How Clean is Clean? – A Case Study of the Deep River Derelict Barge Sunken Oil Spill Response in Washington State

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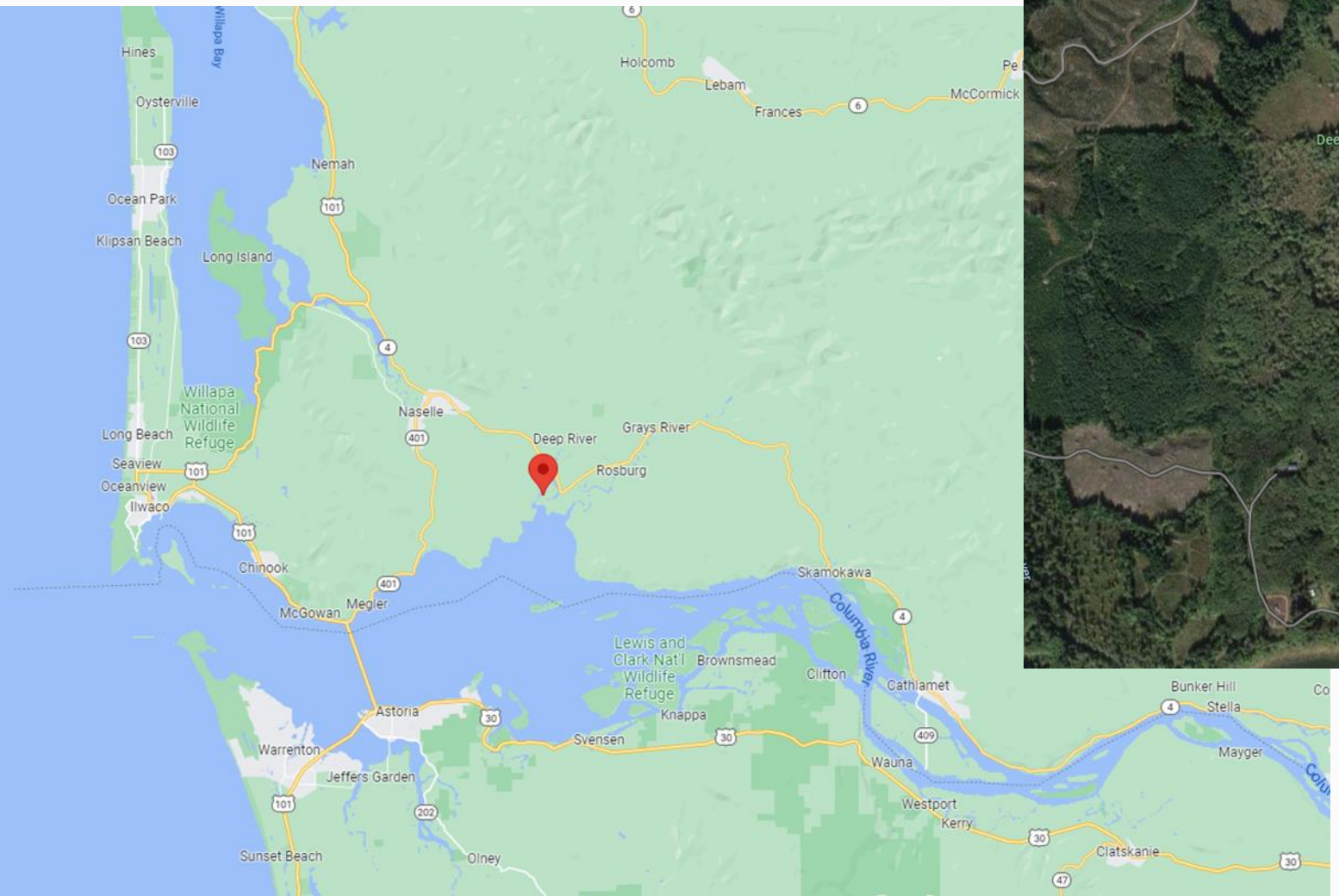
Incident Overview

- USCG and Ecology notified of a mystery sheen
- Investigated to find sheen in the water and staining on vegetation
- Tracked the source to a 15 by 40 foot derelict barge
  - 1,600 gallons of thick, black, tar-like oil – weathered bunker c
  - 3,000 gallons oily water


Hines
Willapa Bay
Oysterville
Holcomb
Lebam
Frances
McCormick
Nemah
Ocean Park
Klipsan Beach
Long Island
Willapa National Wildlife Refuge
Long Beach
Seaview
Oceanview
Ilwaco
Naselle
Deep River
Grays River
Rosburg
Chinook
McGowan
Megler
Skamokawa
Columbia River
Lewis and Clark Nat'l Wildlife Refuge
Brownsmead
Clifton
Cathlamet
Astoria
Knappa
Svensen
Warrenton
Jeffers Garden
Wauna
Westport
Kerry
Bunker Hill
Stella
Mayger
Clatskanie
Sunset Beach
Olney

Valley Bible C
Wahkiakum West Communications
Deep River Boat Launch
Deep River
Miller Point

AAC
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Valley Bible
Wahkiakum West Communications
Deep River Boat Launch
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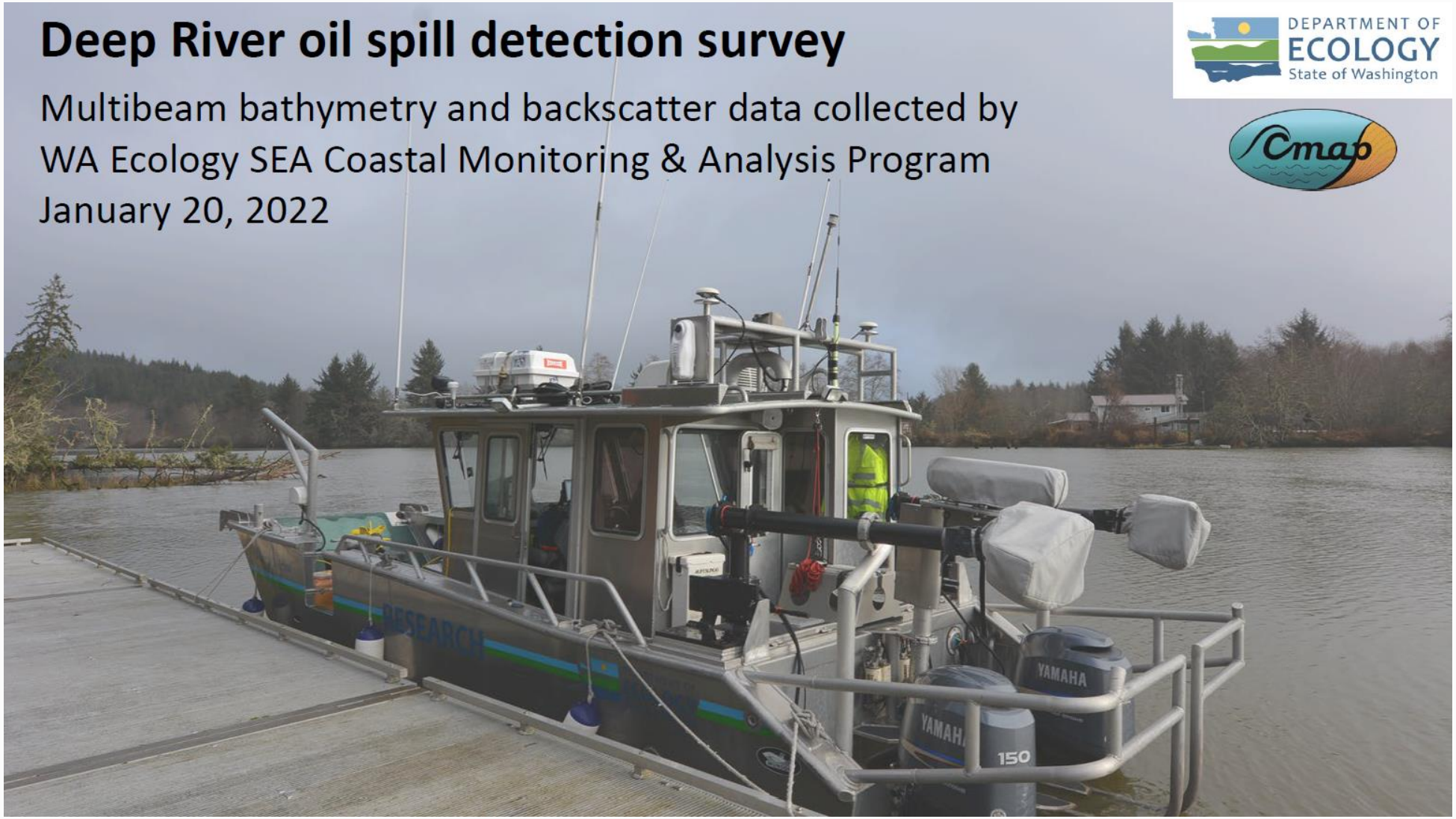
Cleanup Endpoints – Shoreline Vegetation Surveys

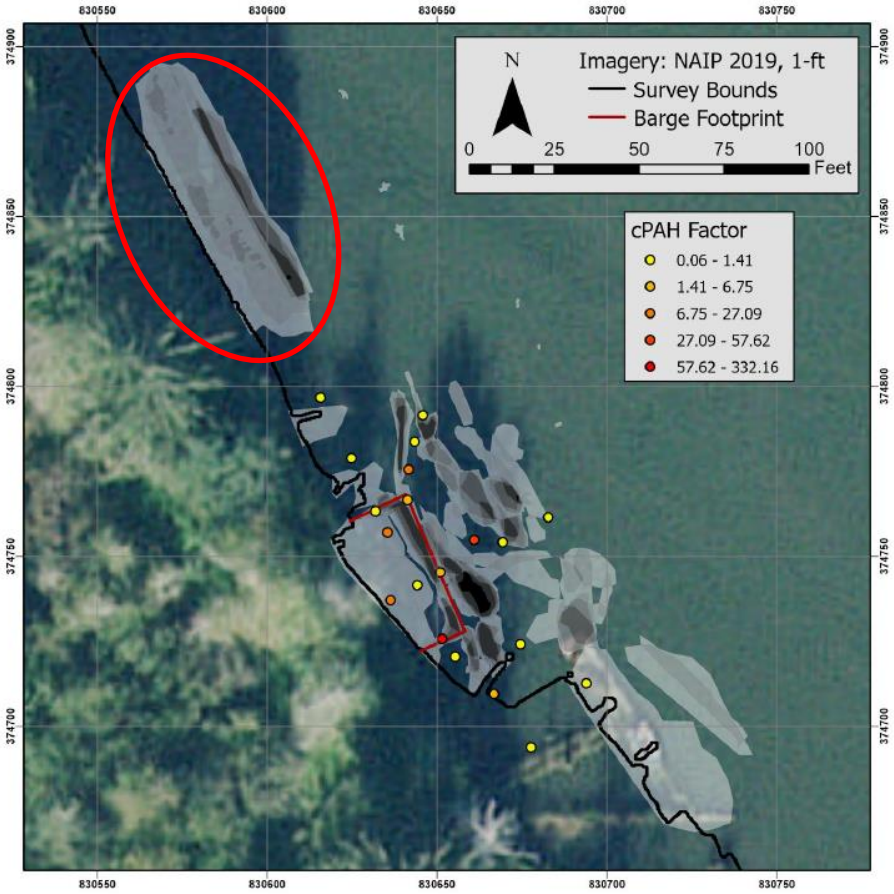
Cleanup Endpoints – Quantitative Sediment Sampling

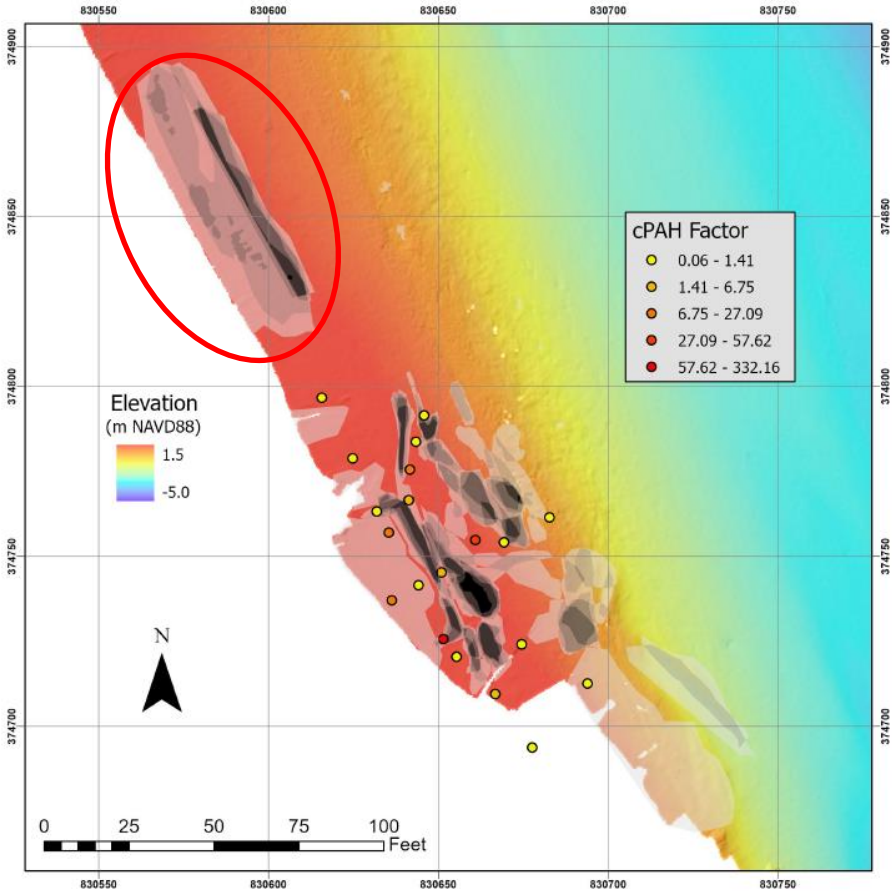
Bathymetric Mapping



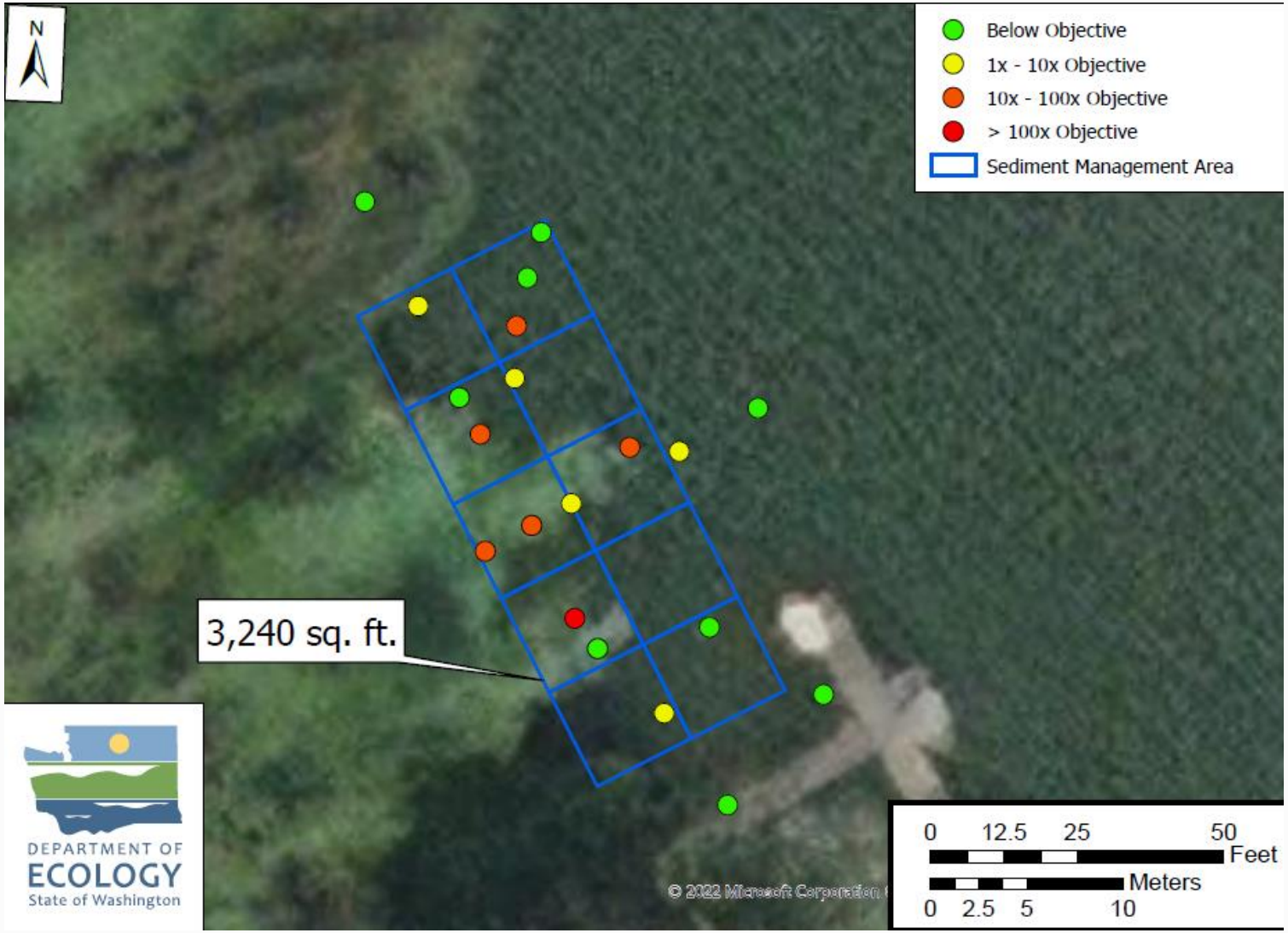
Bathymetric Mapping

Potential oil deposit locations from MBES survey overlaid with Spills samples



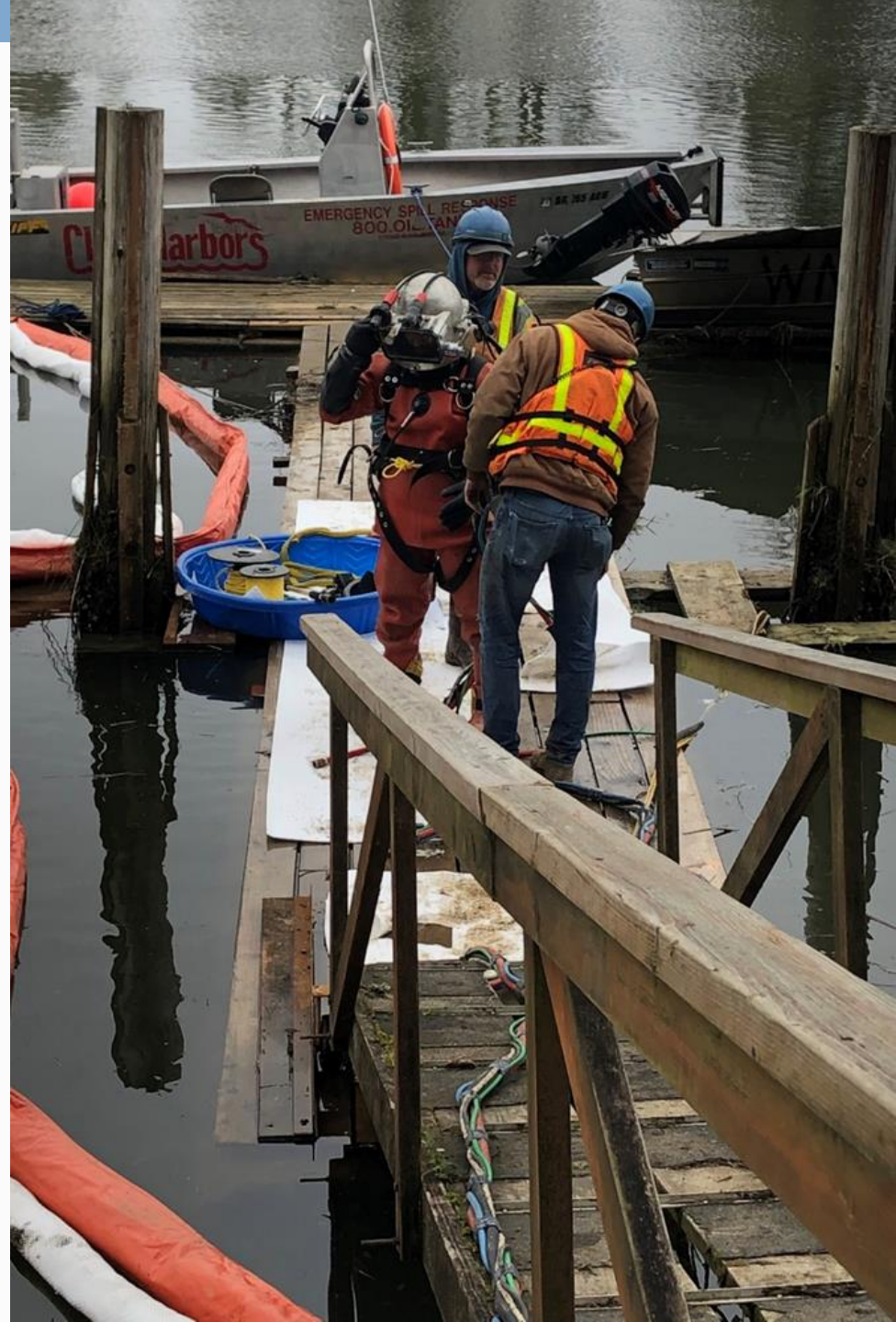


Cleanup Area



Sediment Cleanup Recommendations

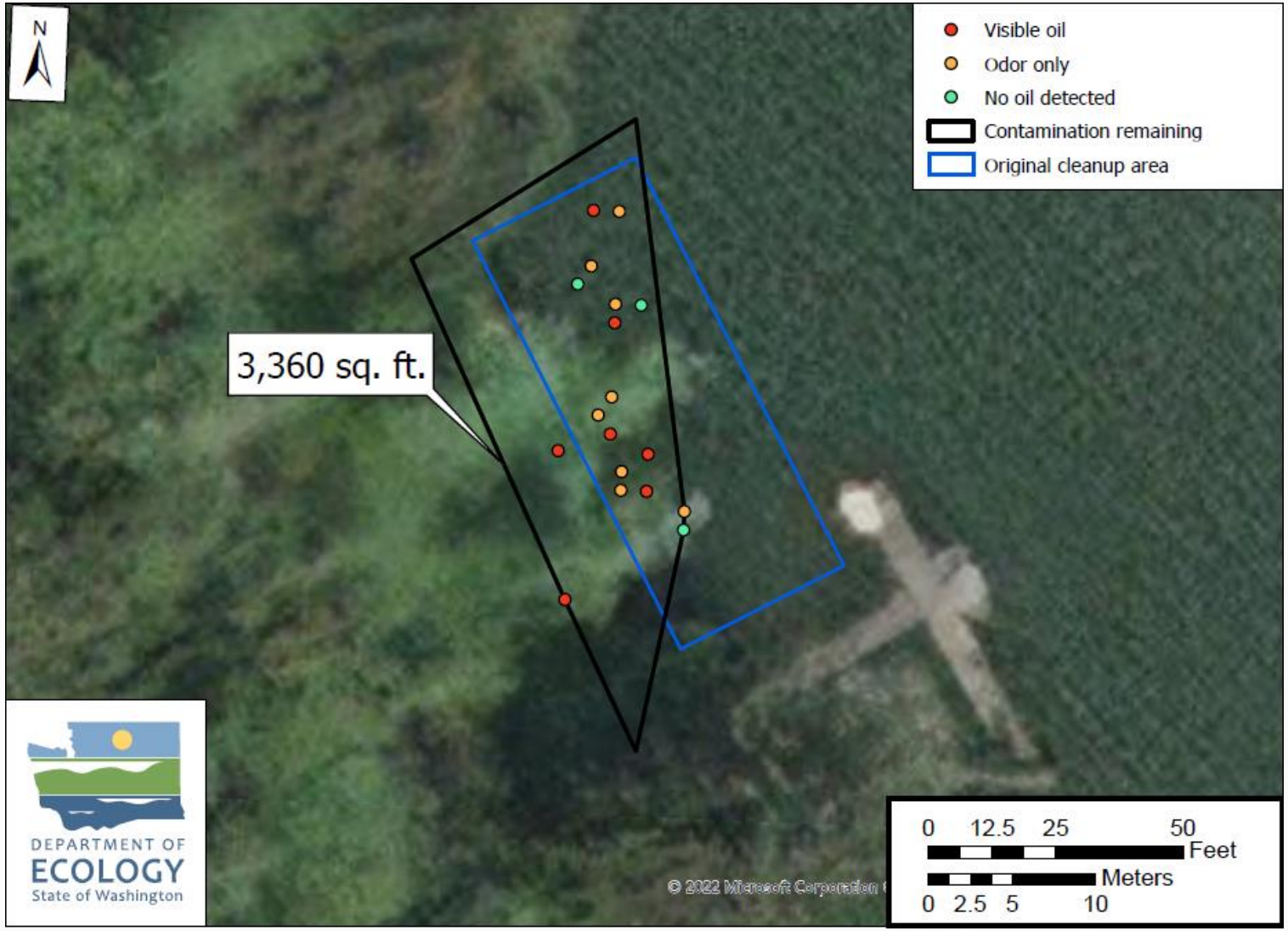
- Enhanced Passive Collection
  - Manual cleanup, Vessel Submerged Oil Recovery System (V-SOR), Gabion Baskets
- Diver Directed Dredging
- Dredging using an excavator, clamshell, or pond dredge



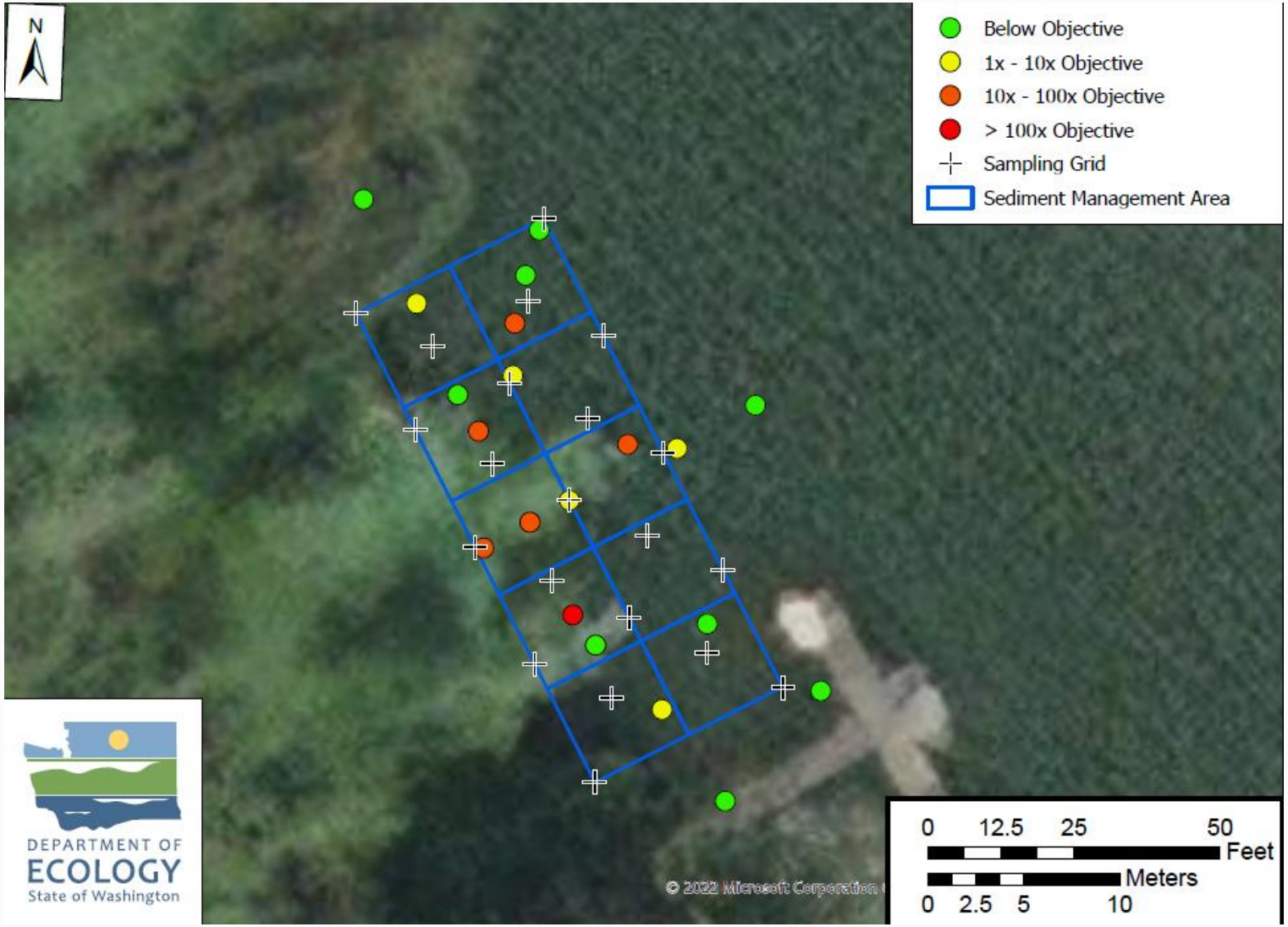
HydroChemPSC

Cleanup Endpoints – Qualitative Sediment Sampling

Readjusting the Cleanup Area



Cleanup Endpoints – Qualitative Sediment Sampling



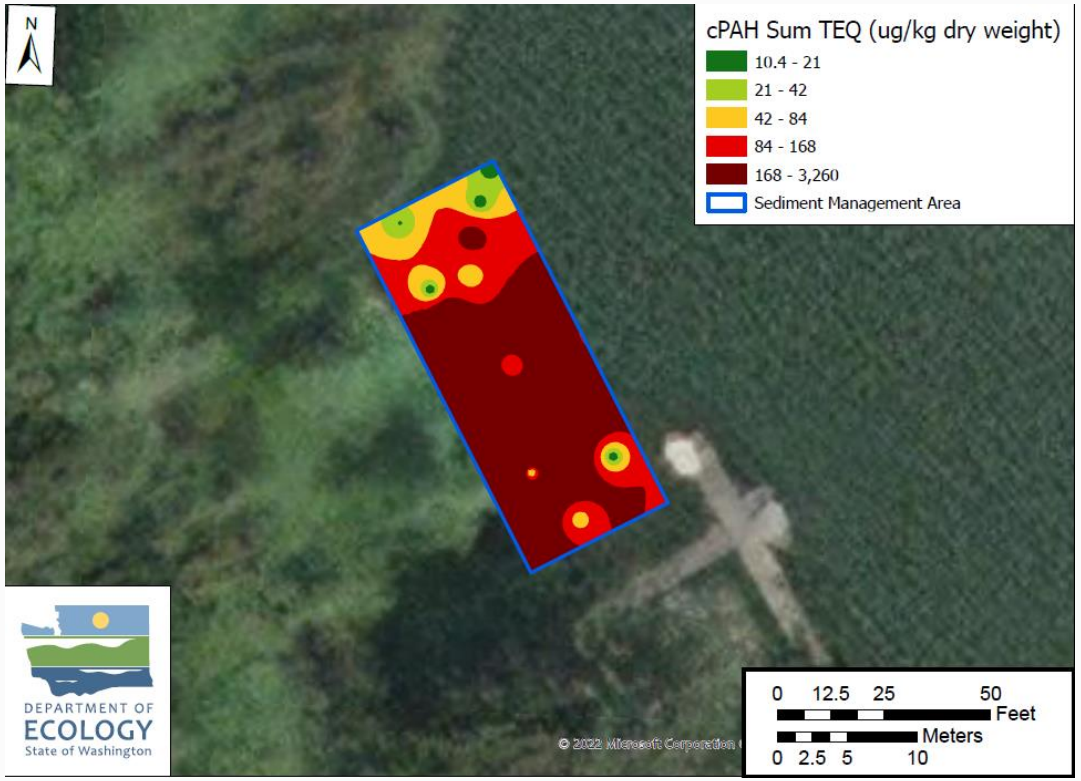
Human Health Risk

Area-weighted average of cPAH ≤ 21 µg/kg dry weight cPAH sum TEQ (Toxicity Equivalence) (i.e. natural background)

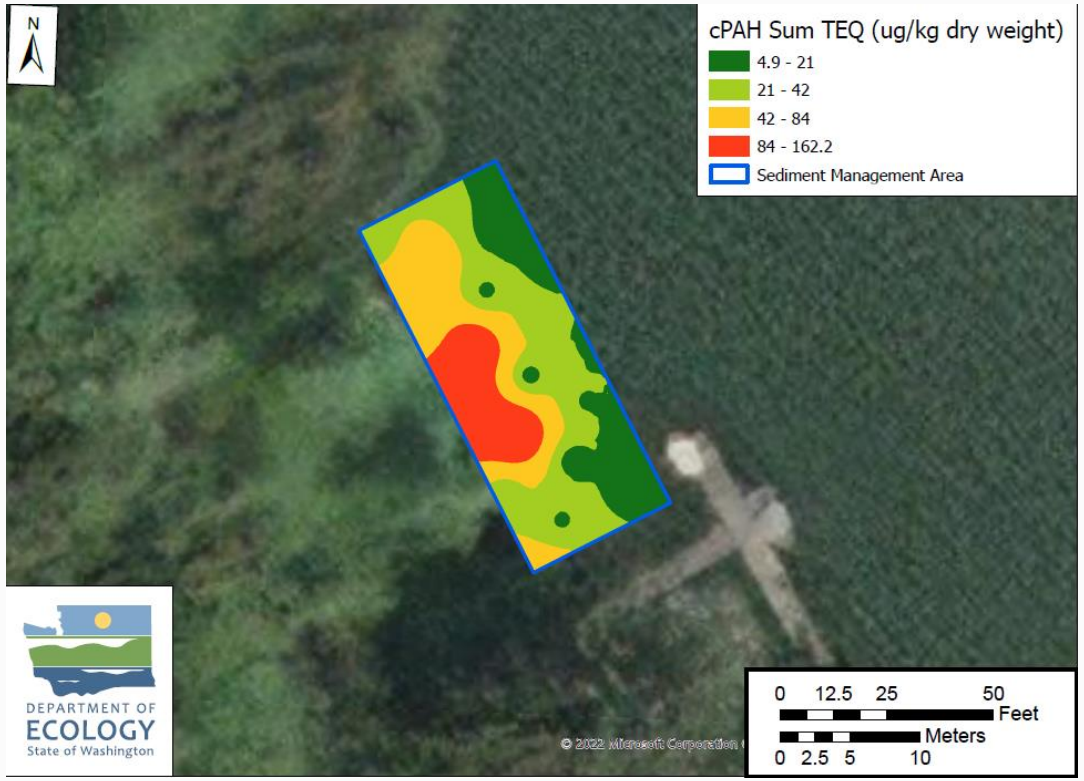
Carcinogenic Polycyclic Aromatic Hydrocarbon (cPAH)	Toxicity Equivalency Factors (TEF - unitless)
Benzo[a]pyrene	1
Benzo[a]anthracene	0.1
Total benzofluoranthenes	0.1
Chrysene	0.01
Dibenz[a,h]anthracene	0.1
Indeno[1,2,3-cd]pyrene	0.1

Cleanup Endpoints?

Prior to Cleanup – 371 µg/Kg DW



Post Cleanup – 46 µg/Kg DW



Benthic Community Risk

List of cleanup levels for each Analyte or Parameter

Analyte/Parameter	Cleanup Level	Category
TPH-Diesel	340 mg/kg dw	Bulk Petroleum Hydrocarbon
TPH-Residual	3600 mg/kg dw	Bulk Petroleum Hydrocarbon
Naphthalene	2100 µg/kg dw	Polycyclic Aromatic Hydrocarbon
2-Methylnaphthalene	670 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Acenaphthylene	1300 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Acenaphthene	500 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Flourene	540 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Phenanthrene	1500 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Anthracene	960 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Flouranthene	1700 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Pyrene	2600 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Benzo[a]anthracene	1300 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Chrysene	1400 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Total benzofluoranthenes	3200 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Benzo[a]pyrene	1600 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Indeno[1,2,3-cd]pyrene	600 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Dibenz[a,h]anthracene	230 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Benzo{g,h,I]perylene	670 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Total PAHs	17000 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Total LPAH	5200 µg/kg dw	Polycyclic Aromatic Hydrocarbon
Total HPAH	12000 µg/kg dw	Polycyclic Aromatic Hydrocarbon

How Clean is Clean?

- Shoreline vegetation
  - Met cleanup endpoints
    - No oil observed,
    - No longer generates sheen that will affect sensitive areas, wildlife, or human health, or
    - No longer rubs off on contact

- Sediments
  - Did not meet Washington state sediment cleanup standards **(but got very close!)**
  - Met cleanup endpoints
    - No oil observed,
    - No longer generates sheen that will affect sensitive areas, wildlife, or human health, or
    - No longer rubs off on contact

Lessons Learned

- Lean forward on external communications, messaging, and coordination
- Identify and agree upon cleanup endpoints early…but be flexible
- Try to use more than one methodology to detect and delineate submerged oil, and verify cleanup endpoints

Thank you!

Acknowledgements
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