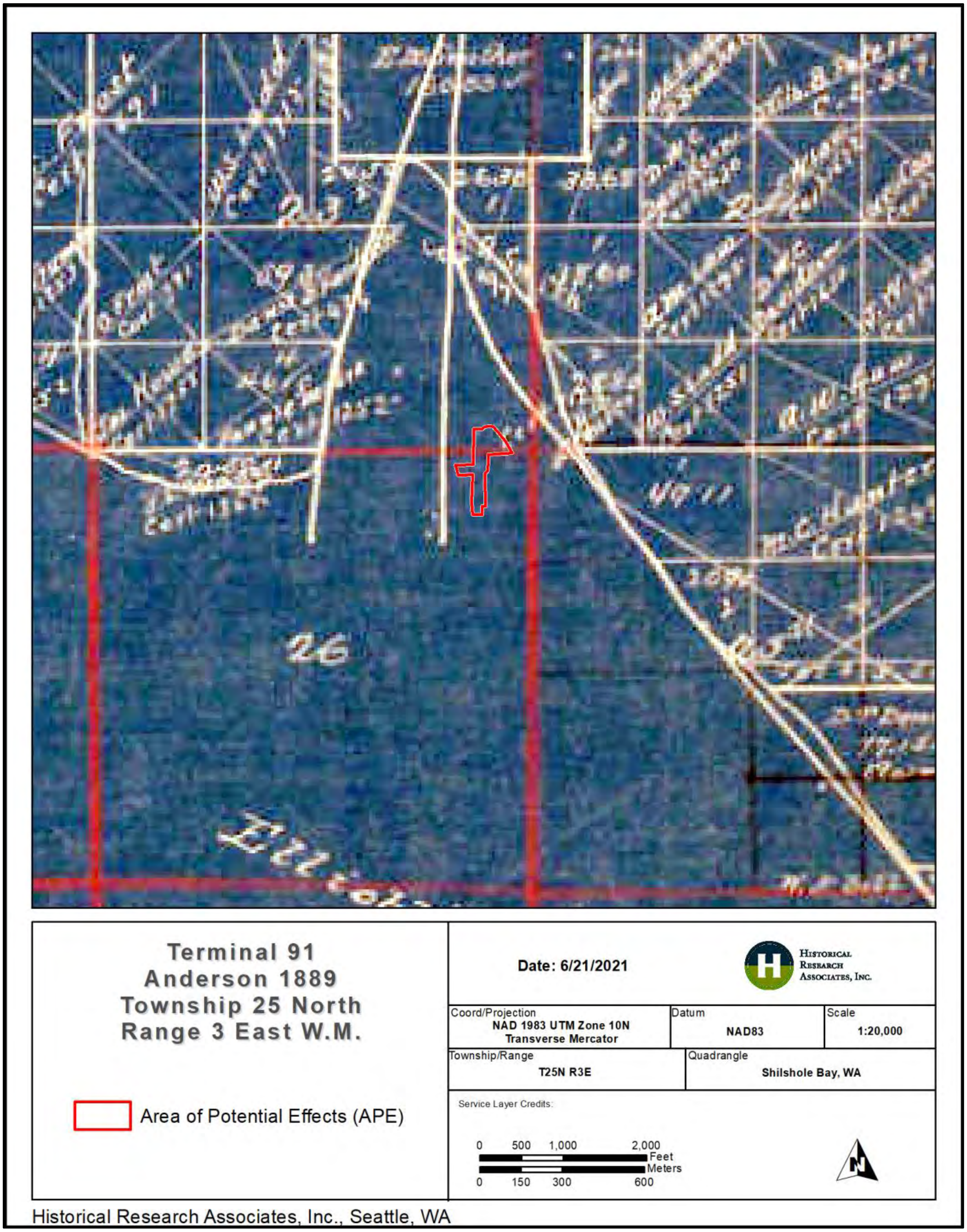

Figure A-4. 1889 Township Plats of King County, Washington Territory - Page 09, Township 25N, Range 3E.

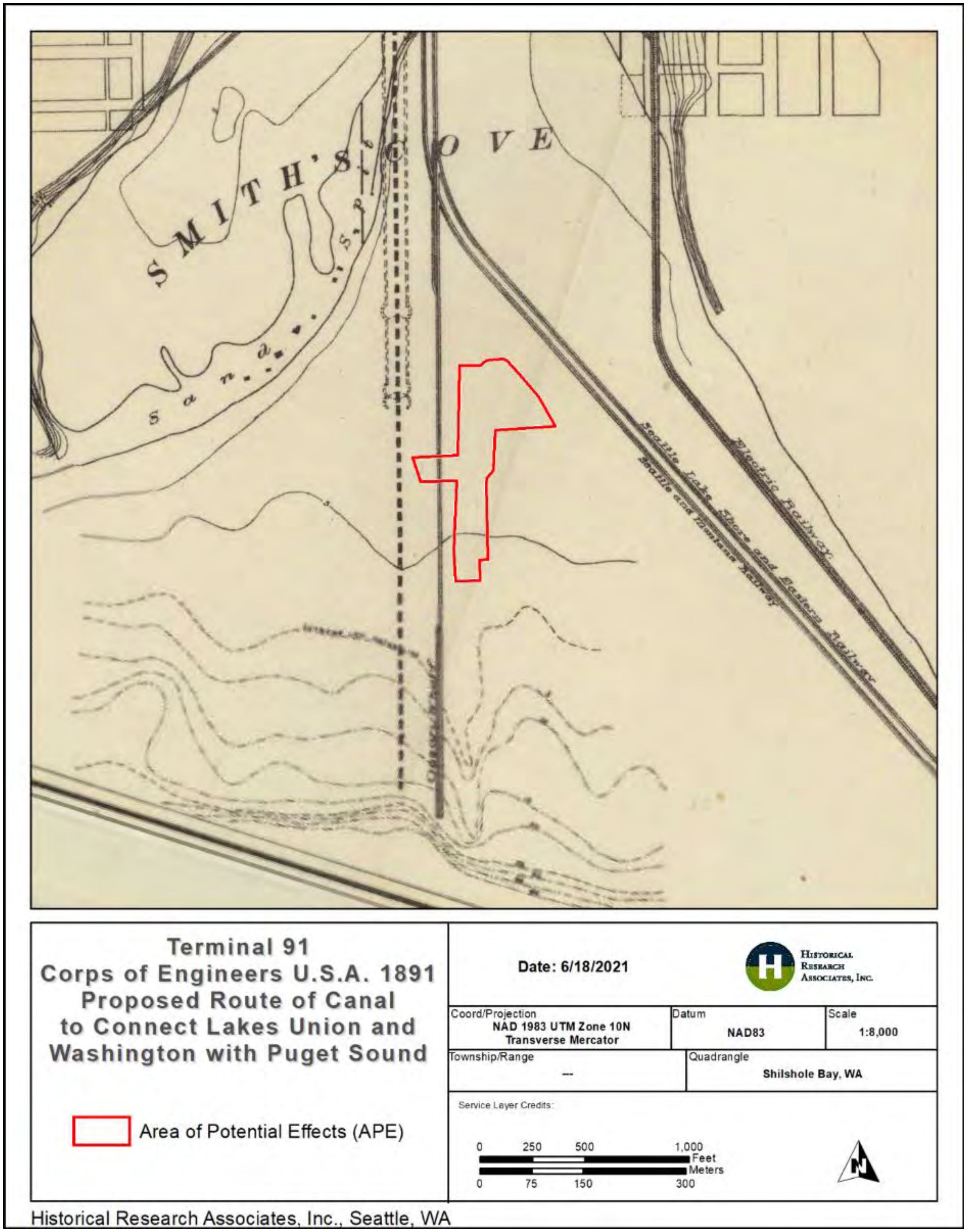

Figure A-5. 1891 Proposed Route of Canal to Connect Lakes Union and Washington with Puget Sound.

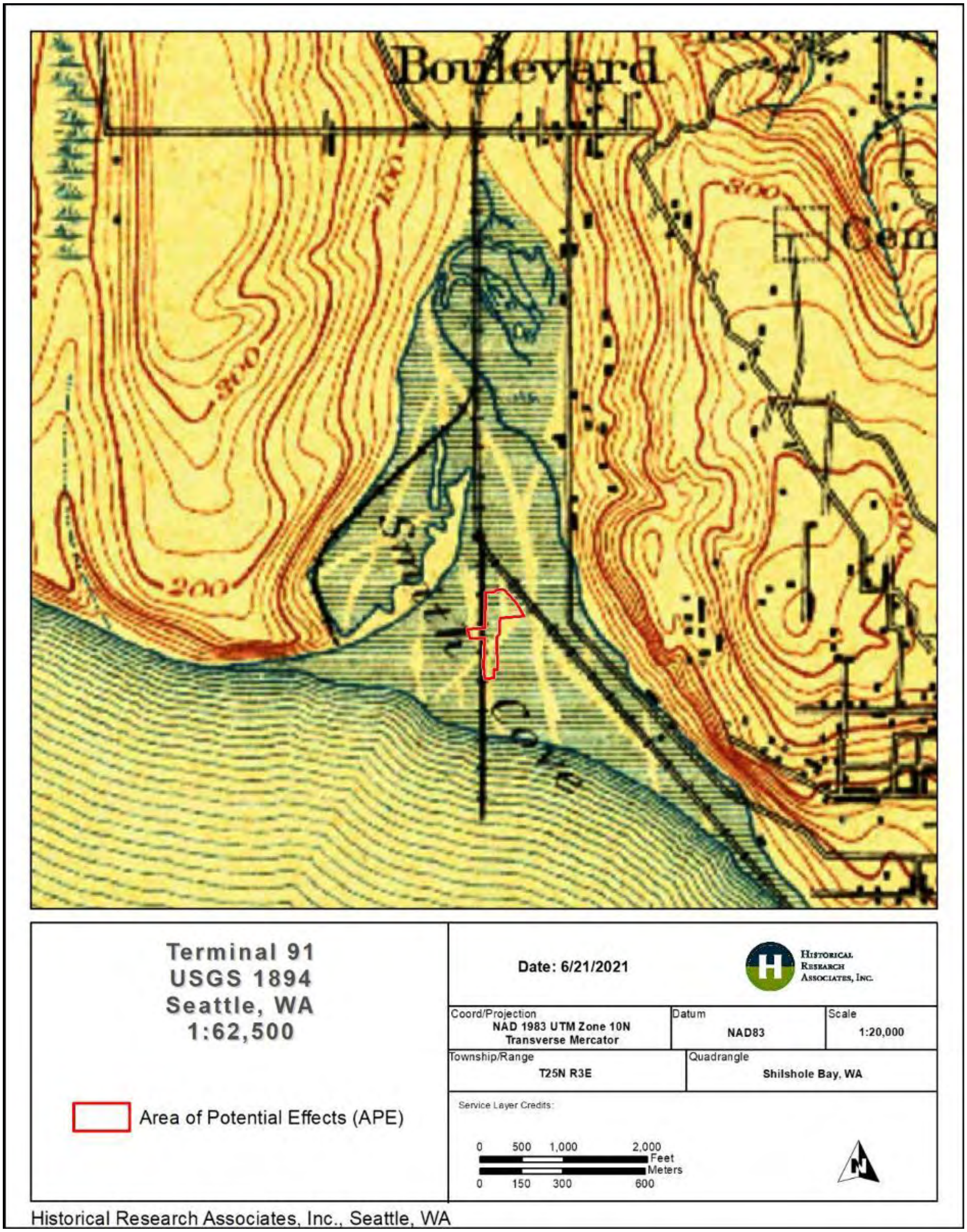

Figure A-6. 1894 Seattle Quadrangle.

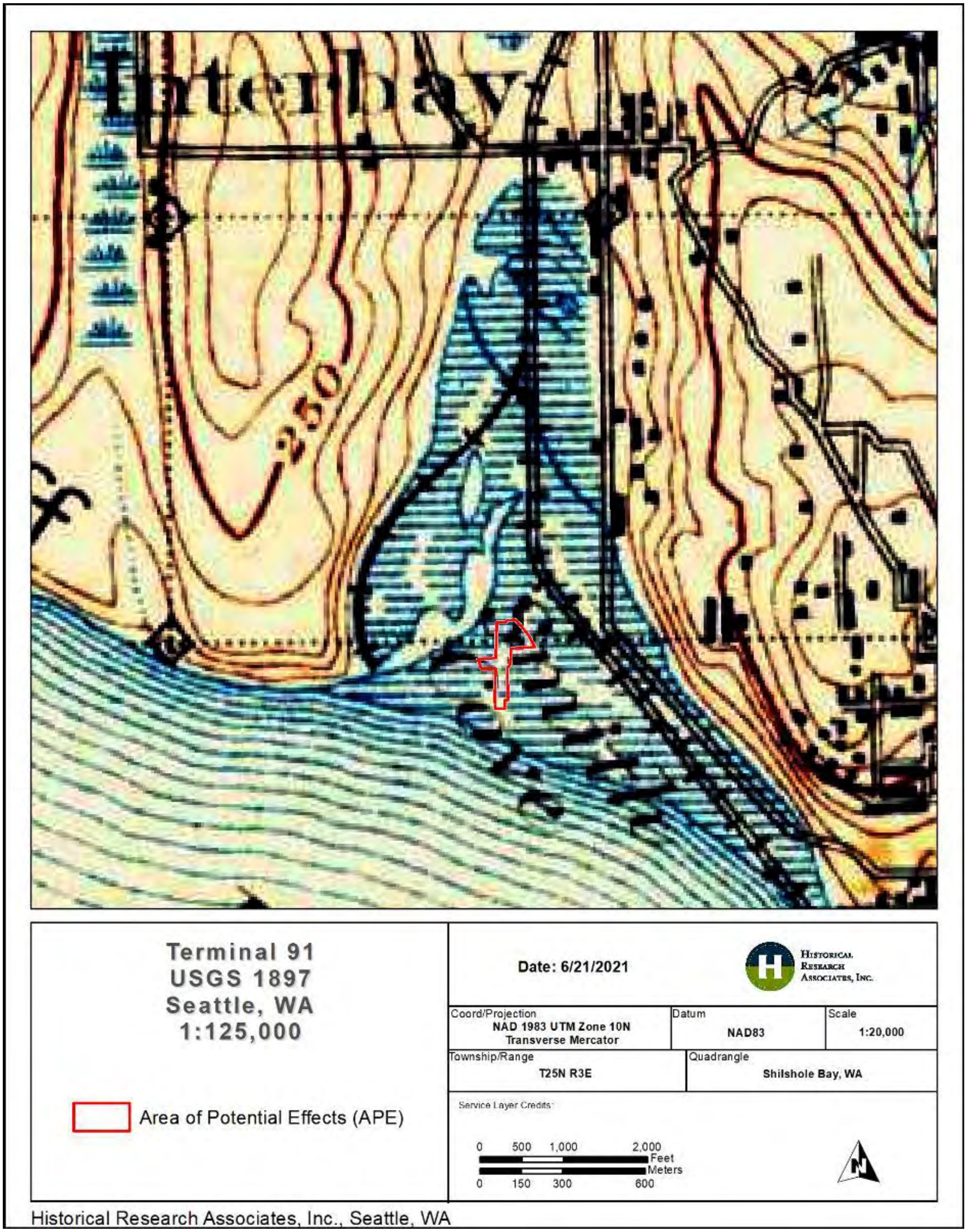

Figure A-7. 1897 Seattle, WA Quadrangle.

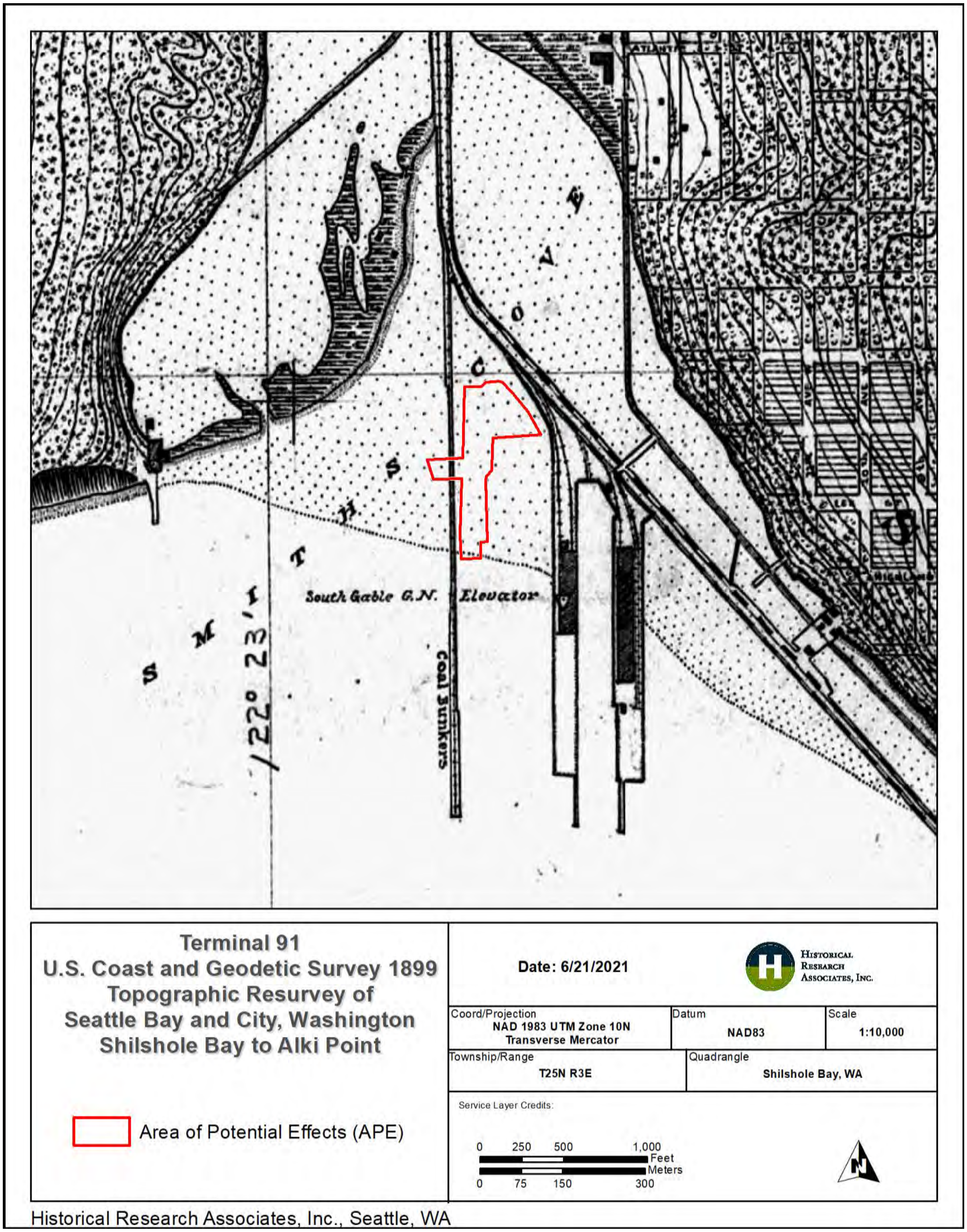

Figure A-8. 1899 T-Sheet of Seattle Bay and City, Washington.

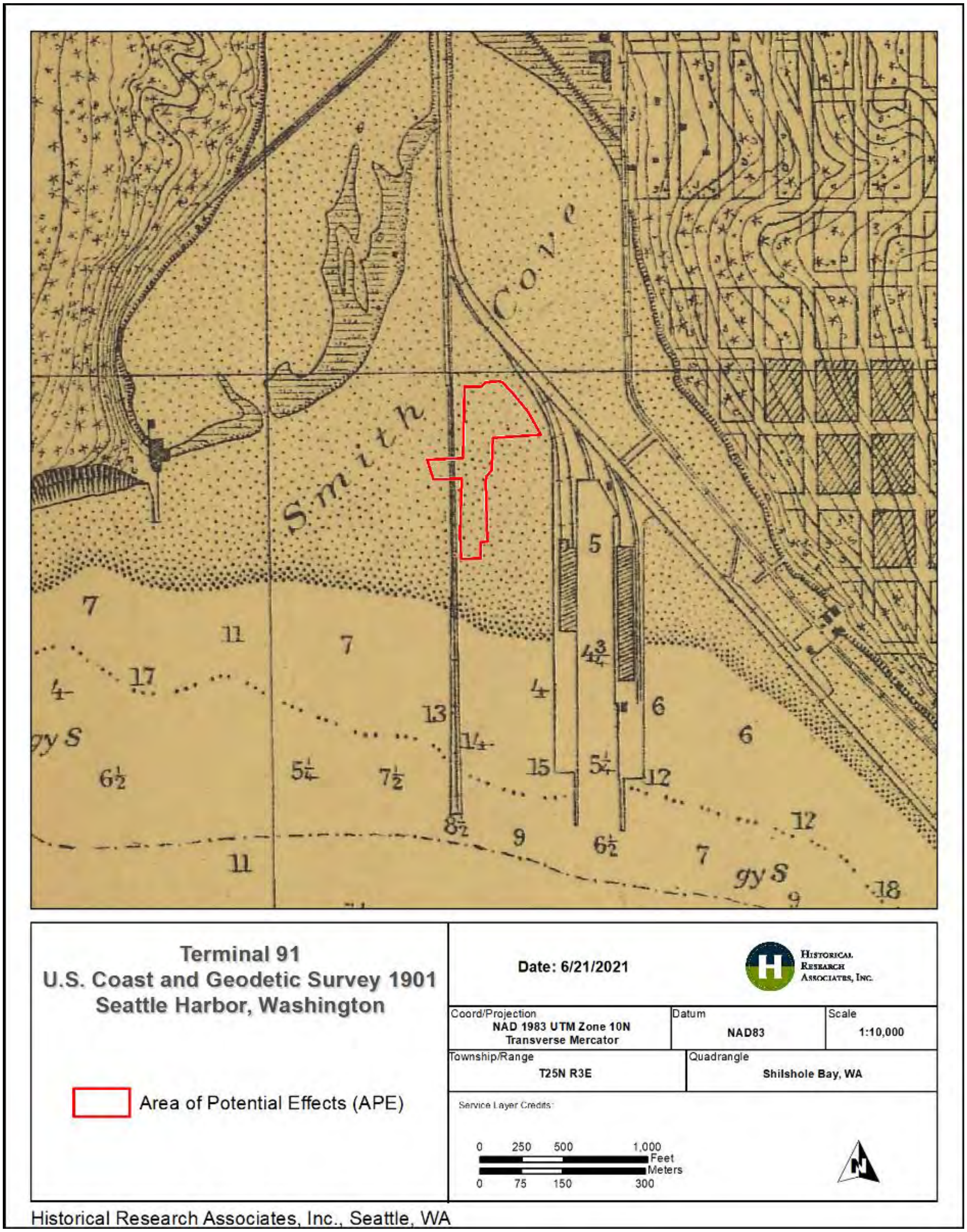

Figure A-9. 1901 Seattle Harbor, Washington.

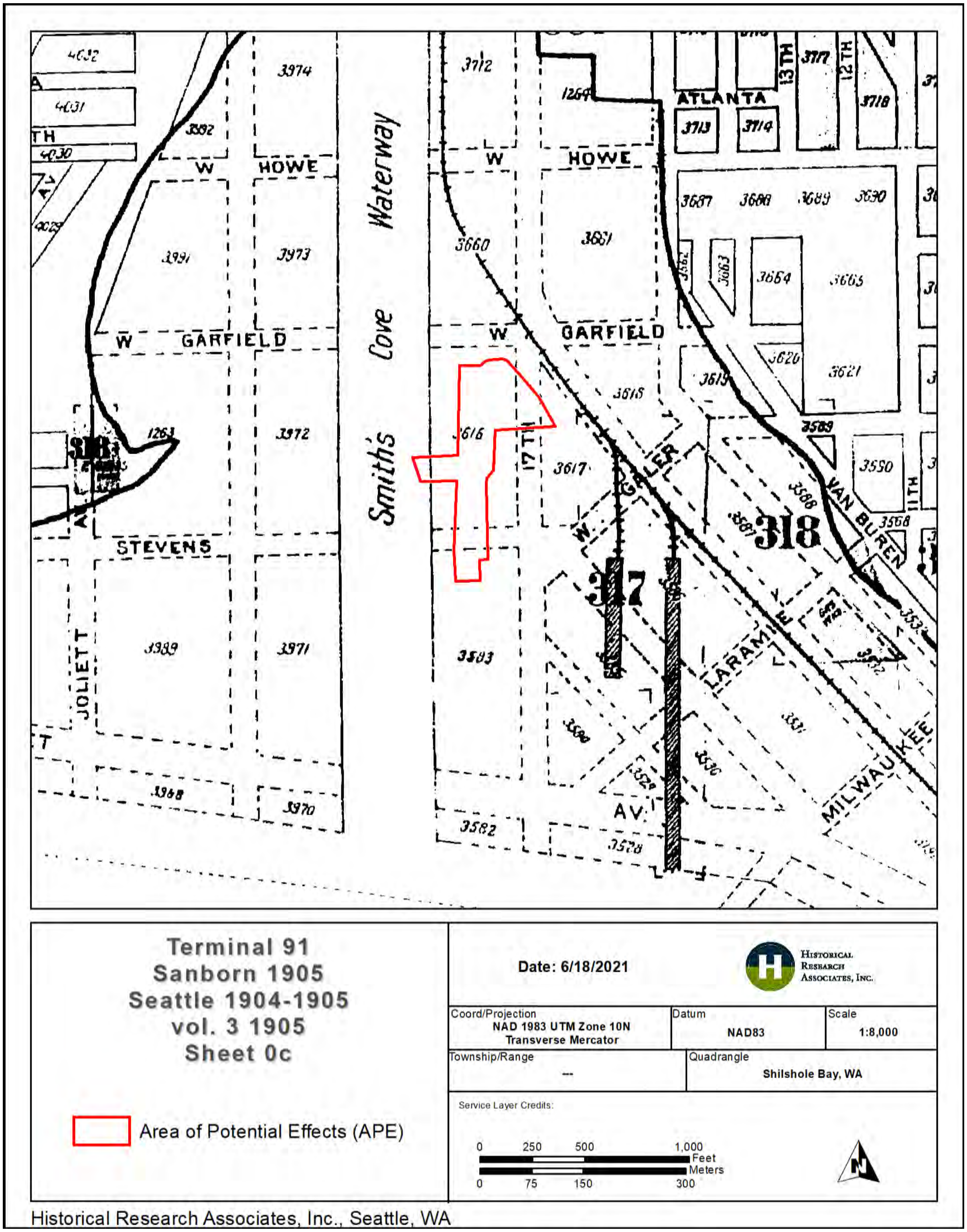

Figure A-10. 1904–1905 Sanborn Fire Insurance Map.

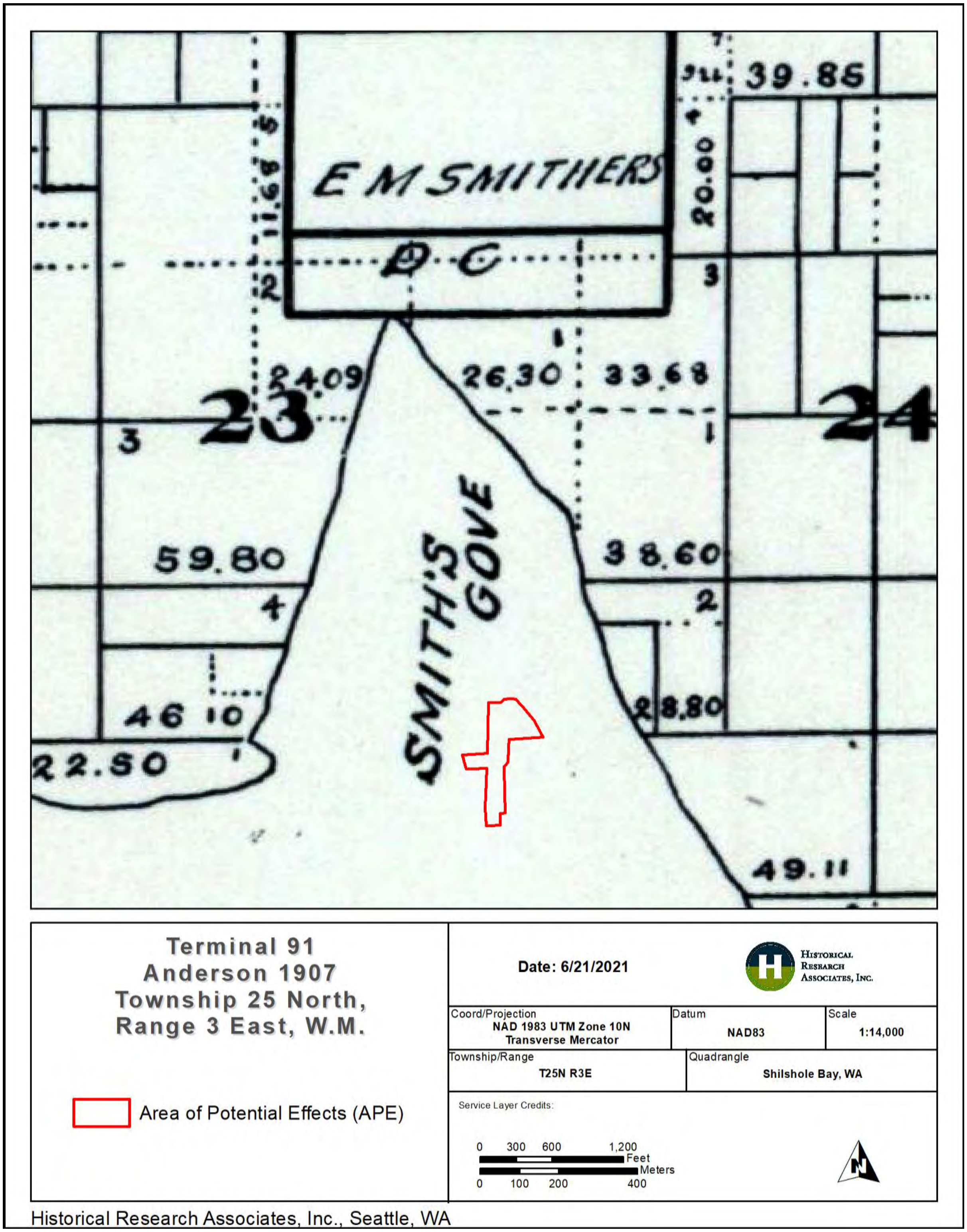

Figure A-11. 1907 Anderson Map Co's King Co. Atlas - Page 07, Township 25N, Range 3E.

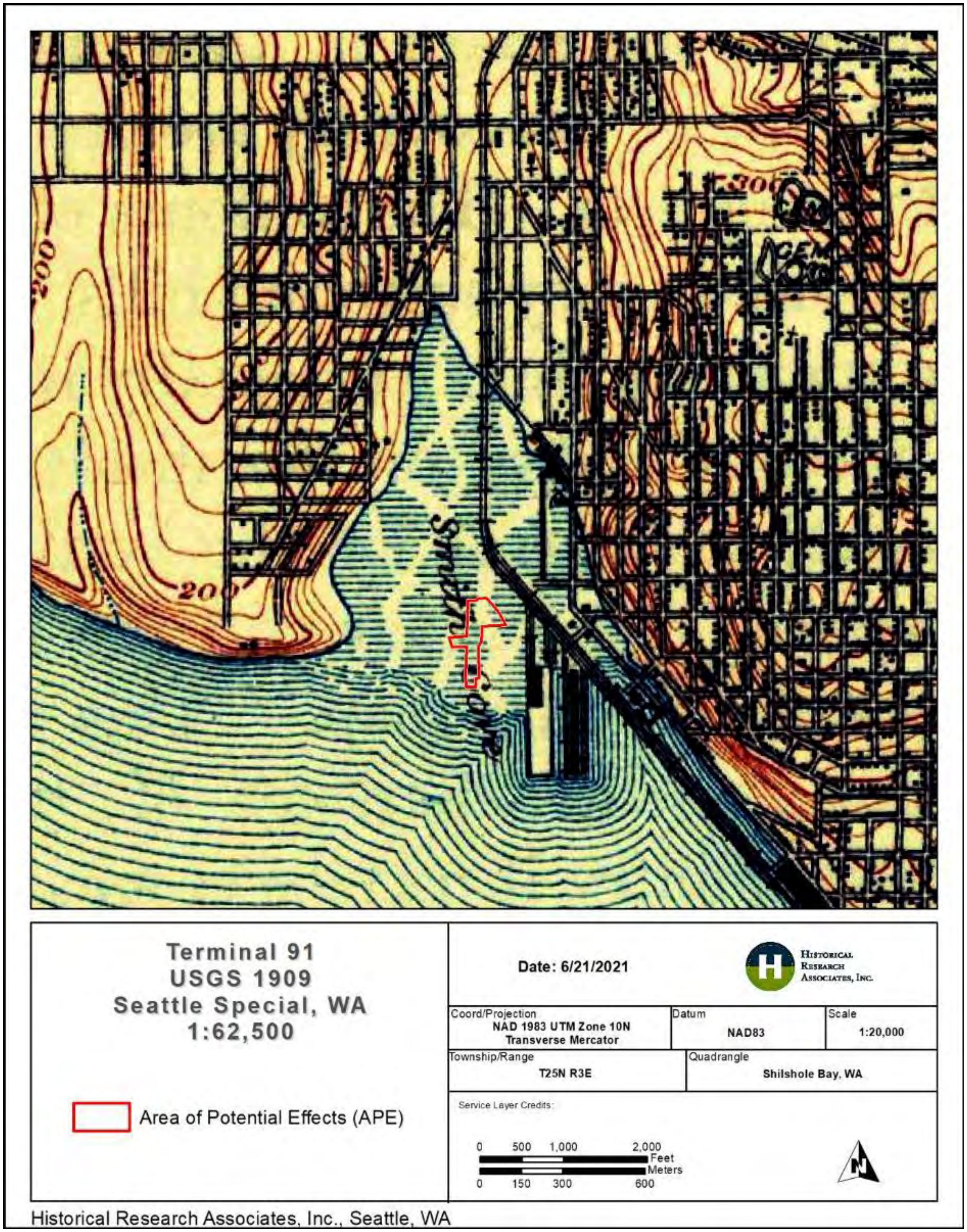

Figure A-12. 1909 Seattle, WA Quadrangle.

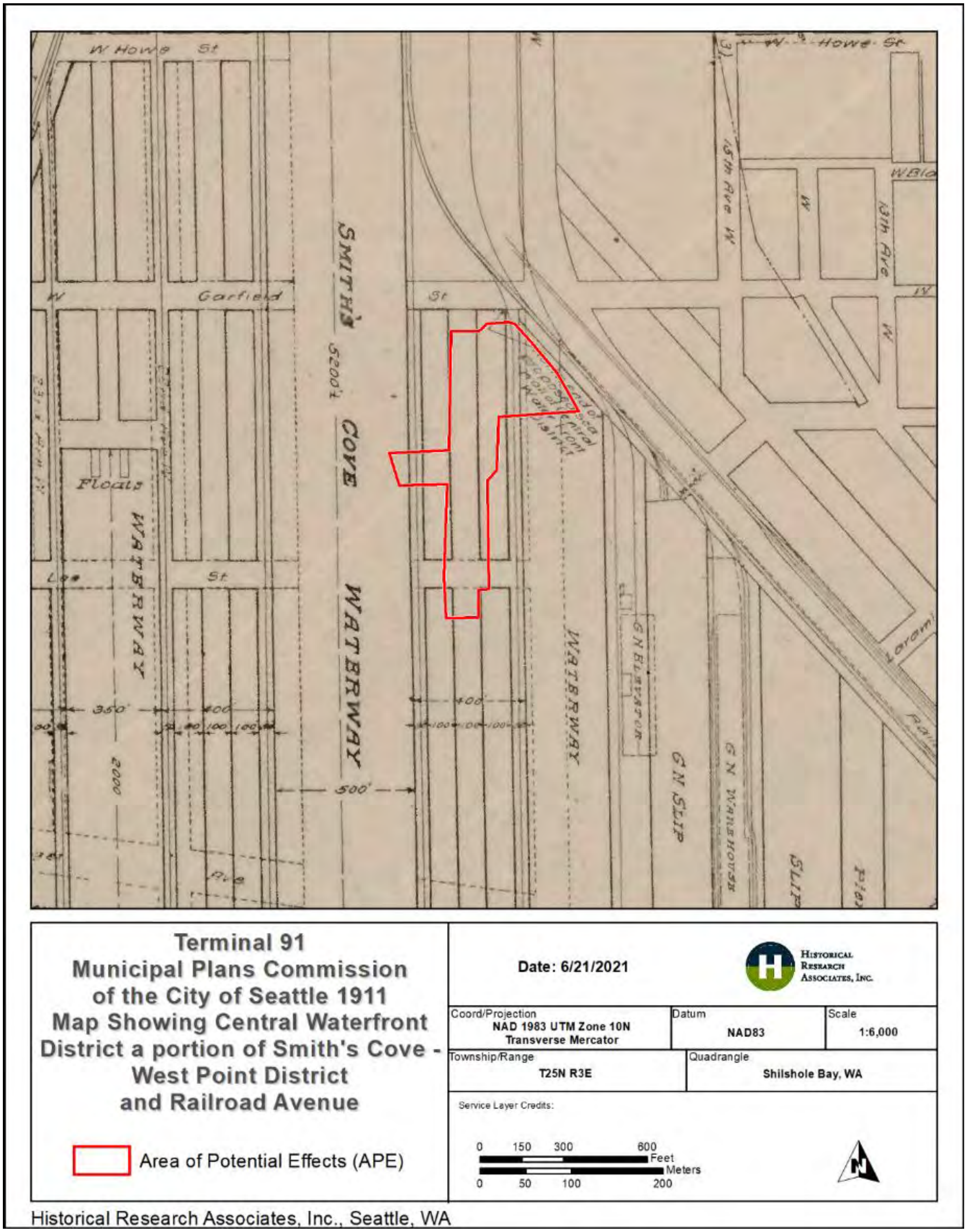

Figure A-13. 1911 Municipal Plans Commission of the City of Seattle map showing Central Waterfront District.

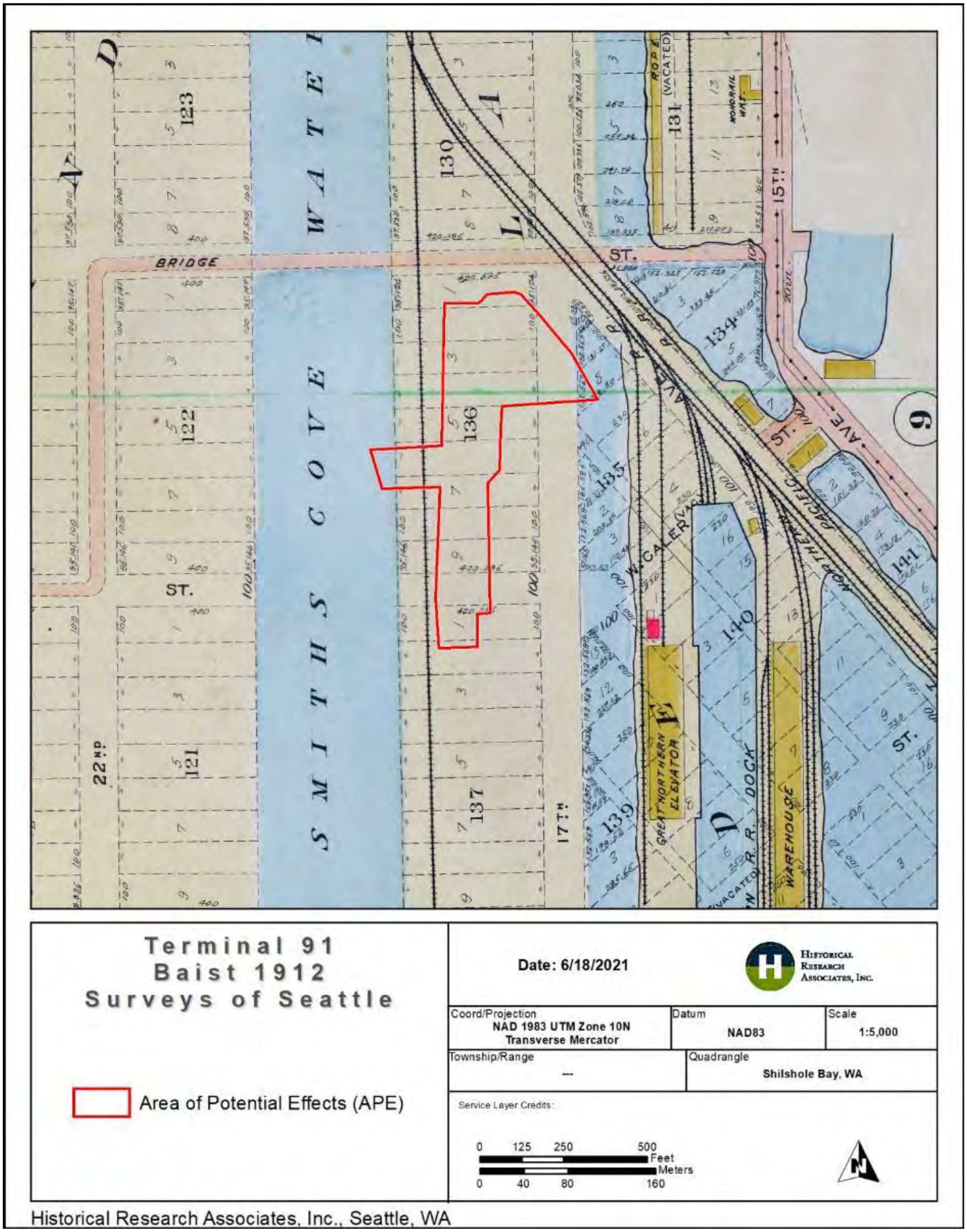

Figure A-14. 1912 Baist's Real Estate Atlas.

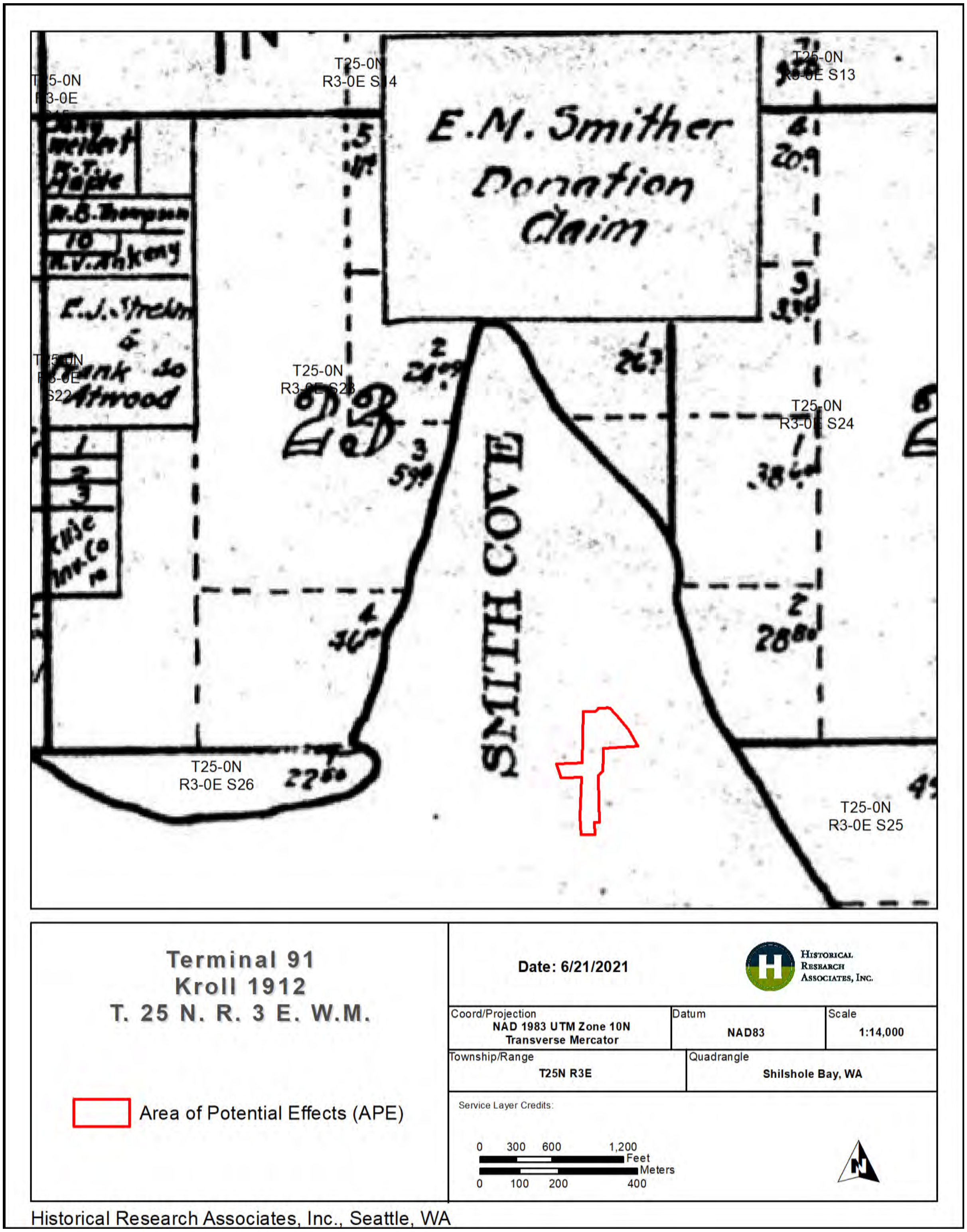

Figure A-15. Kroll's Atlas of King County, 1912 - Page 07, Township 25N, Range 3E.

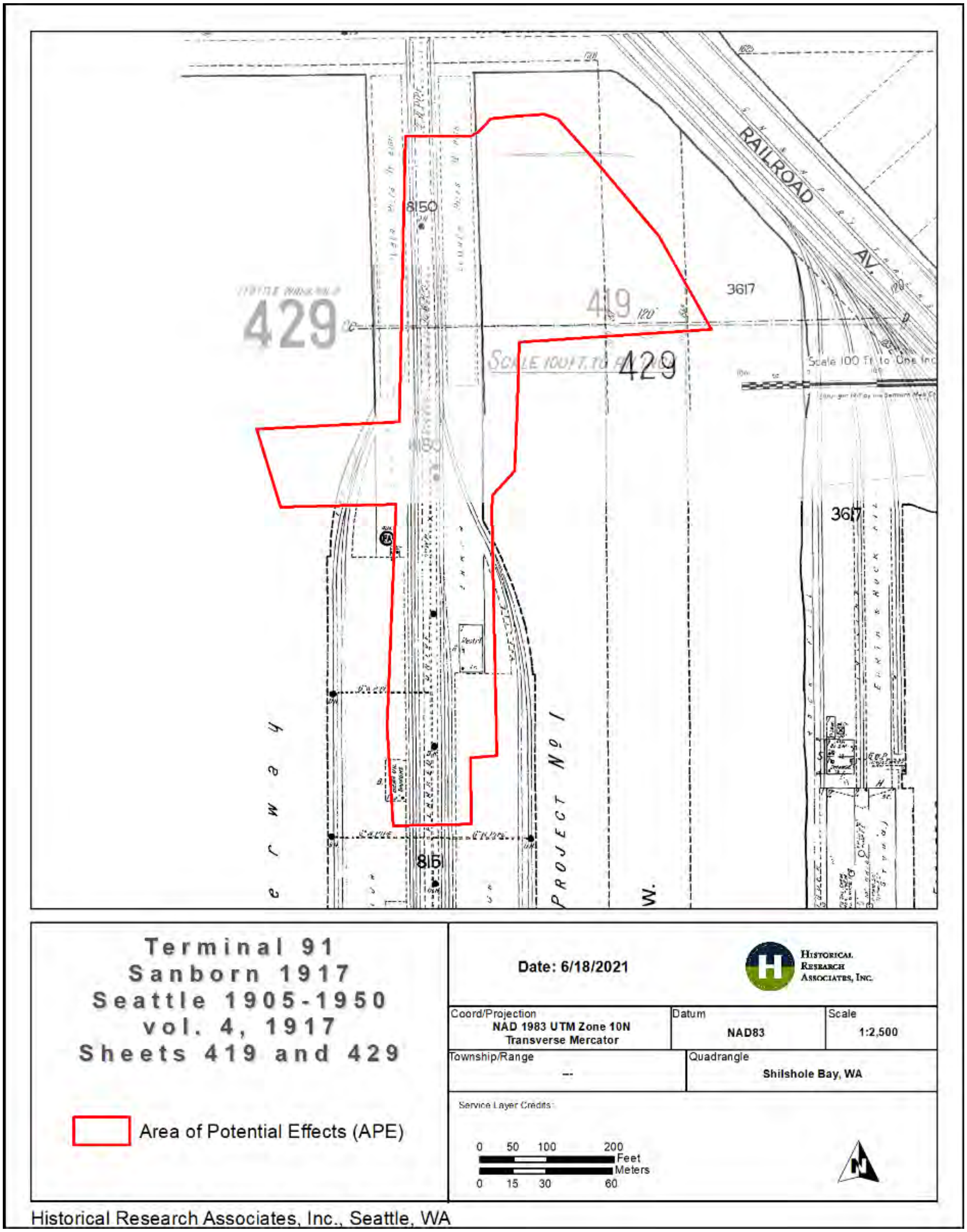

Figure A-16. 1917 Sanborn Fire Insurance Map.

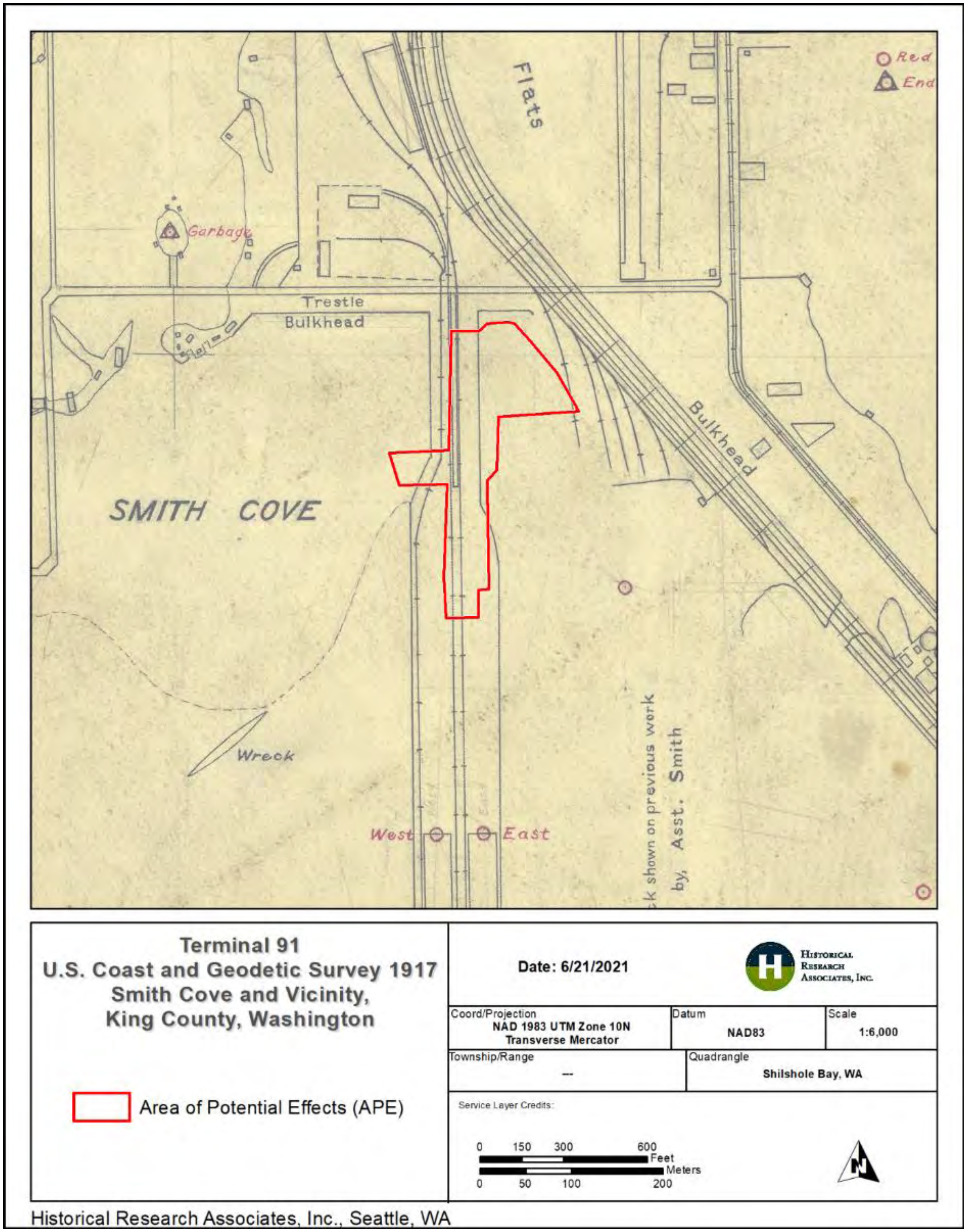

Figure A-17. 1917 Smith Cove and Vicinity, King County, WA.

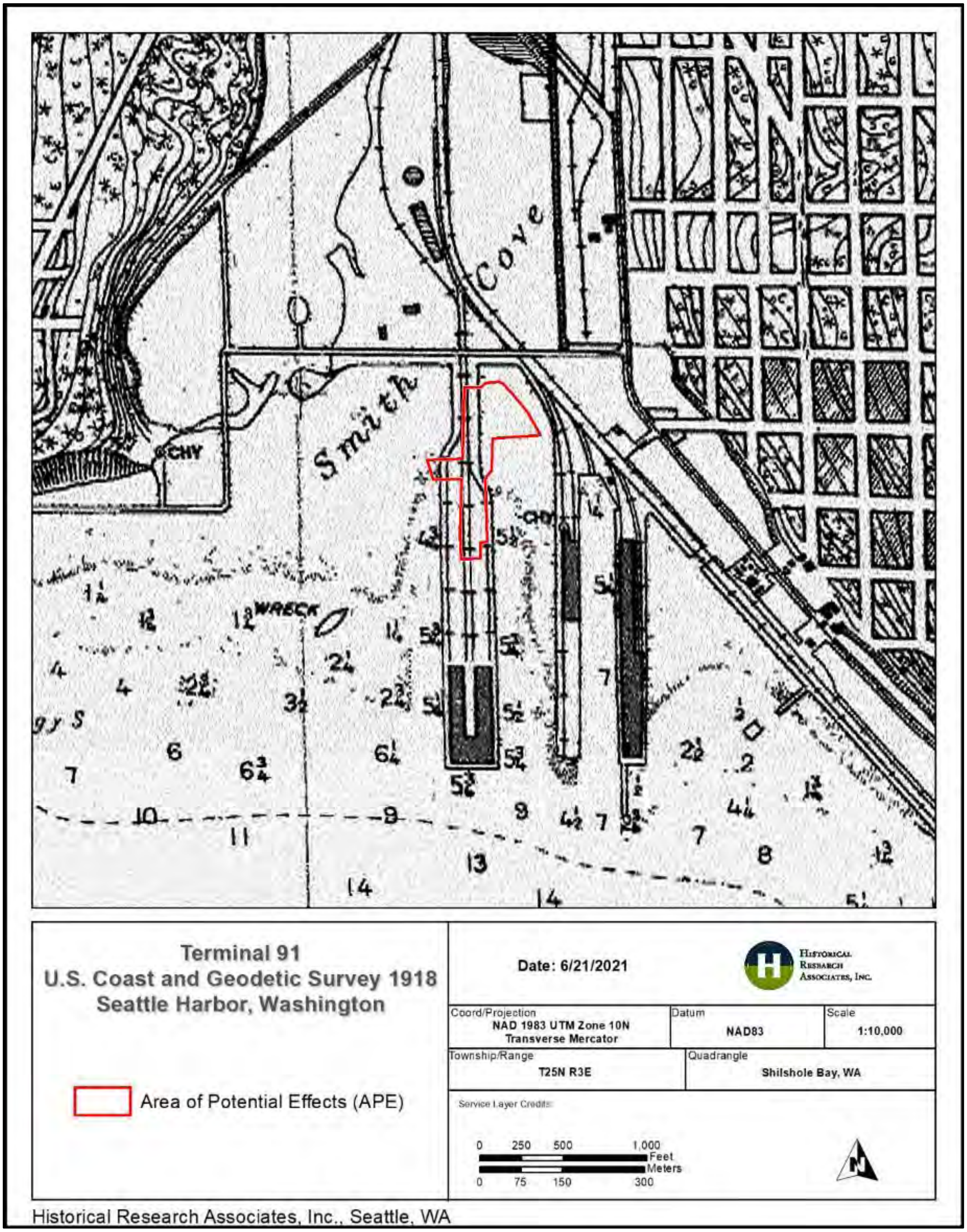

Figure A-18. 1918 Seattle Harbor.

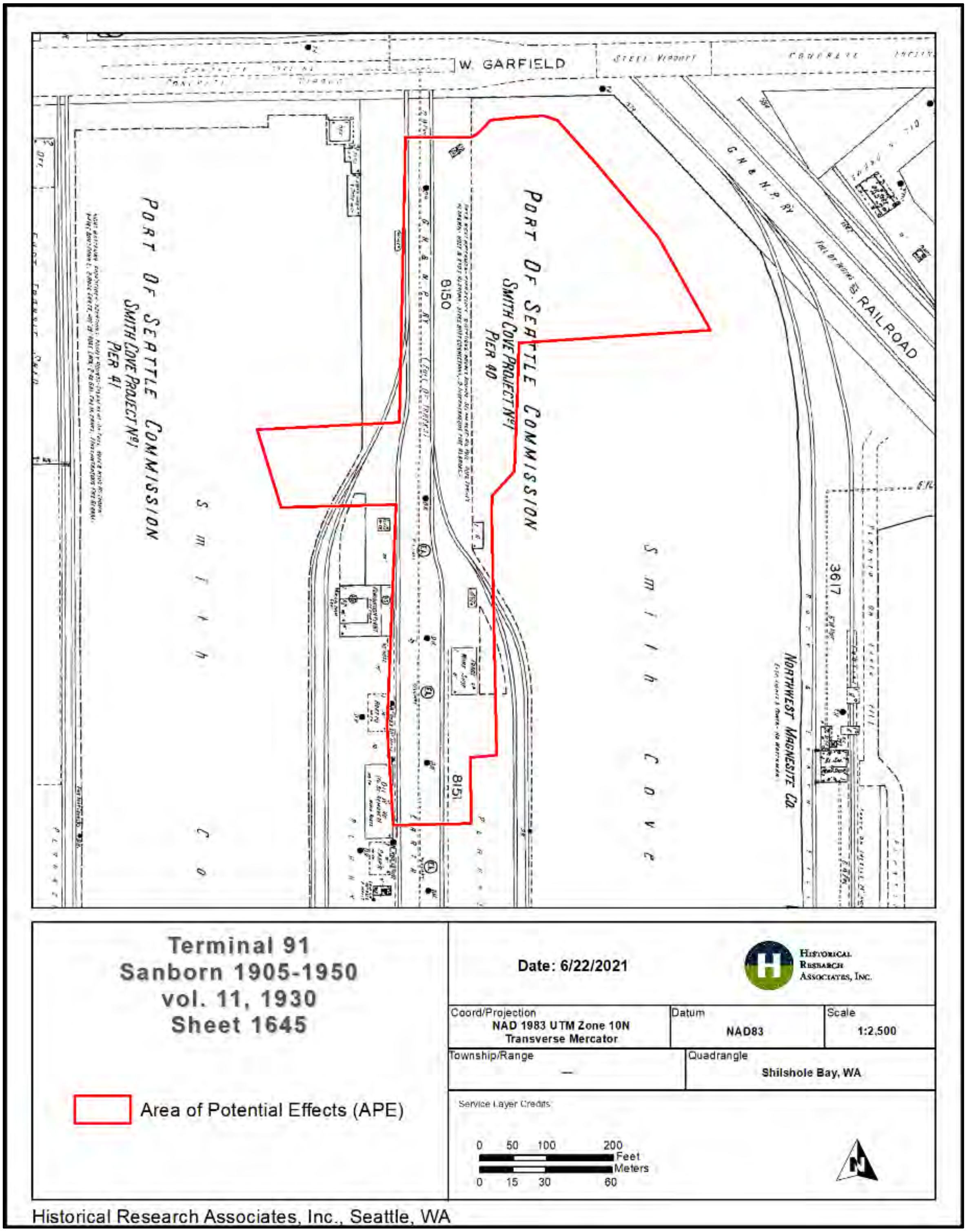

Figure A-19. 1930 Sanborn Fire Insurance Map.

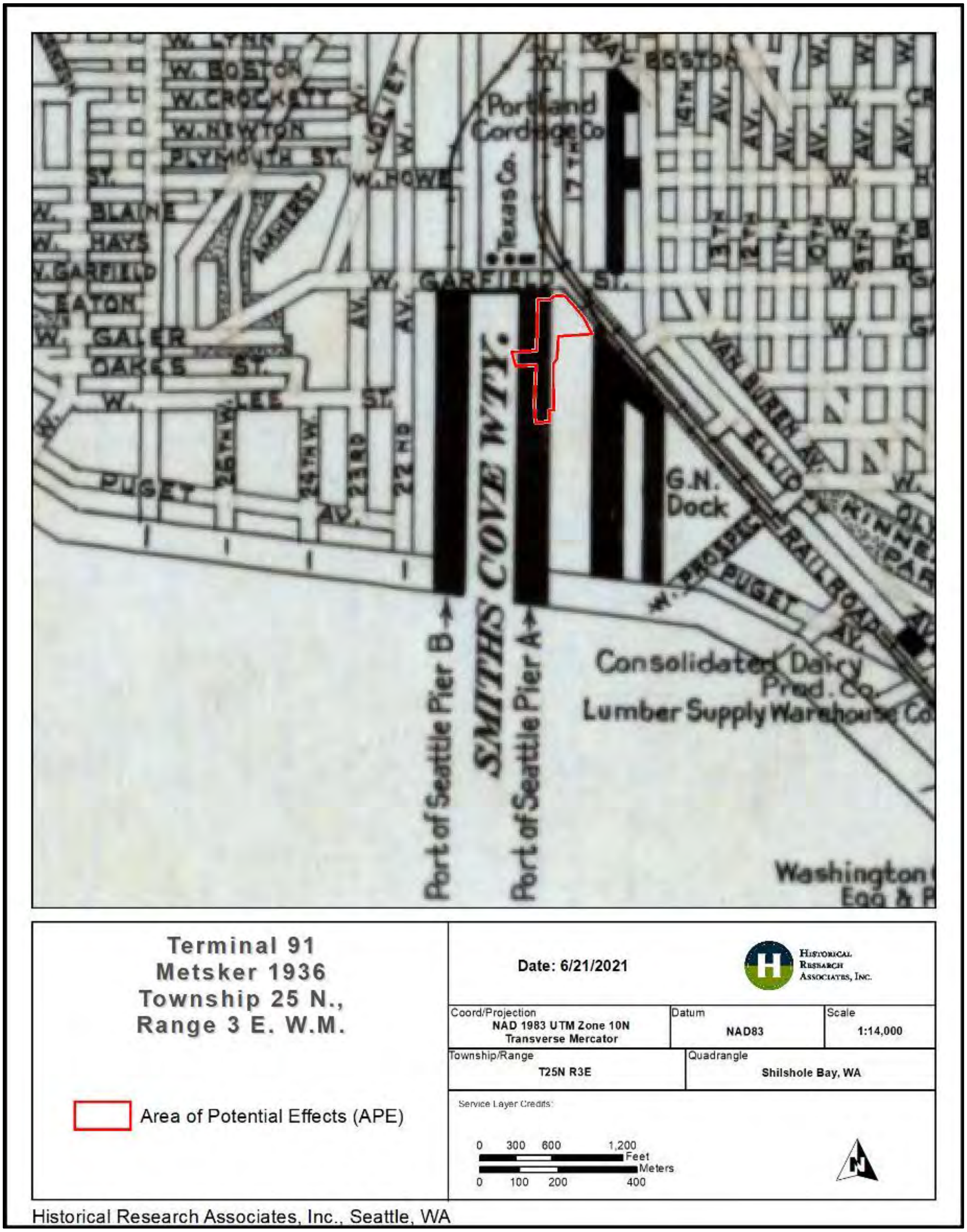

Figure A-20. Township 25 N., Range 3 E., Seattle - Northwest, Fort Lawton, Interbay, Ballard.

Figure A-21. 1936 aerial photograph.

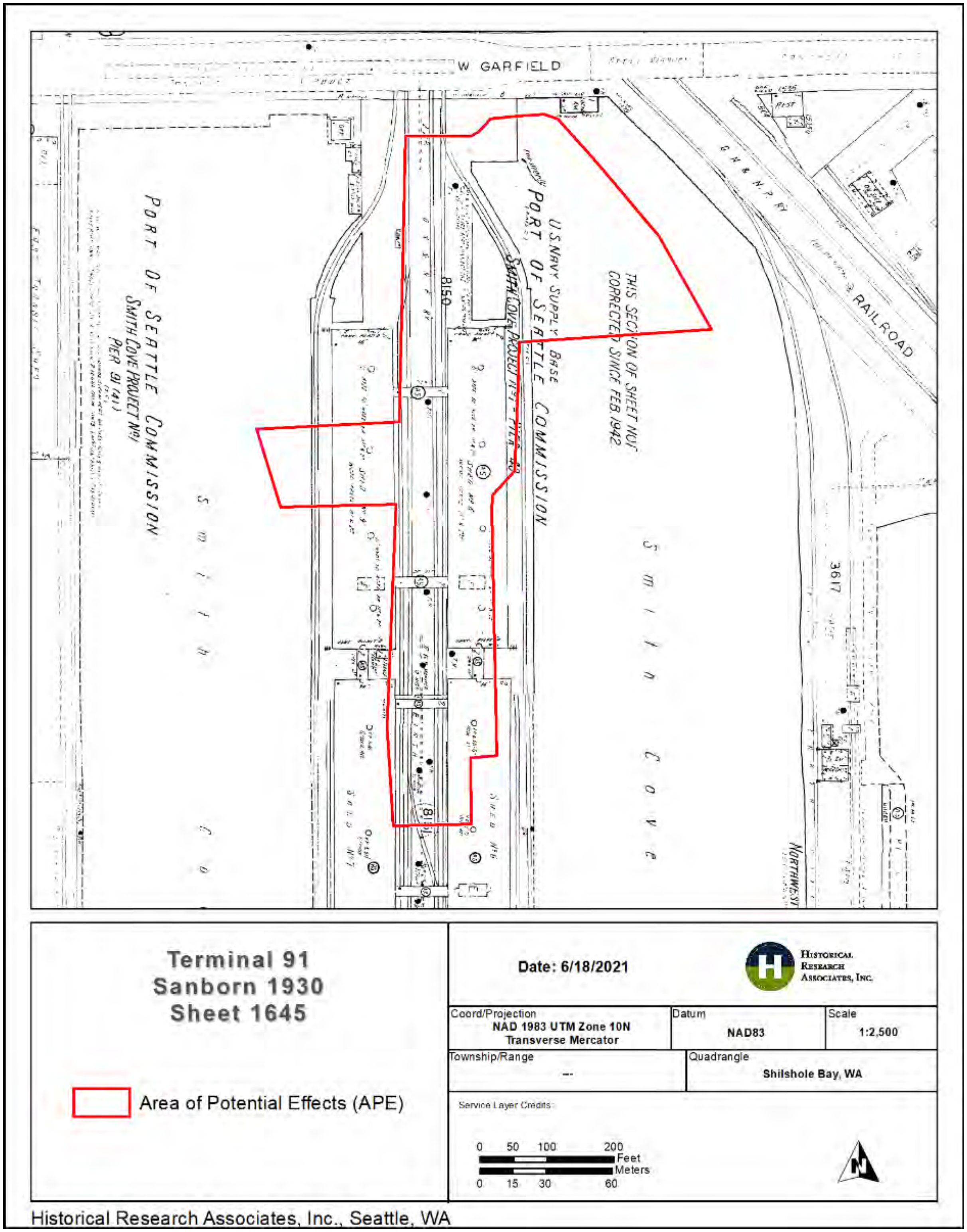

Figure A-22. 1942 Sanborn Fire Insurance Map.

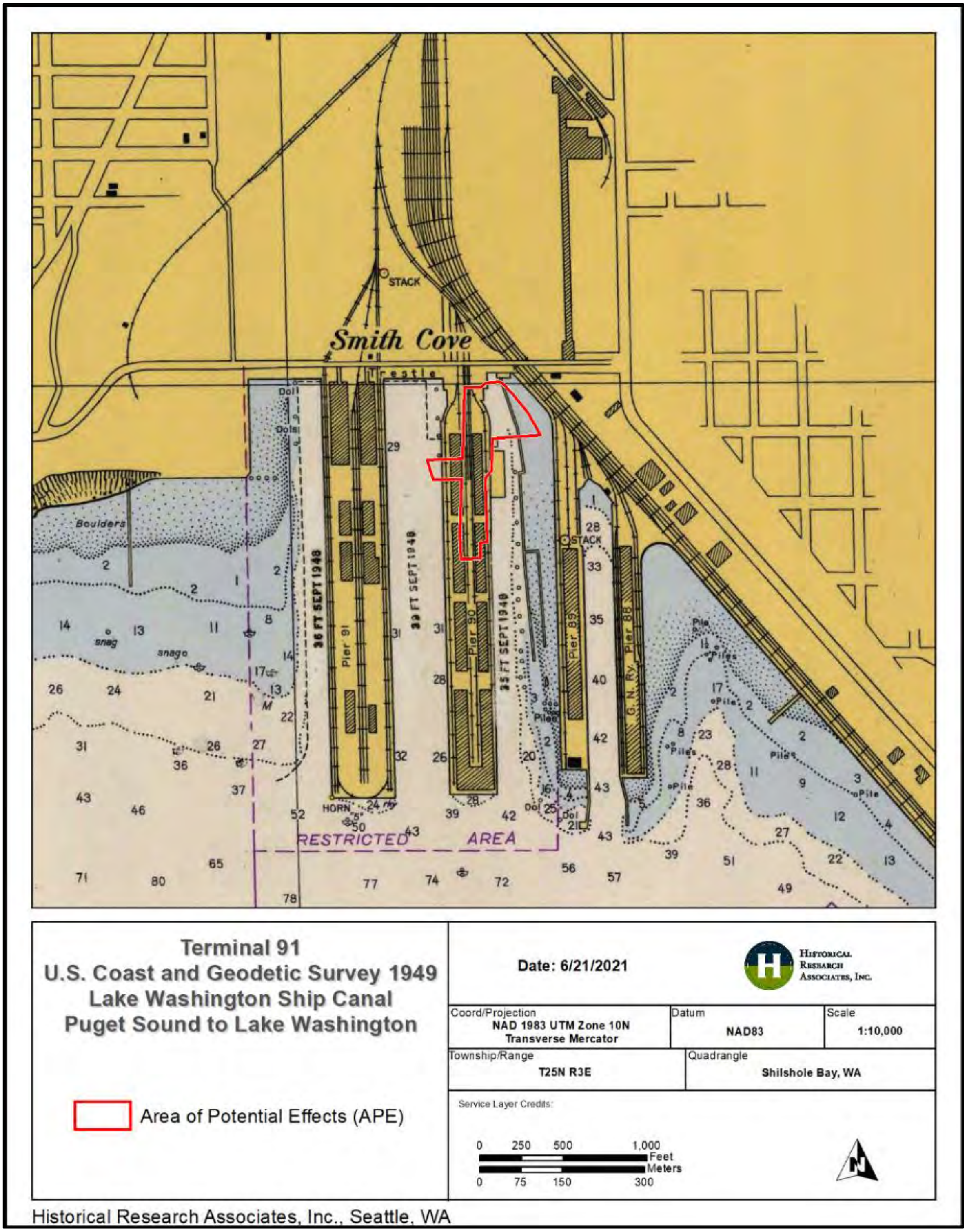

Figure A-23. 1949 Lake Washington Ship Canal.

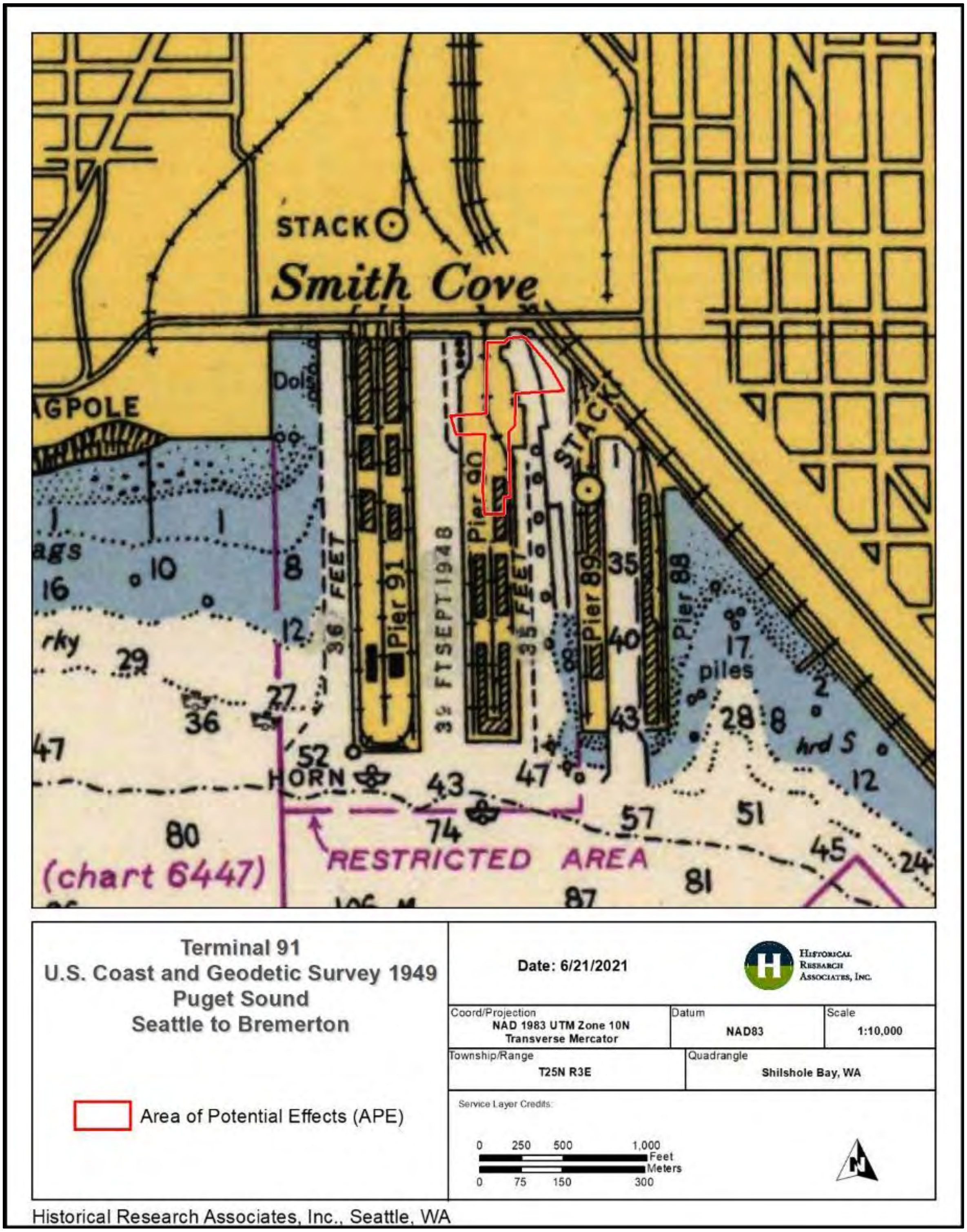

Figure A-24. 1949 Seattle to Bremerton.

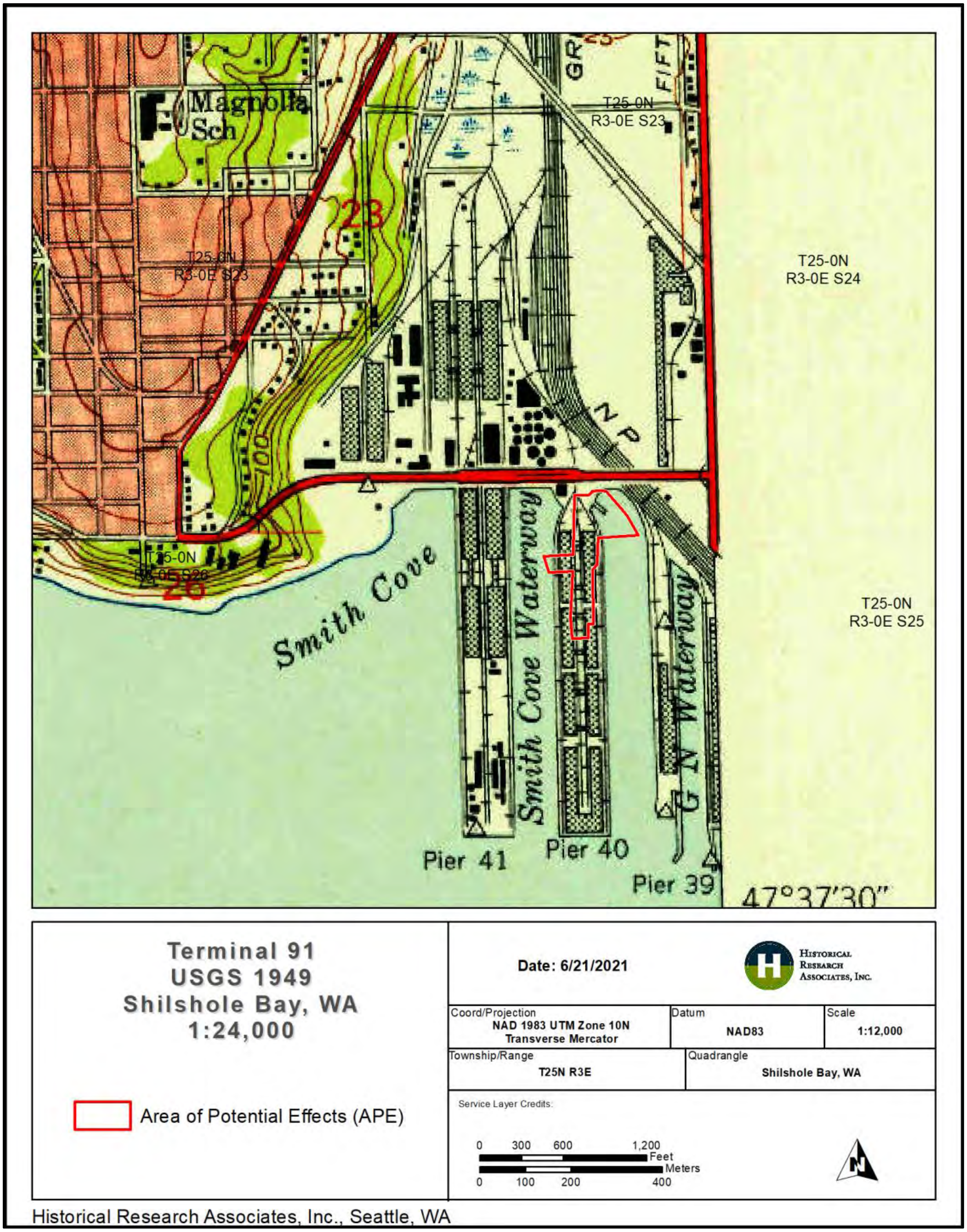

Figure A-25. 1949 Shilshole Bay Quadrangle.

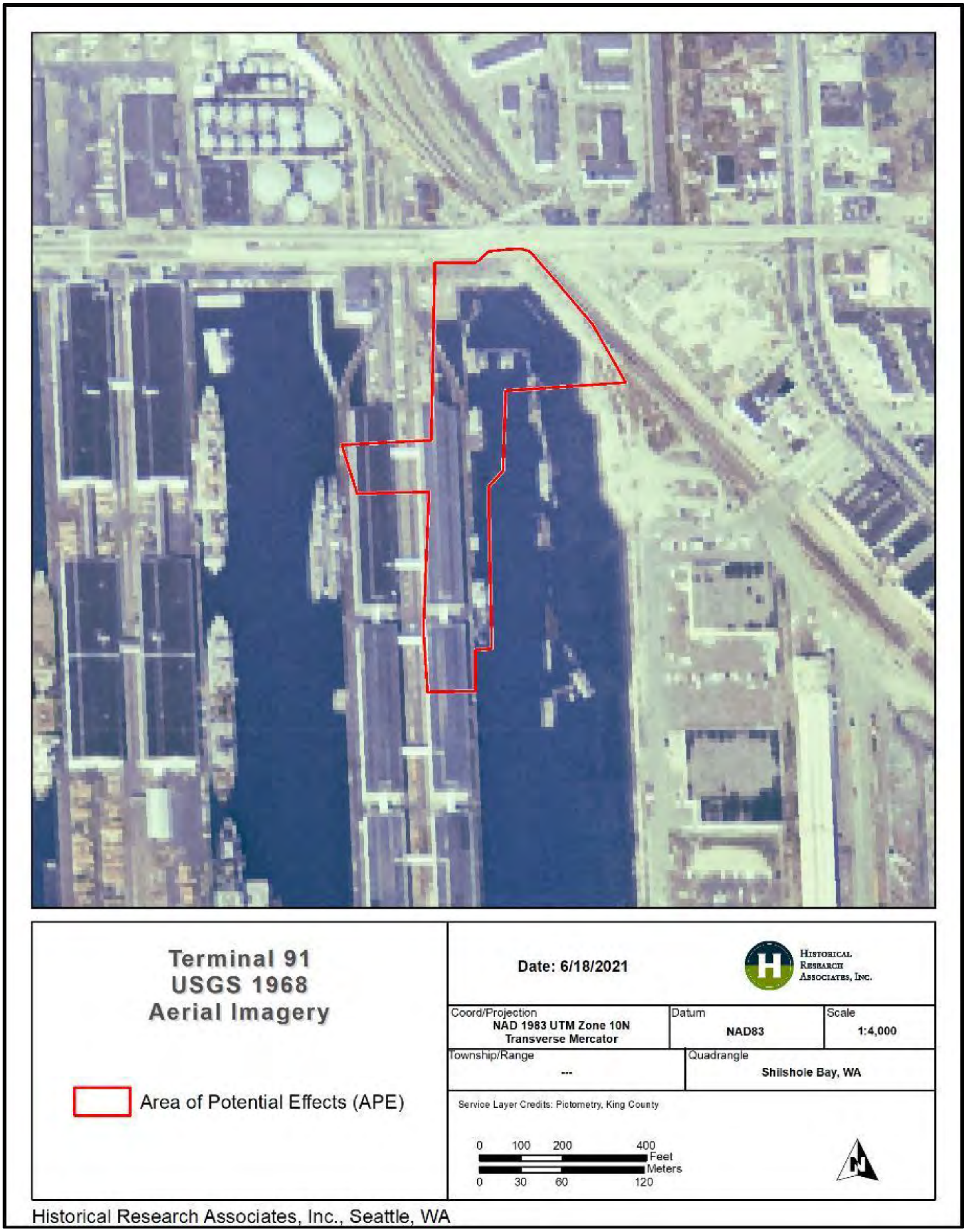

Figure A-26. 1968 aerial photograph.

Figure A-27. 1977 aerial photograph.

Confidential Appendix B. HRA-3306.01-1 Archaeological Site Form

Appendix C. Historic Property Inventory Forms

Historic Property Report

Resource Name: Pier 90 Property ID: 725037

Location

Address: 2001 W Garfield St, Seattle, Washington, 98119

Tax No/Parcel No: 7666201516

Geographic Areas: Seattle Certified Local Government, SHILSHOLE BAY Quadrangle, King County

Information

Number of stories: N/A

Construction Dates:

Construction Type	Year	Circa
Built Date	1913	☐

Historic Use:

Category	Subcategory
Transportation	Transportation - Water-Related
Transportation	Transportation - Water-Related

Historic Context:

Category
Maritime - Trade and Commerce

Architect/Engineer:

Category	Name or Company

Thematics:

Local Registers and Districts

Name	Date Listed	Notes

Project History

Project Number, Organization, Project Name	Resource Inventory	SHPO Determination	SHPO Determined By, Determined Date
2021-06-03984, , Terminal 91 Berths 6 and 8 Redevelopment	6/29/2021	Survey/Inventory	

Photos

Pier 90 within the APE, view northeast

Pier 90 buildings within the APE to be demolished, view northwest

Pier 90 floating within the APE, view northeast

Pier 90 floating dock within the APE, view south

Pier 90 paved railroad spur within APE, view southeast

Pier 90 former railroad spur within APE, view northeast

Pier 90 within the APE showing pier substructure, view west

Inventory Details - 6/29/2021

Common name:	
Date recorded:	6/29/2021
Field Recorder:	Lauren Waldroop
Field Site number:	
SHPO Determination	

Detail Information

Characteristics:

Category	Item
Foundation	Post & Pier
Plan	Rectangle
Cladding	Asphalt - Rolled
Structural System	Log

Styles:

Period	Style Details
No Style	No Style

Surveyor Opinion

Significance narrative:

Integrity

As shown through various maps, the area of Pier 90 within the APE has been substantially altered since 1913. The Navy widened the pier and constructed a new railroad spur in 1942, which was later paved. Under the Navy's ownership, buildings were removed, and new ones constructed that occupied much of the pier. These buildings have since been removed and, within the APE, seven metal-frame buildings were constructed in the late 1990s, which are slated to be demolished as part of the project.

From its period of construction (1913), the pier features integrity of location, as it remains on its original site. The waterfront has been filled and altered with various waterfront and roadway projects associated with military operations, shipping, tourist traffic (how the pier has been used in recent years), and the pier no longer retains integrity of setting. Further, due to changes in ownership and use, the pier has undergone extensive alterations within the APE, including widening, addition of a railroad spur, abandonment of that spur, and the construction and removal of buildings. Therefore, the pier does not retain integrity of design, materials, workmanship, and feeling. Additionally, Pier 90 has changed ownership and use several times since it was constructed, and no longer retains integrity of association.

Evaluation

Pier 90 was constructed in 1913 and was primarily used for loading and unloading shipments. During World War II, the pier was used by the U.S. Navy for "extensive naval craft mooring, repair, and deactivation activities" (Windward 2017:10). While the naval station does not appear to have been associated with a significant World War II mission, it was used to supply and repair ships. The Navy sold the pier to the Port of Seattle in 1976. Pier 90 is associated as a significant contributor to World War II naval activity in the Puget Sound (Criterion A). Preliminary research did not reveal any association of the resource with the lives of significant persons (Criterion B). The resource does embody the characteristics of a city pier; however, it no longer conveys its historic use for shipping along the railway, as all railroad spurs have been removed. The resource does not embody the distinctive characteristics of period or method of construction; or represent the work of a master; or possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction (i.e., is part of a district) (Criterion C). Finally, the resource was built of common construction methods and well-known materials and is unlikely to answer important research questions or yield information about human history that can only be answered by the actual physical material, design, construction methods, or interrelation of these resources (Criterion D). While Pier 90 is significant for its association with naval activity in the Puget Sound during World War II, due to substantial alterations the pier no longer conveys that significance. Historical Research Associates recommends Pier 90 within the project APE does not retain sufficient integrity from its period of construction (1913) and does not qualify for listing in the National Register of Historic Places under any criteria.

Physical description:

Originally constructed in 1913, Pier 90 is one of two piers located within Terminal 91. Pier 90 is approximately 2,540 ft long and 300 ft wide, with two larger buildings at the south end (outside of the APE). Only a portion of Pier 90 is located within the APE for the Project. Within the APE, Pier 90 is paved in asphalt and is supported by wood piers and beams. Some areas of the substructure are concealed by corrugated metal. The eastern edge of the pier within the APE includes a former railroad spur that was abandoned and paved over. On the east side of the pier within the APE are two floating docks, one of which contains a metal-framed boathouse. According to Port of Seattle staff, the boathouse was constructed in 2018 to replace an earlier boathouse constructed in the 1980s.

Additional buildings on Pier 90 include warehouse and office buildings constructed in the 1990s and located on the edge of the APE. They are generally rectangular, clad in T1-11, with side-gabled roofs. None of these buildings are 45 years old or older.

Bibliography:

Windward Environmental LLC (Windward)
2017 T-91 Historical Review Report. Windward Environmental LLC., Seattle, Washington. Prepared for the Port of Seattle.

Historic Property Report

Resource Name: Pier 90 Railroad Spur

Property ID: 725039

Location

Address: 2001 W Garfield St, Seattle, Washington, 98119

Tax No/Parcel No: 7666201516

Information

Number of stories: N/A

Construction Dates:

Construction Type	Year	Circa
	1942	☐
Built Date	1942	☐

Historic Use:

Category	Subcategory
Transportation	Transportation - Rail-Related
Transportation	Transportation - Rail-Related

Historic Context:

Category
Transportation

Architect/Engineer:

Category	Name or Company

Thematics:

Local Registers and Districts

Name	Date Listed	Notes

Project History

Project Number, Organization, Project Name	Resource Inventory	SHPO Determination	SHPO Determined By, Determined Date
2021-06-03984, , Terminal 91 Berths 6 and 8 Redevelopment	6/29/2021	Survey/Inventory	

Photos

Pier 90 Railroad Spur within the APE, view northeast.

Pier 90 Railroad Spur substructure within APE, view northwest

Pier 90 Railroad Spur metal post within APE, view northeast

Pier 90 Railroad Spur wood bumpers within APE, view north

Pier 90 Railroad Spur within the APE, view north.

Historic Property Report

Resource Name: Pier 90 Railroad Spur

Property ID: 725039

Inventory Details - 6/29/2021

Common name:	
Date recorded:	6/29/2021
Field Recorder:	Lauren Waldroop
Field Site number:	
SHPO Determination	

Detail Information

Characteristics:

Category	Item
Foundation	Post & Pier
Cladding	Asphalt - Rolled
Structural System	Log
Plan	Irregular

Styles:

Period	Style Details
No Style	No Style

Surveyor Opinion

Significance narrative:

Integrity

From its period of construction (1942), the railroad spur features integrity of location. Pier 90 has changed ownership and use since the railroad spur was constructed, and the spur no longer retains integrity of setting and association. Further, alterations within the APE include abandonment of the spur and paving, leading to a loss of integrity of design, materials, workmanship, and feeling.

Evaluation

Pier 90 was constructed in 1942 as part of U.S. Navy improvements to Pier 90. During World War II, the pier was used by the U.S. Navy for “extensive naval craft mooring, repair, and deactivation activities” (Windward 2017:10). While the naval station does not appear to have been associated with a significant World War II mission, it was used to supply and repair ships. The railroad spurs were used to ship materials in and out of the piers. The Navy sold the pier to the Port of Seattle in 1976. Pier 90 is associated as a significant contributor to World War II naval activity in the Puget Sound (Criterion A). Preliminary research did not reveal any association of the resource with the lives of significant persons (Criterion B). Due to the abandonment of the spur and its subsequent paving, the resource does not embody the distinctive characteristics of a type, period, or method of railroad spur or trestle construction; or represent the work of a master; or possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction (i.e., is part of a district) (Criterion C). Finally, the resource was built of common construction methods and well-known materials and is unlikely to answer important research questions or yield information about human history that can only be answered by the actual physical material, design, construction methods, or interrelation of these resources (Criterion D).

While Pier 90 is significant for its association with naval activity in the Puget Sound during World War II, the railroad spur has been abandoned and paved and therefore, no longer conveys that significance. Historical Research Associates recommends Pier 90 Railroad Spur within the project APE does not retain sufficient integrity from its period of construction (1942) and does not qualify for listing in the National Register of Historic Places under any criteria.

Physical description:

Built in 1942, the Pier 90 railroad spur was one of several spur lines once located on Pier 90 (Sanborn 1942). This railroad spur follows the eastern edge of the pier and is approximately 880 ft long. The Navy had paved the spur by 1969, and it is currently used to access two floating docks on the eastern edge of Pier 90 within the project APE. Along the spur are several wood bumpers and metal posts. It is unclear if the Navy fully removed the railroad tracks, and the tracks may still be in place. The wood support piers and trestle are still present.

Bibliography:

Sanborn Map & Publishing Company (Sanborn)

1942 Insurance Maps of Seattle, Washington. Sanborn Map & Publishing Company, New York.

Windward Environmental LLC (Windward)

2017 T-91 Historical Review Report. Windward Environmental LLC., Seattle, Washington. Prepared for the Port of Seattle.

Appendix D

GREENHOUSE GAS EMISSIONS WORKSHEET

City of Seattle Department of Planning and Development
SEPA GHG Emissions Worksheet
Version 1.7 12/26/07

Introduction
The Washington State Environmental Policy Act (SEPA) requires environmental review of development proposals that may have a significant adverse impact on the environment. If a proposed development is subject to SEPA, the project proponent is required to complete the SEPA Checklist. The Checklist includes questions relating to the development's air emissions. The emissions that have traditionally been considered cover smoke, dust, and industrial and automobile emissions. With our understanding of the climate change impacts of GHG emissions, the City of Seattle requires the applicant to also estimate these emissions.

Emissions created by Development
GHG emissions associated with development come from multiple sources:

- The extraction, processing, transportation, construction and disposal of materials and landscape disturbance (Embodied Emissions)
- Energy demands created by the development after it is completed (Energy Emissions)
- Transportation demands created by the development after it is completed (Transportation Emissions)

GHG Emissions Worksheet
This GHG Emissions Worksheet has been developed to assist applicants in answering the SEPA Checklist question relating to GHG emissions. The worksheet was originally developed by King County, but the City of Seattle and King County are working together on future updates to maintain consistency of methodologies across jurisdictions.

The SEPA GHG Emissions worksheet estimates all GHG emissions that will be created over the life span of a project. This includes emissions associated with obtaining construction materials, fuel used during construction, energy consumed during a buildings operation, and transportation by building occupants.

Using the Worksheet
1. Descriptions of the different residential and commercial building types can be found on the second tabbed worksheet ("Definition of Building Types"). If a development proposal consists of multiple projects, e.g. both single family and multi-family residential structures or a commercial development that consists of more than on type of commercial activity, the appropriate information should be estimated for each type of building or activity.

2. For paving, estimate the total amount of paving (in thousands of square feet) of the project.

3. The Worksheet will calculate the amount of GHG emissions associated with the project and display the amount in the "Total Emissions" column on the worksheet. The applicant should use this information when completing the SEPA checklist.

4. The last three worksheets in the Excel file provide the background information that is used to calculate the total GHG emissions.

5. The methodology of creating the estimates is transparent; if there is reason to believe that a better estimate can be obtained by changing specific values, this can and should be done. Changes to the values should be documented with an explanation of why and the sources relied upon.

6. Print out the “Total Emissions” worksheet and attach it to the SEPA checklist. If the applicant has made changes to the calculations or the values, the documentation supporting those changes should also be attached to the SEPA checklist.

Terminal 91 Berth 6 and 8 Redevelopment Project

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions Per Unit or Per Thousand Square Feet (MTCO2e) Embodied	Energy	Transportation	Lifespan Emissions (MTCO2e)
Single-Family Home............................	0		98	672	792	0
Multi-Family Unit in Large Building	0		33	357	766	0
Multi-Family Unit in Small Building	0		54	681	766	0
Mobile Home.......................................	0		41	475	709	0
Education		0.0	39	646	361	0
Food Sales		0.0	39	1,541	282	0
Food Service		0.0	39	1,994	561	0
Health Care Inpatient		0.0	39	1,938	582	0
Health Care Outpatient		0.0	39	737	571	0
Lodging		0.0	39	777	117	0
Retail (Other Than Mall)........................		0.0	39	577	247	0
Office		12.0	39	723	588	16192
Public Assembly		0.0	39	733	150	0
Public Order and Safety		0.0	39	899	374	0
Religious Worship		0.0	39	339	129	0
Service		0.0	39	599	266	0
Warehouse and Storage		3.0	39	352	181	1715
Other		0.0	39	1,278	257	0
Vacant		0.0	39	162	47	0

Section II: Pavement..........................

Pavement...		0.00				0

Total Project Emissions: **17907**

Version 1.7 12/26/07

Definition of Building Types

Type (Residential) or Principal Activity (Commercial)	**Description**
Single-Family Home.................................	Unless otherwise specified, this includes both attached and detached buildings
Multi-Family Unit in Large Building	Apartments in buildings with more than 5 units
Multi-Family Unit in Small Building	Apartments in building with 2-4 units
Mobile Home..	
Education	Buildings used for academic or technical classroom instruction, such as elementary, middle, or high schools, and classroom buildings on college or university campuses. Buildings on education campuses for which the main use is not classroom are included in the category relating to their use. For example, administration buildings are part of "Office," dormitories are "Lodging," and libraries are "Public Assembly."
Food Sales	Buildings used for retail or wholesale of food.
Food Service	Buildings used for preparation and sale of food and beverages for consumption.
Health Care Inpatient	Buildings used as diagnostic and treatment facilities for inpatient care.
Health Care Outpatient	Buildings used as diagnostic and treatment facilities for outpatient care. Doctor's or dentist's office are included here if they use any type of diagnostic medical equipment (if they do not, they are categorized as an office building).
Lodging	Buildings used to offer multiple accommodations for short-term or long-term residents, including skilled nursing and other residential care buildings.
Retail (Other Than Mall)...........................	Buildings used for the sale and display of goods other than food.
Office	Buildings used for general office space, professional office, or administrative offices. Doctor's or dentist's office are included here if they do not use any type of diagnostic medical equipment (if they do, they are categorized as an outpatient health care building).
Public Assembly	Buildings in which people gather for social or recreational activities, whether in private or non-private meeting halls.
Public Order and Safety	Buildings used for the preservation of law and order or public safety.
Religious Worship	Buildings in which people gather for religious activities, (such as chapels, churches, mosques, synagogues, and temples).
Service	Buildings in which some type of service is provided, other than food service or retail sales of goods
Warehouse and Storage	Buildings used to store goods, manufactured products, merchandise, raw materials, or personal belongings (such as self-storage).
Other	Buildings that are industrial or agricultural with some retail space; buildings having several different commercial activities that, together, comprise 50 percent or more of the floorspace, but whose largest single activity is agricultural, industrial/ manufacturing, or residential; and all other miscellaneous buildings that do not fit into any other category.
Vacant	Buildings in which more floorspace was vacant than was used for any single commercial activity at the time of interview. Therefore, a vacant building may have some occupied floorspace.

Sources: ....

Residential 2001 Residential Energy Consumption Survey
Square footage measurements and comparisons
http://www.eia.doe.gov/emeu/recs/sqft-measure.html

Commercial Commercial Buildings Energy Consumption Survey (CBECS),
Description of CBECS Building Types
http://www.eia.doe.gov/emeu/cbecs/pba99/bldgtypes.html

Embodied Emissions Worksheet

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# thousand sq feet/ unit or building	Life span related embodied GHG missions (MTCO2e/ unit)	Life span related embodied GHG missions (MTCO2e/ thousand square feet) - See calculations in table below
Single-Family Home..............................	2.53	98	39
Multi-Family Unit in Large Building	0.85	33	39
Multi-Family Unit in Small Building	1.39	54	39
Mobile Home.......................................	1.06	41	39
Education	25.6	991	39
Food Sales	5.6	217	39
Food Service	5.6	217	39
Health Care Inpatient	241.4	9,346	39
Health Care Outpatient	10.4	403	39
Lodging	35.8	1,386	39
Retail (Other Than Mall).........................	9.7	376	39
Office	14.8	573	39
Public Assembly	14.2	550	39
Public Order and Safety	15.5	600	39
Religious Worship	10.1	391	39
Service	6.5	252	39
Warehouse and Storage	16.9	654	39
Other	21.9	848	39
Vacant	14.1	546	39

Section II: Pavement............................

All Types of Pavement...........................			50

	Columns and Beams	Intermediate Floors	Exterior Walls	Windows	Interior Walls	Roofs	Total Embodied Emissions (MTCO2e)	Total Embodied Emissions (MTCO2e/ thousand sq feet)
Average GWP (lbs CO2e/sq ft): Vancouver, Low Rise Building	5.3	7.8	19.1	51.2	5.7	21.3		
Average Materials in a 2,272-square foot single family home	0.0	2269.0	3206.0	285.0	6050.0	3103.0		
MTCO2e	0.0	8.0	27.8	6.6	15.6	30.0	88.0	38.7

Sources

All data in black text — King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov

Residential floorspace per unit — 2001 Residential Energy Consumption Survey (National Average, 2001)
Square footage measurements and comparisons
http://www.eia.doe.gov/emeu/recs/sqft-measure.html

Floorspace per building — EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003)
Table C3. Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003
http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003excel/c3.xls

Average GWP (lbs CO2e/sq ft): Vancouver, Low Rise Building — Athena EcoCalculator
Athena Assembly Evaluation Tool v2.3- Vancouver Low Rise Building
Assembly Average GWP (kg) per square meter
http://www.athenasmi.ca/tools/ecoCalculator/index.html

Lbs per kg	2.20
Square feet per square meter	10.76

Average Materials in a 2,272-square foot single family home — Buildings Energy Data Book: 7.3 Typical/Average Household
Materials Used in the Construction of a 2,272-Square-Foot Single-Family Home, 2000
http://buildingsdatabook.eren.doe.gov/?id=view_book_table&TableID=2036&t=xls
See also: NAHB, 2004 Housing Facts, Figures and Trends, Feb. 2004, p. 7.

Average window size — Energy Information Administration/Housing Characteristics 1993
Appendix B, Quality of the Data. Pg. 5.
ftp://ftp.eia.doe.gov/pub/consumption/residential/rx93hcf.pdf

Pavement Emissions Factors
MTCO2e/thousand square feet of asphalt
or concrete pavement 50 (see below)

Embodied GHG Emissions……………………Worksheet Background Information

Buildings
Embodied GHG emissions are emissions that are created through the extraction, processing, transportation, construction and disposal of building materials as well as emissions created through landscape disturbance (by both soil disturbance and changes in above ground biomass).

Estimating embodied GHG emissions is new field of analysis; the estimates are rapidly improving and becoming more inclusive of all elements of construction and development.

The estimate included in this worksheet is calculated using average values for the main construction materials that are used to create a typical family home. In 2004, the National Association of Home Builders calculated the average materials that are used in a typical 2,272 square foot single-family household. The quantity of materials used is then multiplied by the average GHG emissions associated with the life-cycle GHG emissions for each material.

This estimate is a rough and conservative estimate; the actual embodied emissions for a project are likely to be higher. For example, at this stage, due to a lack of comprehensive data, the estimate does not include important factors such as landscape disturbance or the emissions associated with the interior components of a building (such as furniture).

King County realizes that the calculations for embodied emissions in this worksheet are rough. For example, the emissions associated with building 1,000 square feet of a residential building will not be the same as 1,000 square feet of a commercial building. However, discussions with the construction community indicate that while there are significant differences between the different types of structures, this method of estimation is reasonable; it will be improved as more data become available.

Additionally, if more specific information about the project is known, King County recommends two online embodied emissions calculators that can be used to obtain a more tailored estimate for embodied emissions: www.buildcarbonneutral.org and www.athenasmi.ca/tools/ecoCalculator/.

Pavement
Four recent life cycle assessments of the environmental impacts of roads form the basis for the per unit embodied emissions of pavement. Each study is constructed in slightly different ways; however, the aggregate results of the reports represent a reasonable estimate of the GHG emissions that are created from the manufacture of paving materials, construction related emissions, and maintenance of the pavement over its expected life cycle. For specifics, see the worksheet.

Special Section: Estimating the Embodied Emissions for Pavement

Four recent life cycle assessments of the environmental impacts of roads form the basis for the per unit embodied emissions of pavement. Each study is constructed in slightly different ways; however, the aggregate results of the reports represent a reasonable estimate of the GHG emissions that are created from the manufacture of paving materials, construction related emissions, and maintenance of the pavement over its expected life cycle.

The results of the studies are presented in different units and measures; considerable effort was undertaken to be able to compare the results of the studies in a reasonable way. For more details about the below methodology, contact matt.kuharic@kingcounty.gov.

The four studies, Meil (2001), Park (2003), Stripple (2001) and Treolar (2001) produced total GHG emissions of 4-34 MTCO2e per thousand square feet of finished paving (for similar asphalt and concrete based pavements). This estimate does not including downstream maintenance and repair of the highway. The average (for all concrete and asphalt pavements in the studies, assuming each study gets one data point) is ~17 MTCO2e/thousand square feet.

Three of the studies attempted to thoroughly account for the emissions associated with long term maintenance (40 years) of the roads. Stripple (2001), Park et al. (2003) and Treolar (2001) report 17, 81, and 68 MTCO2e/thousand square feet, respectively, after accounting for maintenance of the roads.

Based on the above discussion, King County makes the conservative estimate that 50 MTCO2e/thousand square feet of pavement (over the development's life cycle) will be used as the embodied emission factor for pavement until better estimates can be obtained. This is roughly equivalent to 3,500 MTCO2e per lane mile of road (assuming the lane is 13 feet wide).

It is important to note that these studies estimate the embodied emissions for roads. Paving that does not need to stand up to the rigors of heavy use (such as parking lots or driveways) would likely use less materials and hence have lower embodied emissions.

Sources:
Meil, J. A Life Cycle Perspective on Concrete and Asphalt Roadways: Embodied Primary Energy and Global Warming Potential. 2006. Available: http://www.cement.ca/cement.nsf/eee9ec7bbd630126852566c40052107b/6ec79dc8ae03a782852572b90061b914/$FILE/ATTK0WE3/athena%20report%20Feb.%202%202007.pdf

Park, K, Hwang, Y., Seo, S., M.ASCE, and Seo, H. , "Quantitative Assessment of Environmental Impacts on Life Cycle of Highways," Journal of Construction Engineering and Management , Vol 129, January/February 2003, pp 25-31, (DOI: 10.1061/(ASCE)0733-9364(2003)129:1(25)).

Stripple, H. Life Cycle Assessment of Road. A Pilot Study for Inventory Analysis. Second Revised Edition. IVL Swedish Environmental Research Institute Ltd. 2001. Available: http://www.ivl.se/rapporter/pdf/B1210E.pdf

Treloar, G., Love, P.E.D., and Crawford, R.H. Hybrid Life-Cycle Inventory for Road Construction and Use. Journal of Construction Engineering and Management. P. 43-49. January/February 2004.

Energy Emissions Worksheet

Type (Residential) or Principal Activity (Commercial)	Energy consumption per building per year (million Btu)	Carbon Coefficient for Buildings	MTCO2e per building per year	Floorspace per Building (thousand square feet)	MTCE per thousand square feet per year	MTCO2e per thousand square feet per year	Average Building Life Span	Lifespan Energy Related MTCO2e emissions per unit	Lifespan Energy Related MTCO2e emissions per thousand square feet
Single-Family Home............................	107.3	0.108	11.61	2.53	4.6	16.8	57.9	672	266
Multi-Family Unit in Large Building	41.0	0.108	4.44	0.85	5.2	19.2	80.5	357	422
Multi-Family Unit in Small Building	78.1	0.108	8.45	1.39	6.1	22.2	80.5	681	489
Mobile Home..	75.9	0.108	8.21	1.06	7.7	28.4	57.9	475	448
Education	2,125.0	0.124	264.2	25.6	10.3	37.8	62.5	16,526	646
Food Sales	1,110.0	0.124	138.0	5.6	24.6	90.4	62.5	8,632	1,541
Food Service	1,436.0	0.124	178.5	5.6	31.9	116.9	62.5	11,168	1,994
Health Care Inpatient	60,152.0	0.124	7,479.1	241.4	31.0	113.6	62.5	467,794	1,938
Health Care Outpatient	985.0	0.124	122.5	10.4	11.8	43.2	62.5	7,660	737
Lodging	3,578.0	0.124	444.9	35.8	12.4	45.6	62.5	27,826	777
Retail (Other Than Mall).......................	720.0	0.124	89.5	9.7	9.2	33.8	62.5	5,599	577
Office	1,376.0	0.124	171.1	14.8	11.6	42.4	62.5	10,701	723
Public Assembly	1,338.0	0.124	166.4	14.2	11.7	43.0	62.5	10,405	733
Public Order and Safety	1,791.0	0.124	222.7	15.5	14.4	52.7	62.5	13,928	899
Religious Worship	440.0	0.124	54.7	10.1	5.4	19.9	62.5	3,422	339
Service	501.0	0.124	62.3	6.5	9.6	35.1	62.5	3,896	599
Warehouse and Storage	764.0	0.124	95.0	16.9	5.6	20.6	62.5	5,942	352
Other	3,600.0	0.124	447.6	21.9	20.4	74.9	62.5	27,997	1,278
Vacant	294.0	0.124	36.6	14.1	2.6	9.5	62.5	2,286	162

Sources

All data in black text	King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov
Energy consumption for residential buildings	2007 Buildings Energy Data Book: 6.1 Quad Definitions and Comparisons (National Average, 2001) Table 6.1.4: Average Annual Carbon Dioxide Emissions for Various Functions http://buildingsdatabook.eren.doe.gov/ Data also at: http://www.eia.doe.gov/emeu/recs/recs2001_ce/ce1-4c_housingunits2001.html
Energy consumption for commercial buildings and Floorspace per building	EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003) Table C3. Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003 http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003excel/c3.xls
	Note: Data in plum color is found in both of the above sources (buildings energy data book and commercial buildings energy consumption survey).
Carbon Coefficient for Buildings	Buildings Energy Data Book (National average, 2005) Table 3.1.7. 2005 Carbon Dioxide Emission Coefficients for Buildings (MMTCE per Quadrillion Btu) http://buildingsdatabook.eere.energy.gov/?id=view_book_table&TableID=2057 Note: Carbon coefficient in the Energy Data book is in MTCE per Quadrillion Btu. To convert to MTCO2e per million Btu, this factor was divided by 1000 and multiplied by 44/12.
Residential floorspace per unit	2001 Residential Energy Consumption Survey (National Average, 2001) Square footage measurements and comparisons http://www.eia.doe.gov/emeu/recs/sqft-measure.html

average lief span of buildings, estimated by replacement time method

	Single Family Homes	Multi-Family Units in Large and Small Buildings	All Residential Buildings	
New Housing Construction, 2001	1,273,000	329,000	1,602,000	
Existing Housing Stock, 2001	73,700,000	26,500,000	100,200,000	
Replacement time:	57.9	80.5	62.5	(national average, 2001)

Note: Single family homes calculation is used for mobile homes as a best estimate life span.
Note: At this time, KC staff could find no reliable data for the average life span of commercial buildings.
Therefore, the average life span of residential buildings is being used until a better approximation can be ascertained.

Sources:

New Housing Construction, 2001 **Quarterly Starts and Completions by Purpose and Design - US and Regions (Excel)**
http://www.census.gov/const/quarterly_starts_completions_cust.xls
See also: http://www.census.gov/const/www/newresconstindex.html

Existing Housing Stock, 2001 **Residential Energy Consumption Survey (RECS) 2001**
Tables HC1:Housing Unit Characteristics, Million U.S. Households 2001
Table HC1-4a. Housing Unit Characteristics by Type of Housing Unit, Million U.S. Households, 2001
Million U.S. Households, 2001
http://www.eia.doe.gov/emeu/recs/recs2001/hc_pdf/housunits/hc1-4a_housingunits2001.pdf

Transportation Emissions Worksheet

Type (Residential) or Principal Activity (Commercial)	# people/ unit or building	# thousand sq feet/ unit or building	# people or employees/ thousand square feet	vehicle related GHG emissions (metric tonnes CO2e per person per year)	MTCO2e/ year/ unit	MTCO2e/ year/ thousand square feet	Average Building Life Span	Life span transportation related GHG emissions (MTCO2e/ per unit)	Life span transportation related GHG emissions (MTCO2e/ thousand sq feet)
Single-Family Home................................	2.8	2.53	1.1	4.9	13.7	5.4	57.9	792	313
Multi-Family Unit in Large Building	1.9	0.85	2.3	4.9	9.5	11.2	80.5	766	904
Multi-Family Unit in Small Building	1.9	1.39	1.4	4.9	9.5	6.8	80.5	766	550
Mobile Home..	2.5	1.06	2.3	4.9	12.2	11.5	57.9	709	668
Education	30.0	25.6	1.2	4.9	147.8	5.8	62.5	9247	361
Food Sales	5.1	5.6	0.9	4.9	25.2	4.5	62.5	1579	282
Food Service	10.2	5.6	1.8	4.9	50.2	9.0	62.5	3141	561
Health Care Inpatient	455.5	241.4	1.9	4.9	2246.4	9.3	62.5	140506	582
Health Care Outpatient	19.3	10.4	1.9	4.9	95.0	9.1	62.5	5941	571
Lodging	13.6	35.8	0.4	4.9	67.1	1.9	62.5	4194	117
Retail (Other Than Mall)...........................	7.8	9.7	0.8	4.9	38.3	3.9	62.5	2394	247
Office	28.2	14.8	1.9	4.9	139.0	9.4	62.5	8696	588
Public Assembly	6.9	14.2	0.5	4.9	34.2	2.4	62.5	2137	150
Public Order and Safety	18.8	15.5	1.2	4.9	92.7	6.0	62.5	5796	374
Religious Worship	4.2	10.1	0.4	4.9	20.8	2.1	62.5	1298	129
Service	5.6	6.5	0.9	4.9	27.6	4.3	62.5	1729	266
Warehouse and Storage	9.9	16.9	0.6	4.9	49.0	2.9	62.5	3067	181
Other	18.3	21.9	0.8	4.9	90.0	4.1	62.5	5630	257
Vacant	2.1	14.1	0.2	4.9	10.5	0.7	62.5	657	47

Sources

All data in black text	King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov
# people/ unit	Estimating Household Size for Use in Population Estimates (WA state, 2000 average) Washington State Office of Financial Management Kimpel, T. and Lowe, T. Research Brief No. 47. August 2007 http://www.ofm.wa.gov/researchbriefs/brief047.pdf Note: This analysis combines Multi Unit Structures in both large and small units into one category; the average is used in this case although there is likely a difference
Residential floorspace per unit	2001 Residential Energy Consumption Survey (National Average, 2001) Square footage measurements and comparisons http://www.eia.doe.gov/emeu/recs/sqft-measure.html
# employees/thousand square feet	Commercial Buildings Energy Consumption Survey commercial energy uses and costs (National Median, 2003) Table B2 Totals and Medians of Floorspace, Number of Workers, and Hours of Operation for Non-Mall Buildings, 2003 http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set1/2003excel/b2.xls Note: Data for # employees/thousand square feet is presented by CBECS as square feet/employee. In this analysis employees/thousand square feet is calculated by taking the inverse of the CBECS number and multiplying by 1000.

vehicle related GHG emissions

Estimate calculated as follows (Washington state, 2006)_

56,531,930,000 2006 Annual WA State Vehicle Miles Traveled
Data was daily VMT. Annual VMT was 365*daily VMT.
http://www.wsdot.wa.gov/mapsdata/tdo/annualmileage.htm

6,395,798 2006 WA state population
http://quickfacts.census.gov/qfd/states/53000.html

8839 vehicle miles per person per year

0.0506 gallon gasoline/mile
This is the weighted national average fuel efficiency for all cars and 2 axle, 4 wheel light trucks in 2005. This includes pickup trucks, vans and SUVs. The 0.051 gallons/mile used here is the inverse of the more commonly known term “miles/per gallon” (which is 19.75 for these cars and light trucks).
Transportation Energy Data Book. 26th Edition. 2006. Chapter 4: Light Vehicles and Characteristics. Calculations based on weighted average MPG efficiency of cars and light trucks.
http://cta.ornl.gov/data/tedb26/Edition26_Chapter04.pdf
Note: This report states that in 2005, 92.3% of all highway VMT were driven by the above described vehicles.
http://cta.ornl.gov/data/tedb26/Spreadsheets/Table3_04.xls

24.3 lbs CO2e/gallon gasoline
The CO2 emissions estimates for gasoline and diesel include the extraction, transport, and refinement of petroleum as well as their combustion.
Life-Cycle CO2 Emissions for Various New Vehicles. RENew Northfield.
Available: http://renewnorthfield.org/wpcontent/uploads/2006/04/CO2%20emissions.pdf
Note: This is a conservative estimate of emissions by fuel consumption because diesel fuel,
with a emissions factor of 26.55 lbs CO2e/gallon was not estimated.

2205 lbs/metric tonne

4.93 vehicle related GHG emissions (metric tonnes CO2e per person per year)

average lief span of buildings, estimated by replacement time method — See Energy Emissions Worksheet for Calculations

Commercial floorspace per unit — EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003)
Table C3. Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003
http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003excel/c3.xls