Underwater Noise Assessment Program

WPPA ENVIRONMENTAL SEMINAR - SEPTEMBER 2025

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Port of Seattle Maritime Environment and Sustainability

Overview

- Introduction
- Program Design
- Program Implementation
- Program Schedule

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Port of Seattle and Underwater Noise

Underwater noise is one of the **top three threats** to Southern Resident killer whales; it also impacts other sensitive species. It can impede hunting, navigation, communication, reproduction, and danger avoidance.

Underwater Noise Mitigation and Management Plan (UNMMP)

The Port does not have direct control over most port-related activities that generate underwater noise, but is committed to helping ensure that commerce, communities, and keystone species can co-exist sustainably through efforts in four categories:

- Leadership in environmentally responsible stewardship of marine facilities
- Advocacy for sound policy, regulations, and practices related to underwater noise
- Financial investments and studies to advance scientific knowledge
- Partnerships with industry, government agencies, tribes, and non-profits

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Underwater Noise Assessment Program

A key recommendation of the Port's underwater noise mitigation and management plan is to design and implement an underwater noise assessment program.

- Sets the foundation for setting noise reduction targets by establishing an underwater noise baseline (or multiple baselines) against which to measure progress and adapt our strategies based on study findings.
- Provides data for science-based decision-making to maximize effectiveness of underwater noise reduction strategies.
- Aligns with the Green Marine underwater noise environmental indicator framework.

Program Phasing

☑ **Phase I**

1. Pilot study completed with development of UNMMP.

☐ **Phase II**

1. Collect underwater noise data over two years to establish baseline(s).
2. Use findings to establish noise reduction targets.

☐ **Phase III**

1. Long-term monitoring at specified intervals to track progress toward meeting noise reduction targets.
2. Adapt noise reduction strategies based on monitoring results.

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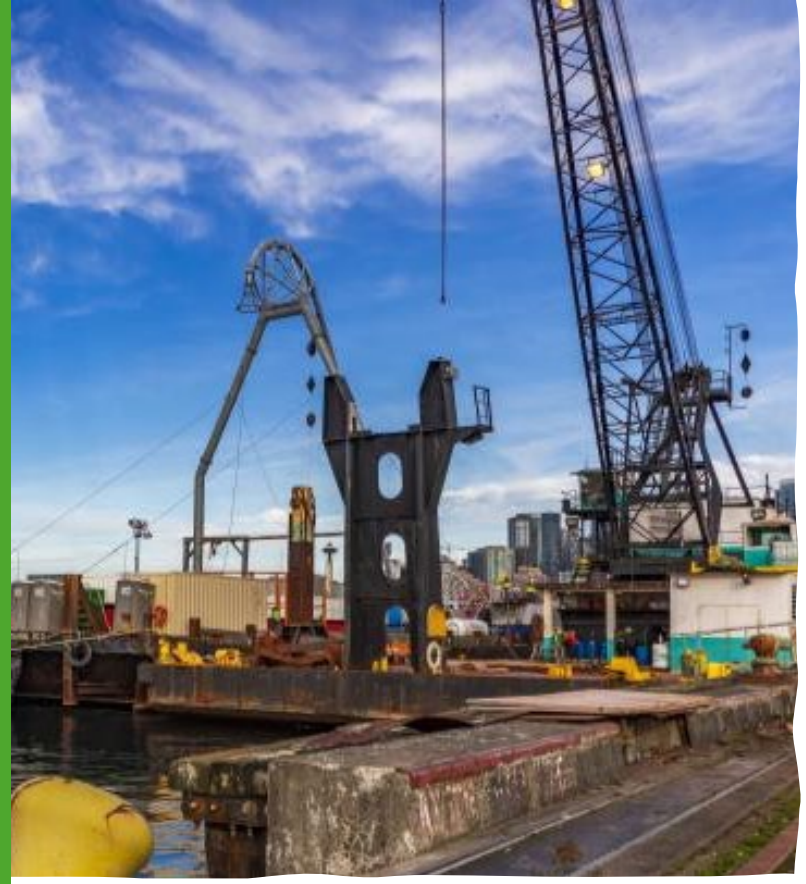

Phase II Scope

- Deploy two hydrophone systems to record baseline noise levels at strategic locations with wide acoustic “fields of view”.
- Collect, analyze, and report on acoustic data to establish a baseline for ambient underwater noise.
- Assess the impact of various maritime activities, and develop data-informed noise reduction targets.

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Phase II Team

Anna Shepherd, Madeline Brooks, Meg Harris

Triangle Associates

Triangle will facilitate stakeholder engagement efforts and support SLR and the Port in conducting outreach and partner engagement during Phases II and III.

Danielle Butsick

Port of Seattle Program Manager

Danielle leads the Port of Seattle's underwater noise mitigation and management program, including design and implementation of the underwater noise assessment program.

Amanda Pierce

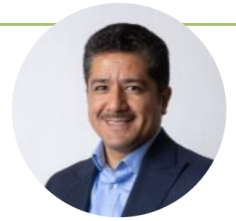
SLR Consulting Senior Water Resources Engineer

Amanda will lead on permitting and outreach and engagement efforts with support from Triangle Associates and Anchor QEA.

Justin Eickmeier

SLR Consulting Underwater Acoustics Team Lead

Justin will serve as the Phase II & III Program Design lead and underwater noise specialist.



Jonathan Vallarta

SLR Consulting Principal Underwater Acoustics

Jonathan will serve as the Phase II Program Implementation lead and underwater noise specialist.

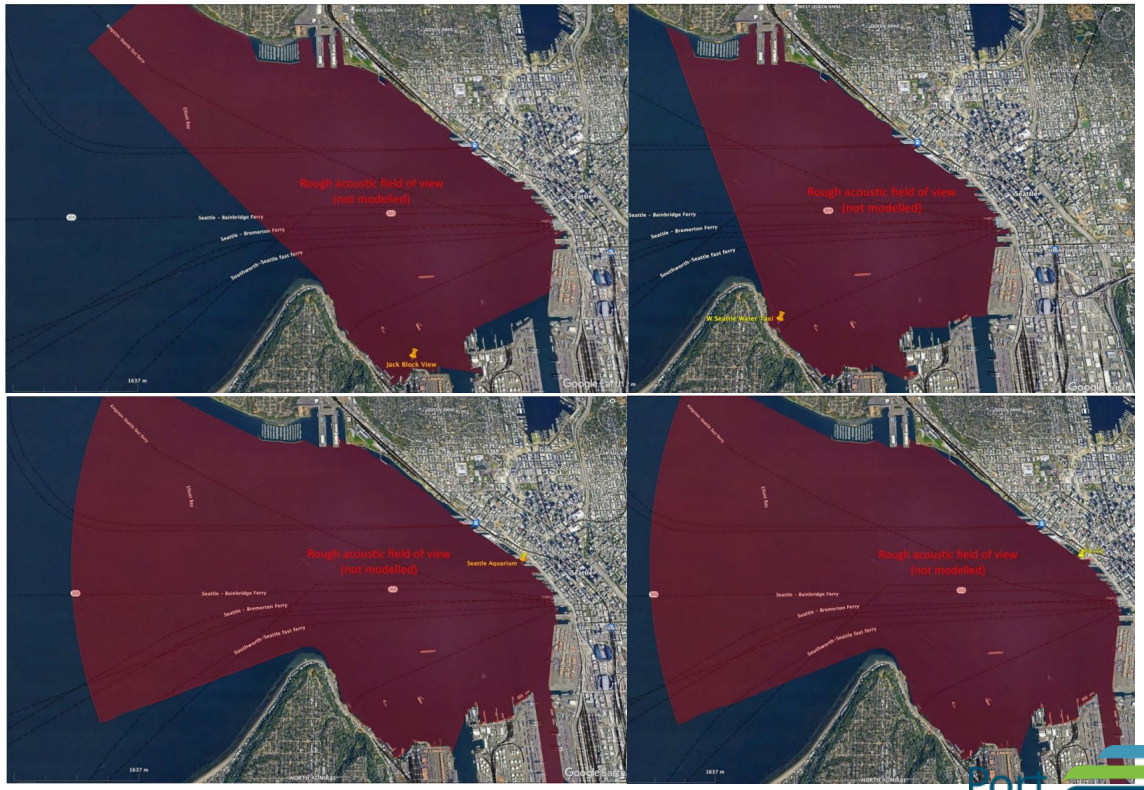
Josh Jensen & Sara Noland

Anchor QEA

Anchor QEA's *Josh Jensen and Sara Noland* will be preparing and coordinating the permits for the Phase II and Phase II Underwater Noise Assessment

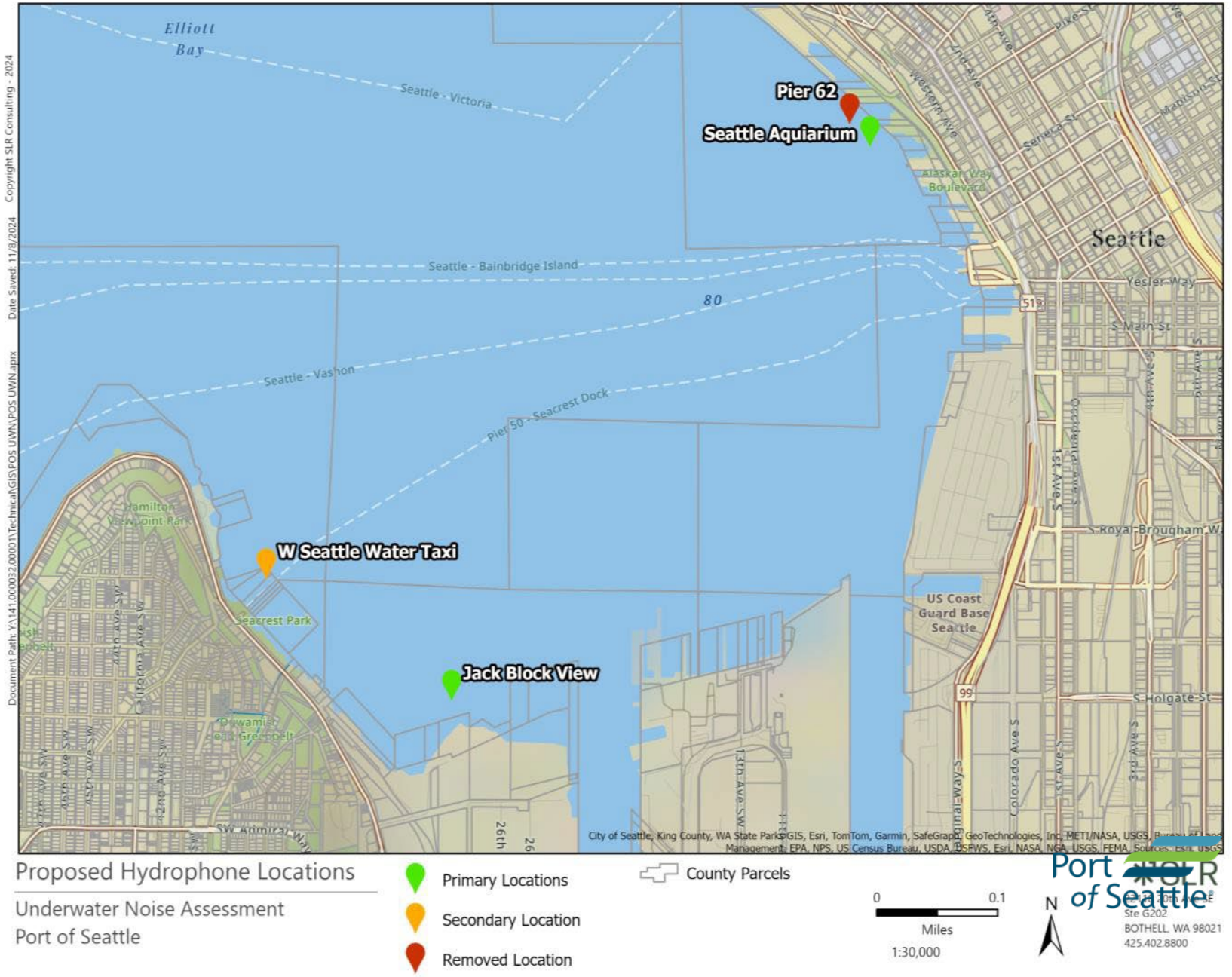
Site Selection Criteria

- **Shoreline ownership**;
- Solar exposure at shore site;
- Acoustic propagation to the mooring site (**acoustic field of view**);
- **Bathymetry** and seafloor type at the mooring site;
- Cable route **obstructions**;
- Cable protection in the intertidal zone;
- **Current speeds**;
- **Equipment protection** from wind, surf, vandalism, fishing gear, anchors; and
- Distance from natural and anthropogenic noise sources (buoys, streams, pumps, marinas, anchorages, bridges, ferry routes, etc.).



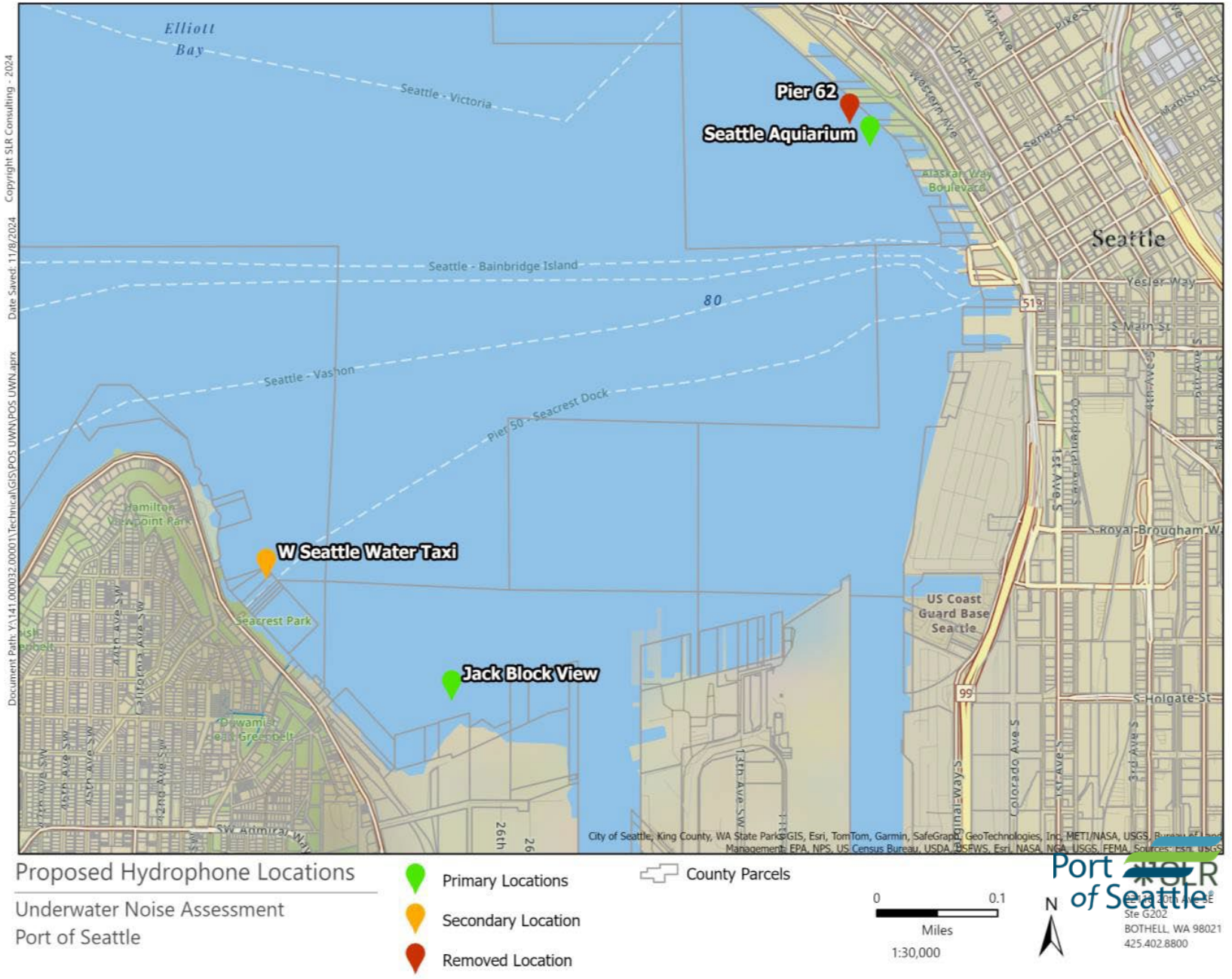
Evaluated Sites

- Four (4) proposed locations:
  - Jack Block Park View Pier
  - Seattle Aquarium Pier
  - Pier 62
  - West Seattle Water Taxi Pier

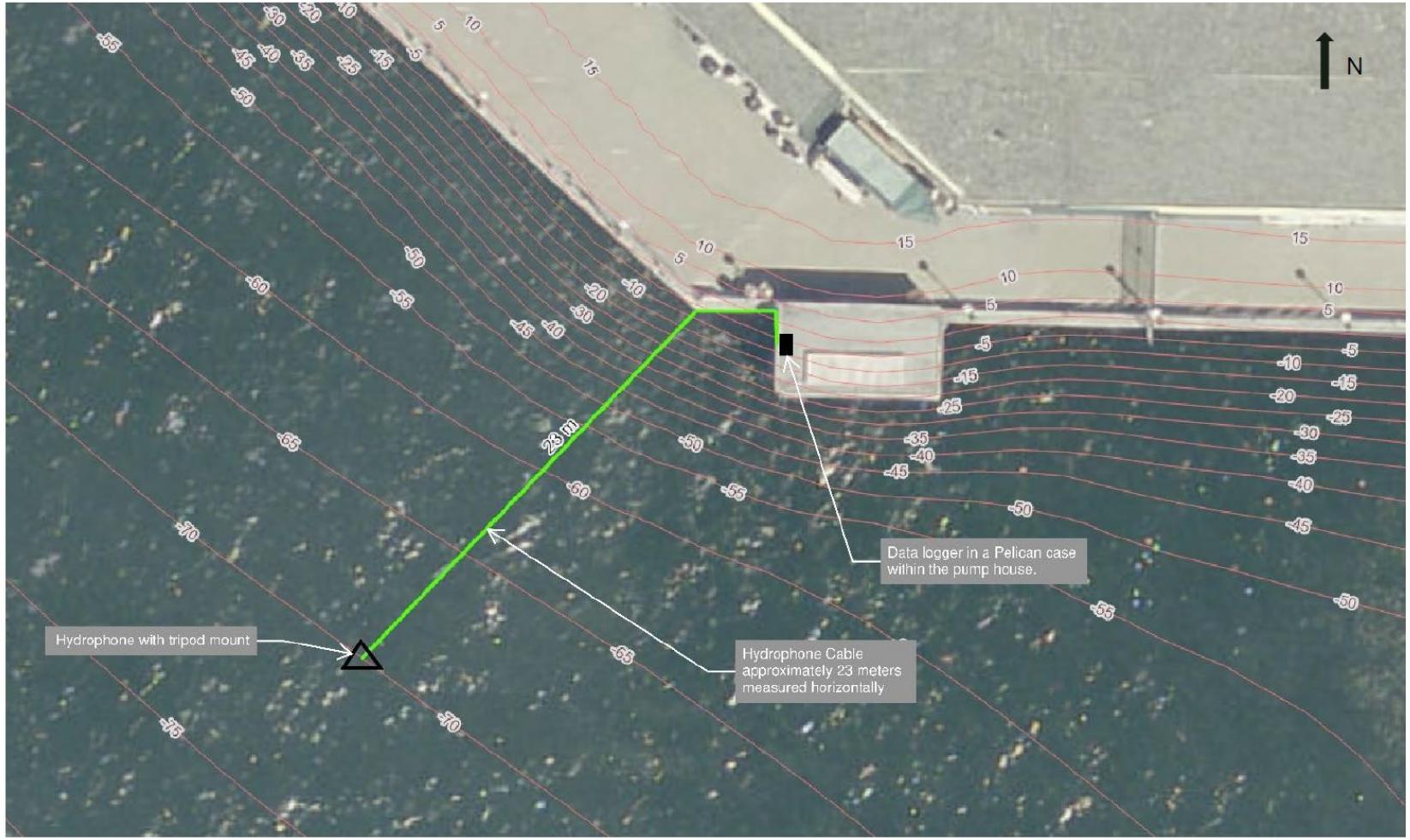


Selected Sites

- Two Locations:
  - Jack Block Park/T5 North
  - Seattle Aquarium



Deployment Configuration



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Equipment & Materials

Shore Station: 1660 Pelican case with power, comms, and data storage connected to one in-water hydrophone with a tripod structure and up to 100 m cable. Power is AC or solar.

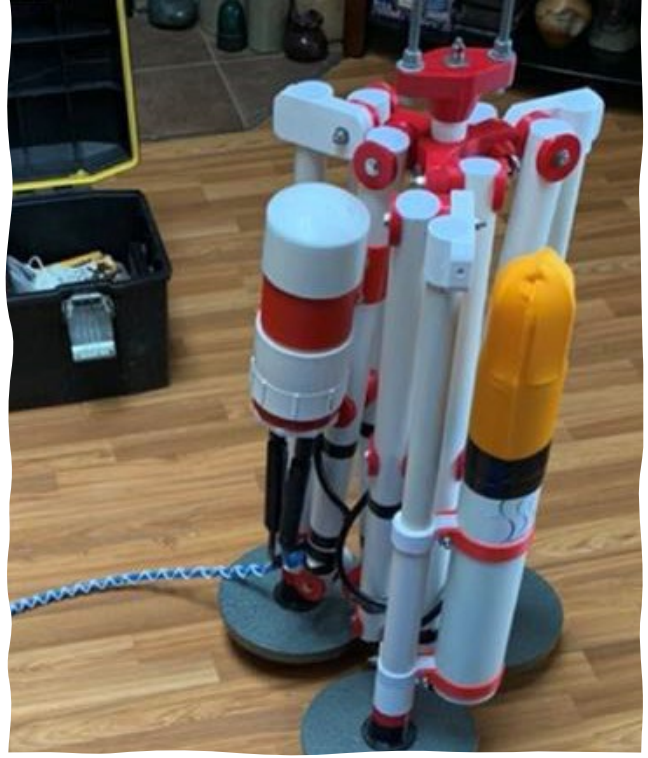
Designed to Avoid/Minimize Environmental Impacts:

- Small device footprint. The mooring will be lowered to the seafloor and held in place with weights.
- The use of cabled-to-shore systems reduces the need for frequent maintenance visits; limits additional vessel traffic/disturbance.

Hydrophone

The hydrophone will be mounted on a collapsible tripod. The tripods are connected to the shore station via underwater Ethernet or DSL cables.

Hydrophones will be placed in water approximately 60 feet deep. Cable lengths between the hydrophones and shore stations will range from approximately 120 to 300 feet.



Data Collection Procedures

1. Continuous monitoring of underwater noise levels, with equipment in place for 2 years.

2. Regular data collection and monthly equipment maintenance will occur, involving hard drive swaps, battery checks, and equipment inspections.

3. Data collection will be non-intrusive. Equipment will be safeguarded from potential damage (waterproof and/or metal encasement).

4. Noise data will be compared to AIS data (provided by the Marine Exchange of Puget Sound), to validate vessel presence with data patterns.

5. All in-water and onshore equipment and cables will be removed after 2 years.

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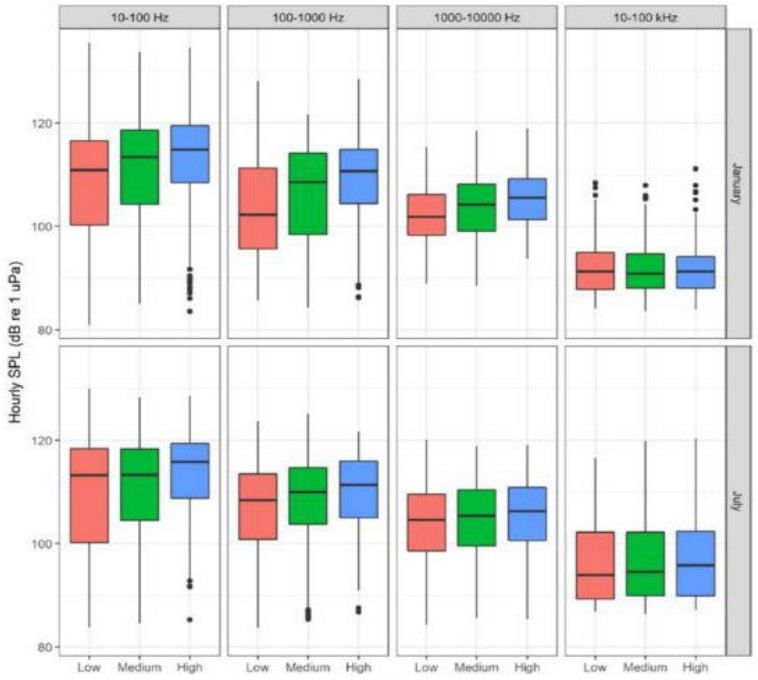
Data Processing & Baseline Determination



Eickmeier, J., et al., 2021

The acoustic data processing aims to obtain a baseline of underwater noise in each of the representative sites.

Averaging Methods:

- Arithmetic mean (AM) or Root Mean Square (RMS)
- Median or 50th percentile
- Mode

Statistical Representation

- Boxplot
- Cumulative Probability Distribution Function (ECDF)
- Spectral Probability Density (SPD)

Visualizations:

- Frequency Domain, Boxplot per frequency group

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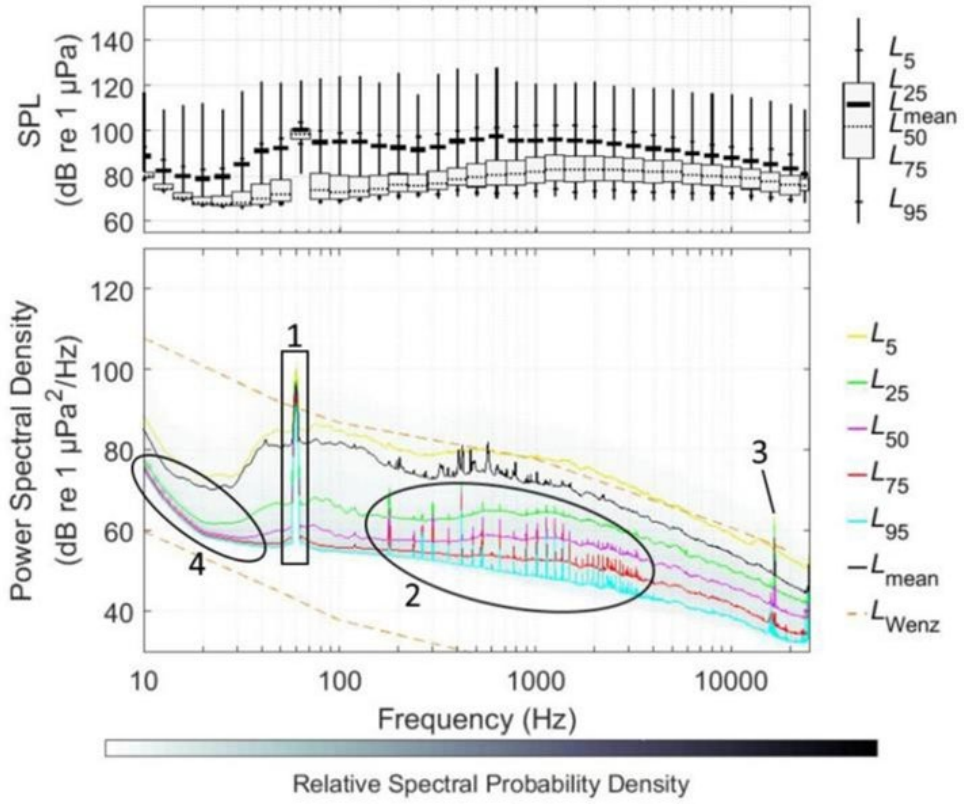
Reporting Metrics and Visualizations



Ambient noise levels will use the general metrics specified in the international ISO standard 17208-1

Pulsed (impulsive Sounds)

- LE,p - sound exposure level – for single pulse
- LE,cum - cumulative exposure level – for a series of pulses
- Lp,0-pk - peak sound pressure level
- Lp,pk-pk - peak-to-peak sound pressure level

Continuous Sounds

- Lp,rms - RMS sound pressure level

Regionally Detected Species (Potential Vocalizations)

- Harbor seal, Harbor porpoise, California sea lion, Steller sea lion, Humpback whale, Gray whale, Common minke whale, Risso's dolphin, Dall's porpoise, and Killer whale resident/transient pods*

Visualizations:

- Frequency Domain, PSD and 1/3 octave percentiles

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Phase II Schedule

Milestone	Date
PHASE II Initial Outreach and Permitting	
Stakeholder Engagement Meeting #1	July 31. 2024
Stakeholder Engagement Meeting #2	November 13, 2024
Stakeholder Engagement Meeting #3	*Updates Via Email Q1 2025*
Stakeholder Engagement Meeting #4	Q4 2025
Phase II Permitting and Program Design	
Final Program Design	December 2024
Permit Package	December 2024
Permit Issuance	July 2025
Phase II Program Implementation	
Equipment Deployment	July 2025
Data Collection and Reporting	Q2 2025-Q2 2027
Noise Reduction Target-Setting	*Q3-Q4 2027*
Phase III Outreach and Program Design	*Q3-Q4 2027*

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Questions?

Danielle Butsick, Sr. Environmental Program Manager

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SHORT VIDEO:

Diving In: Tracking Underwater Noise in Elliott Bay