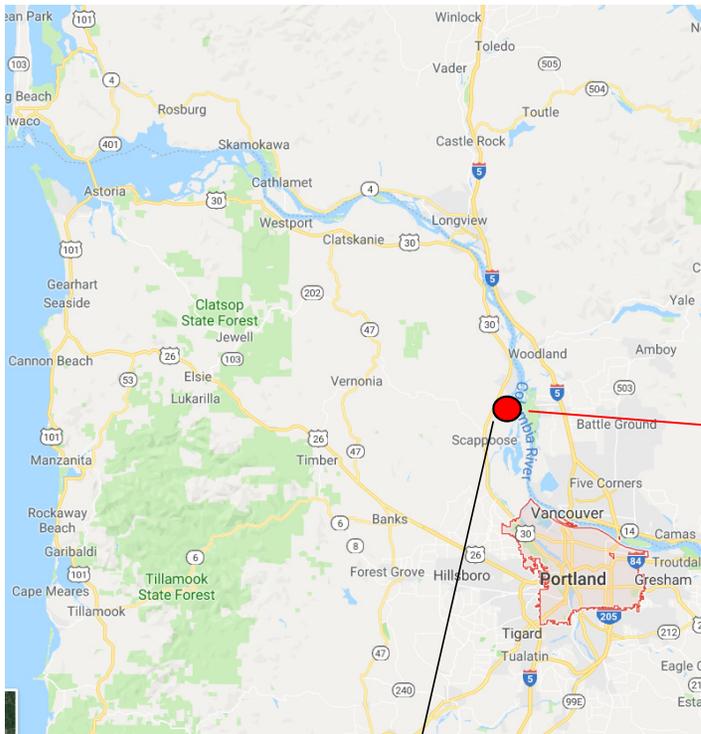


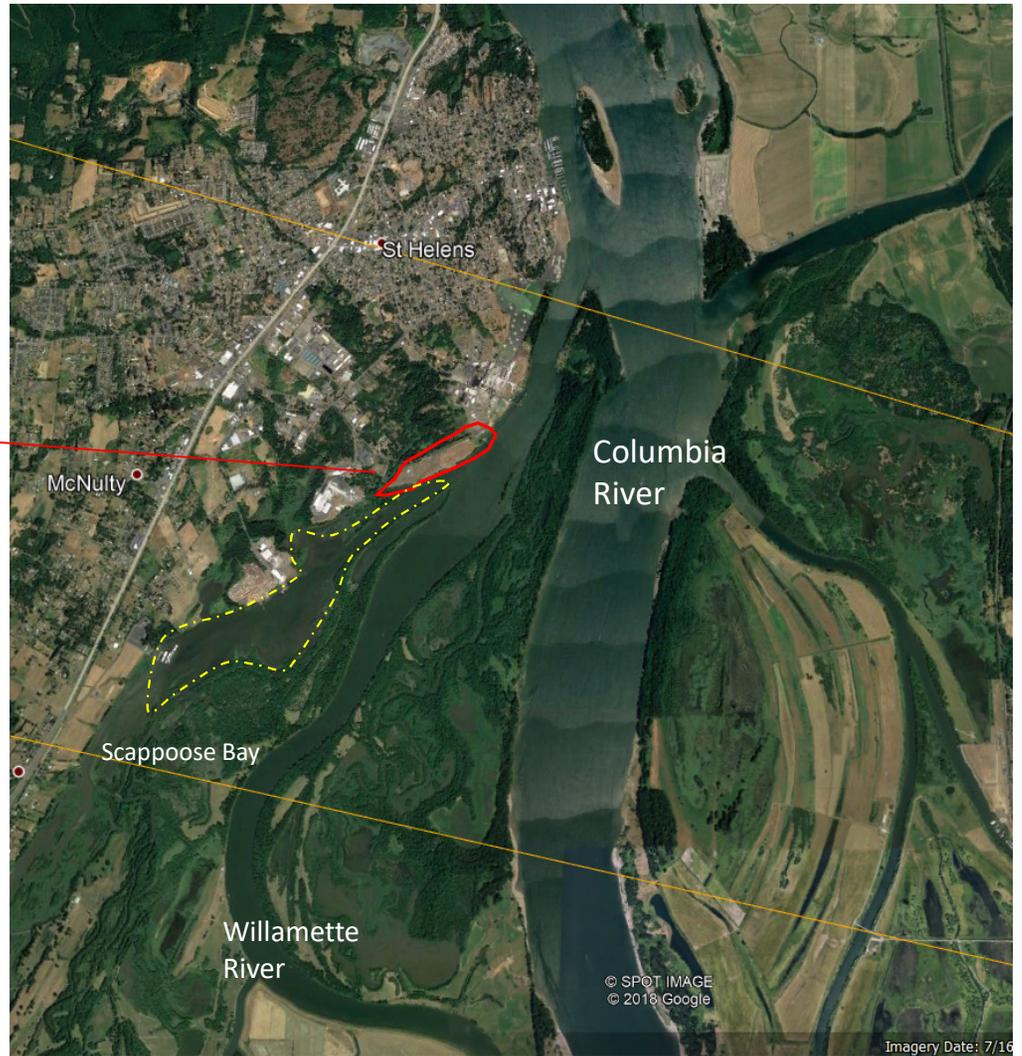
# Sampling Sediment and Porewater in the Lower Willamette River St. Helens, Oregon

Henning Larsen, R.G.

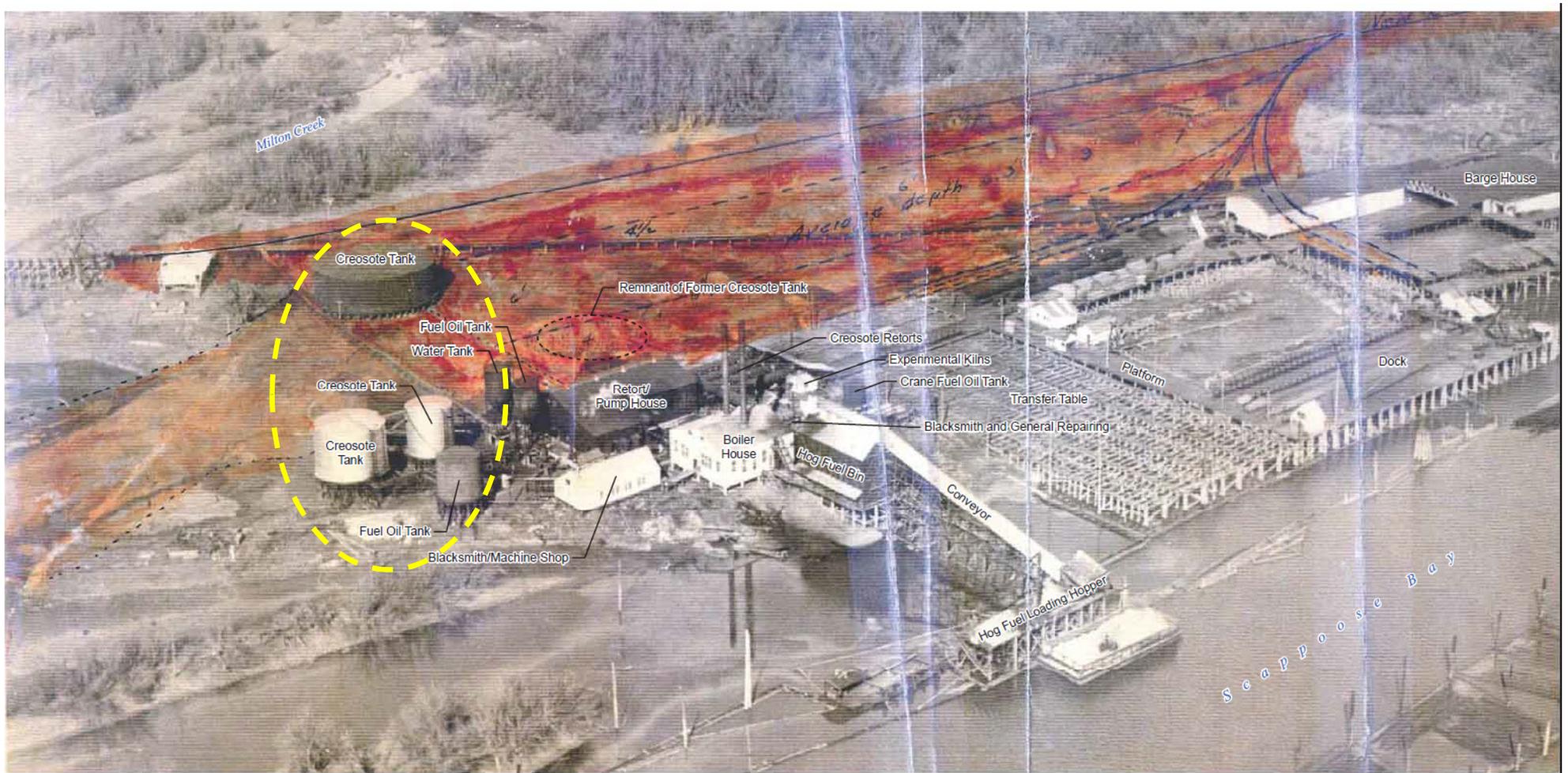
Oregon Dept of Environmental Quality



Former Pope and Talbot  
Wood Treatment Facility  
St. Helens, Oregon



Sampling Sediment Porewater in the Lower Willamette River, EPA GW-SW Interaction Workshop, November 16, 2018; Henning Larsen R.G., Oregon DEQ



## Pope and Talbot Facility Circa 1929 - Operations Ceased in 1960

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## How it Looks Today

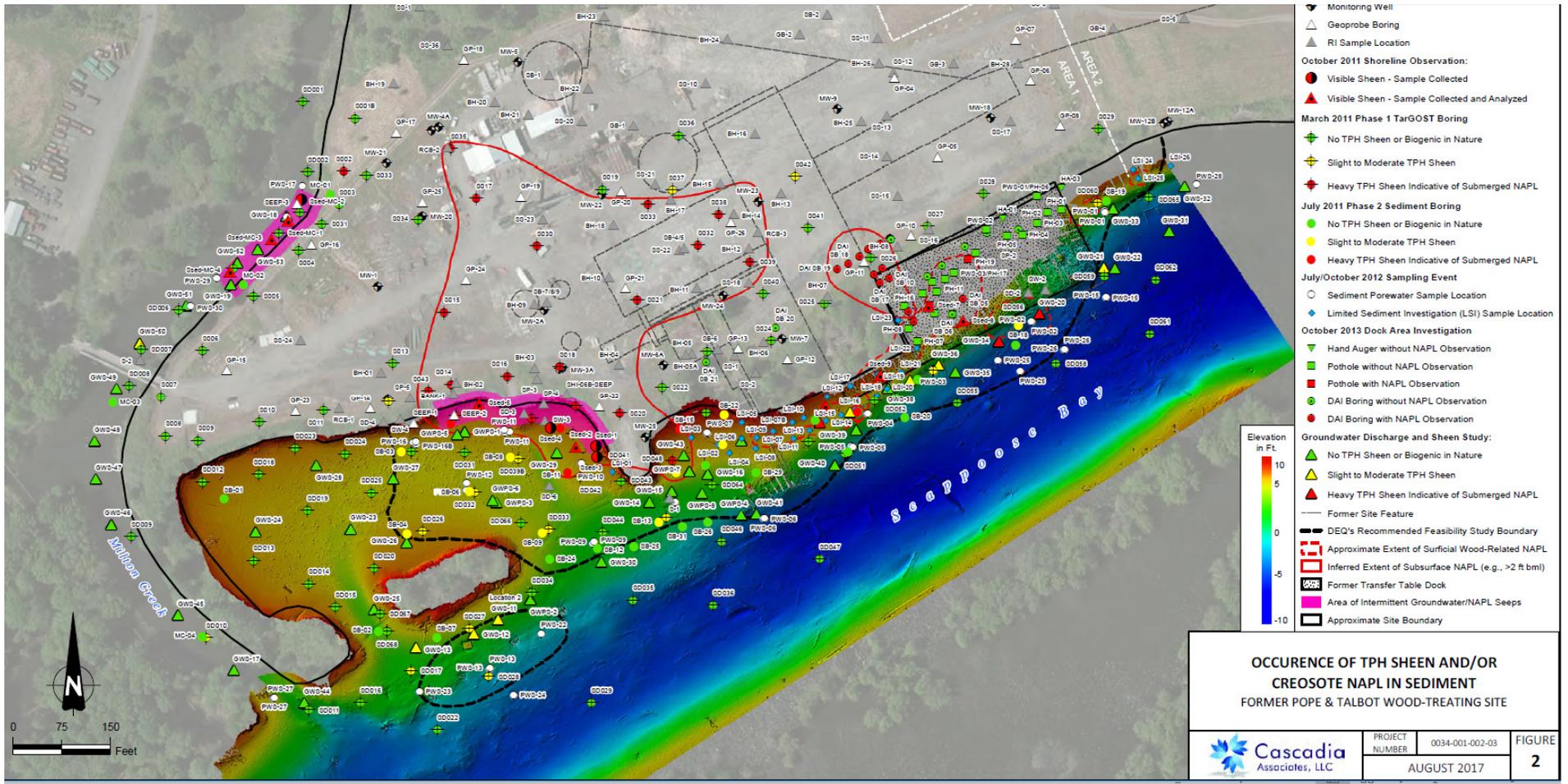
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Former facility and operational areas covered by 2 -21 ft of river dredge spoils



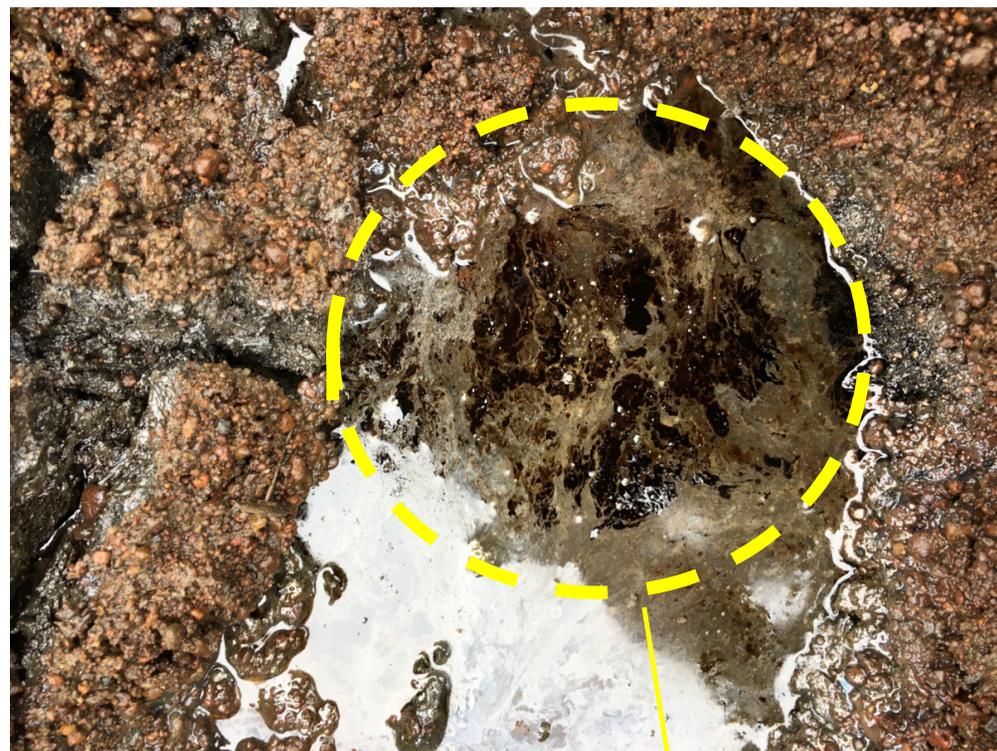
# Former Pope and Talbot Facility - In-Water Remedial Investigation



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Creosote saturated wood waste



NAPL Blebs

## Conditions Beneath the Surface

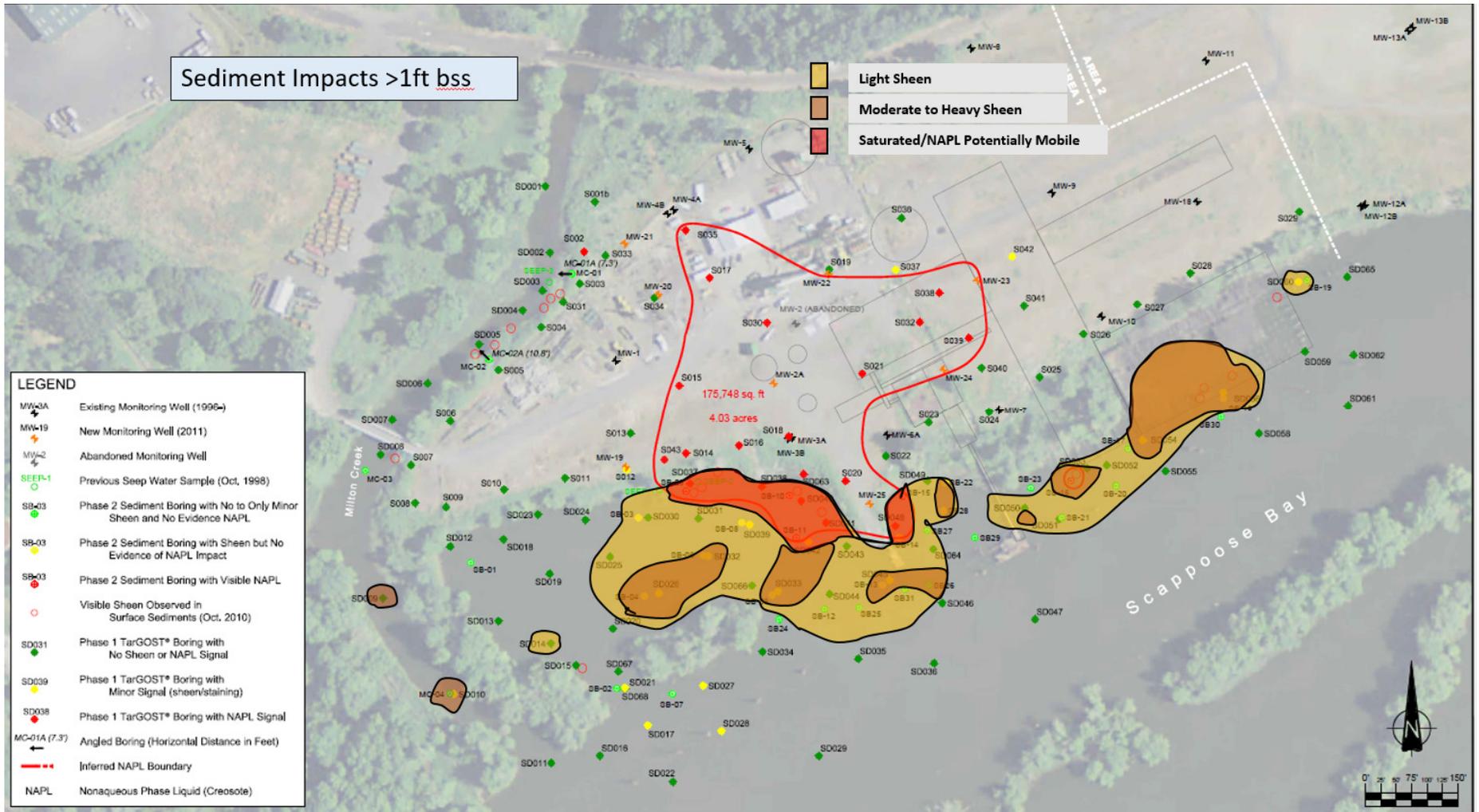
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## Surface Water Sheens



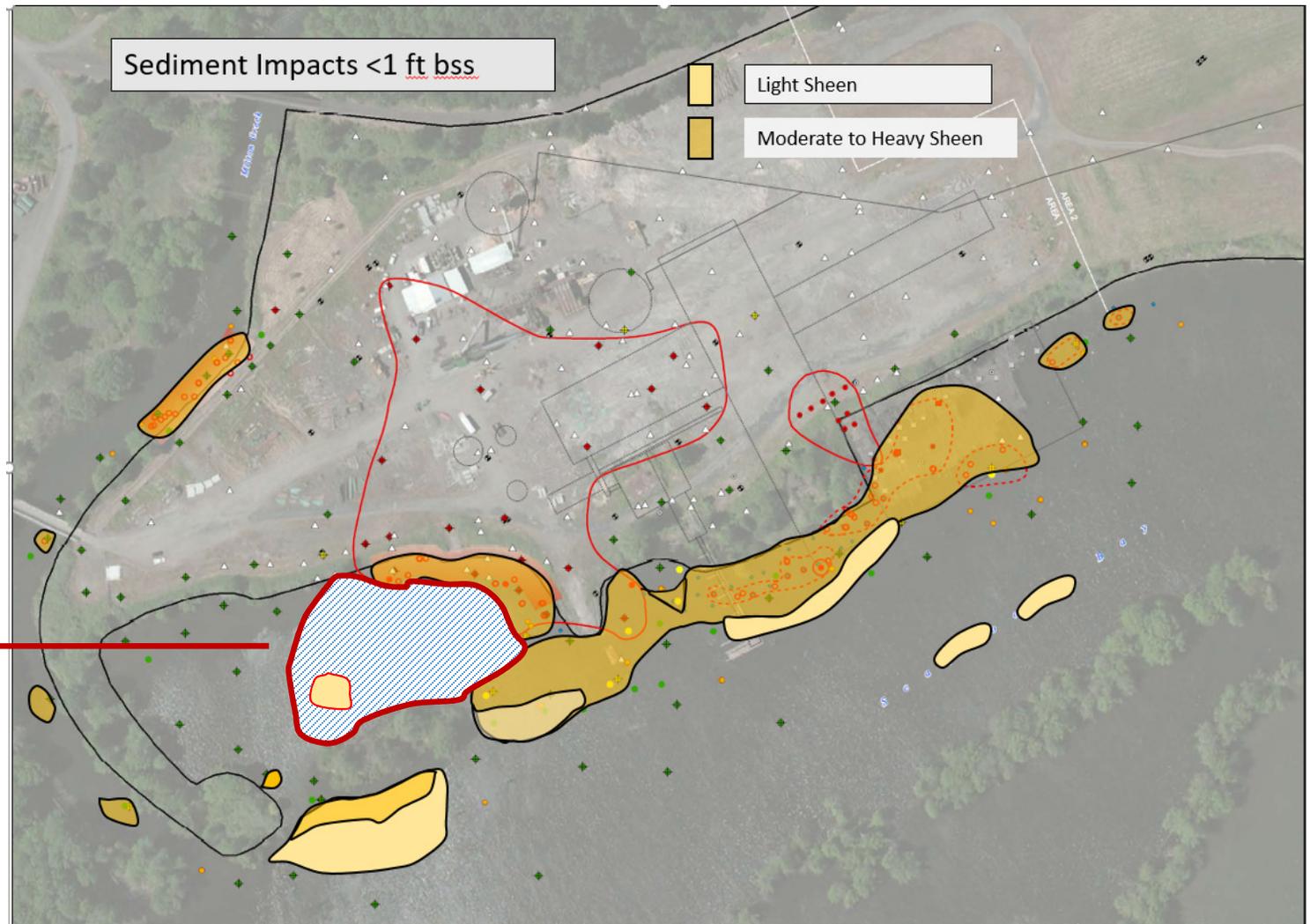
Sampling Sediment and Porewater in a Tidally Influenced River, EPA GW-SW Interaction Workshop, November 16, 2018; Henning Larsen R.G., Oregon DEQ



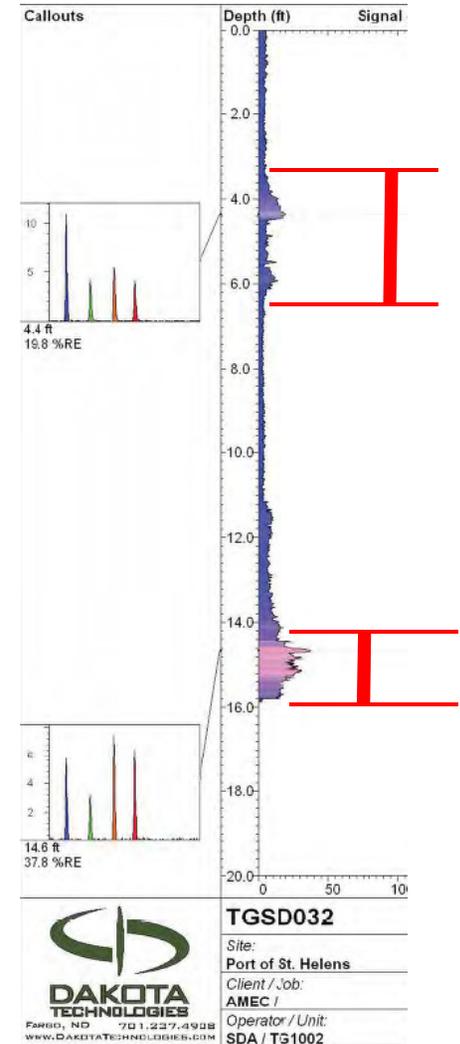
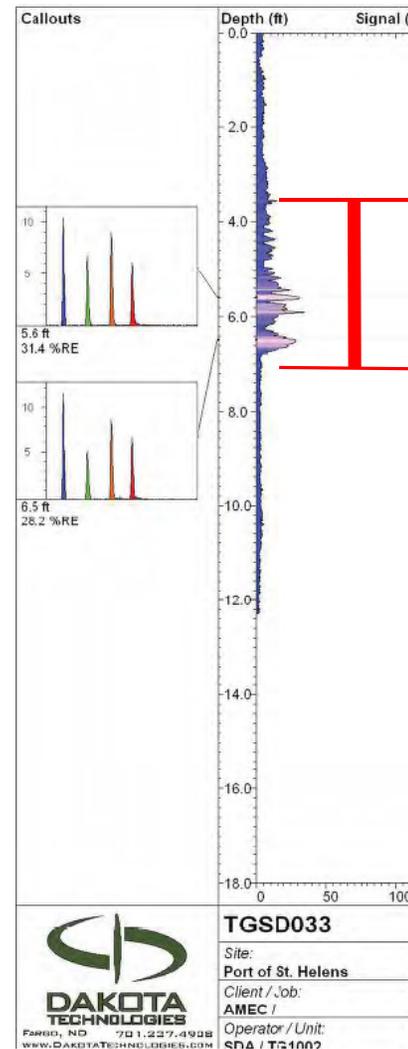
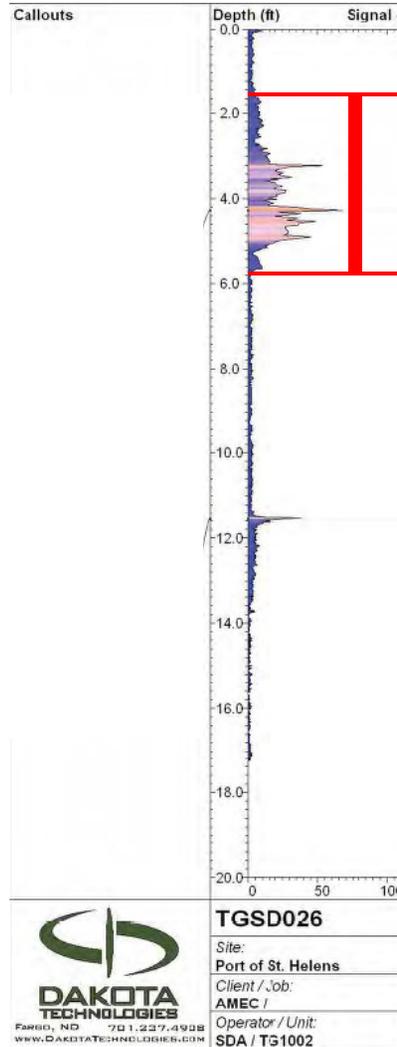
Sampling Sediment and Porewater in a Tidally Influenced River, EPA GW-SW Interaction Workshop, November 16, 2018; Henning Larsen R.G., Oregon DEQ

## Focus of Pore Water Evaluation

Approximately 2 acres of Sediment area with 2-3 ft thick creosote contaminated wood waste covered by 2-6 ft of fine texture sediments deposited over the last 60 years



Creosote contaminated wood waste buried 2-5 ft bss in the “Man-made Cove” as detected by Targost



## Approach – Focused Assessment of Exposure Point Concentrations in the Benthic Environment

### **Develop a Conceptual Site Model for Benthic Habitat**

- Define the depth of the biologically active zone
- Identify sampling periods representing relatively worst-case seasonal conditions
- Develop a vertical profile of contaminant levels in Sediment and Pore-water
- Apply a robust analytical program reflecting the complexity of petroleum chemistry

# Determining the Depth of the Biologically Active Zone

## Literature Review



Sampling Sediment and Porewater in the Lower Willamette River, EPA GW-SW Interaction Workshop, November 16, 2018; Henning Larsen R.G., Oregon DEQ

Table 5. Biologically Relevant Sediment Depths—Biotic Zones—for Decisions Related to Ecological Assessment or Remediation. The biotic zone noted in column 2 is

Habitat Type	Biotic Zone (cm)	Biotic zone (cm) (Considering Biomass)
<b>Lotic</b>		
Stream Coarse Grained/Sand	35	
Stream Coarse Grained/Sand with Fines <sup>b</sup>	25	
River Coarse Grained/Sand with Fines <sup>b</sup>	15	

### DETERMINATION OF THE BIOLOGICALLY RELEVANT SAMPLING DEPTH FOR TERRESTRIAL AND AQUATIC ECOLOGICAL RISK ASSESSMENTS

EPA/600/R-15/176  
ERASC-015F  
October 2015

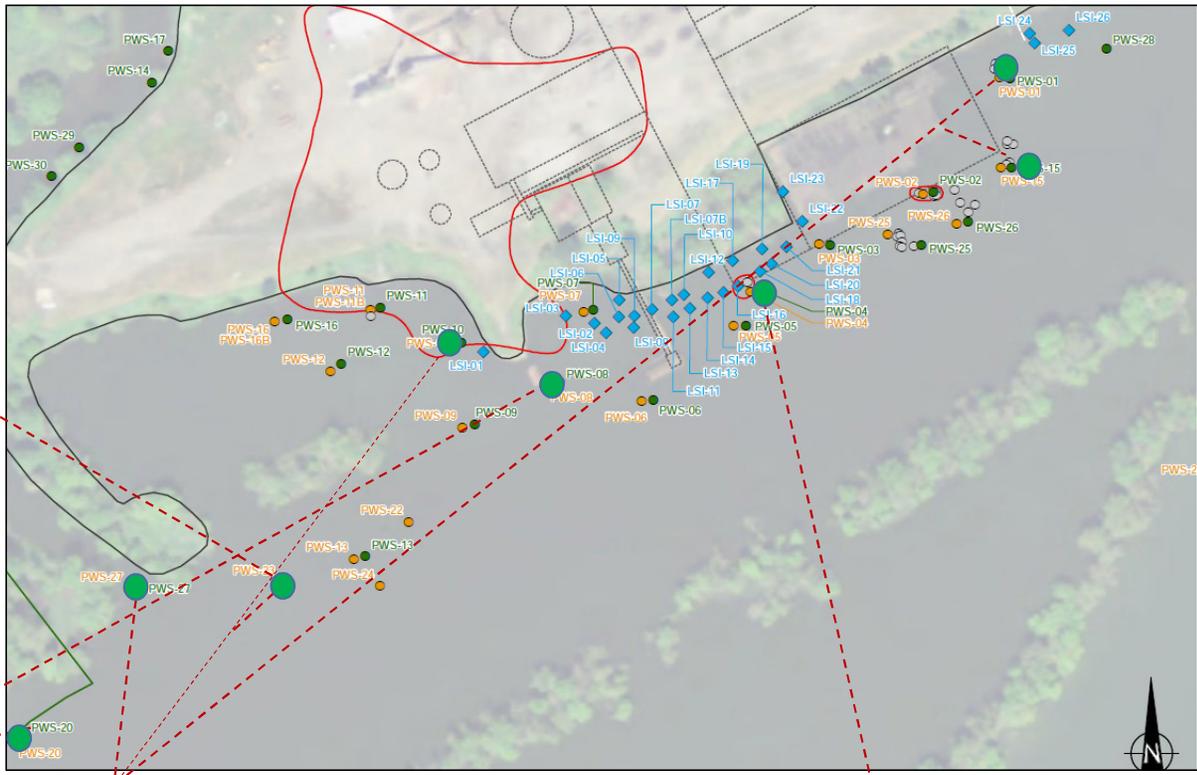
## Direct Observations using “Powergrab” version of the clam shell-type sampler

- Bioturbation
- Redox Conditions
- Substrate/Sediment Texture and composition

# Macroinvertebrates Observed in the Upper Foot of Sediment



Corbicula (4" bss)



Lamprey Ammocetes (2-5" bss)



Oligiochetes (3-12" bss)

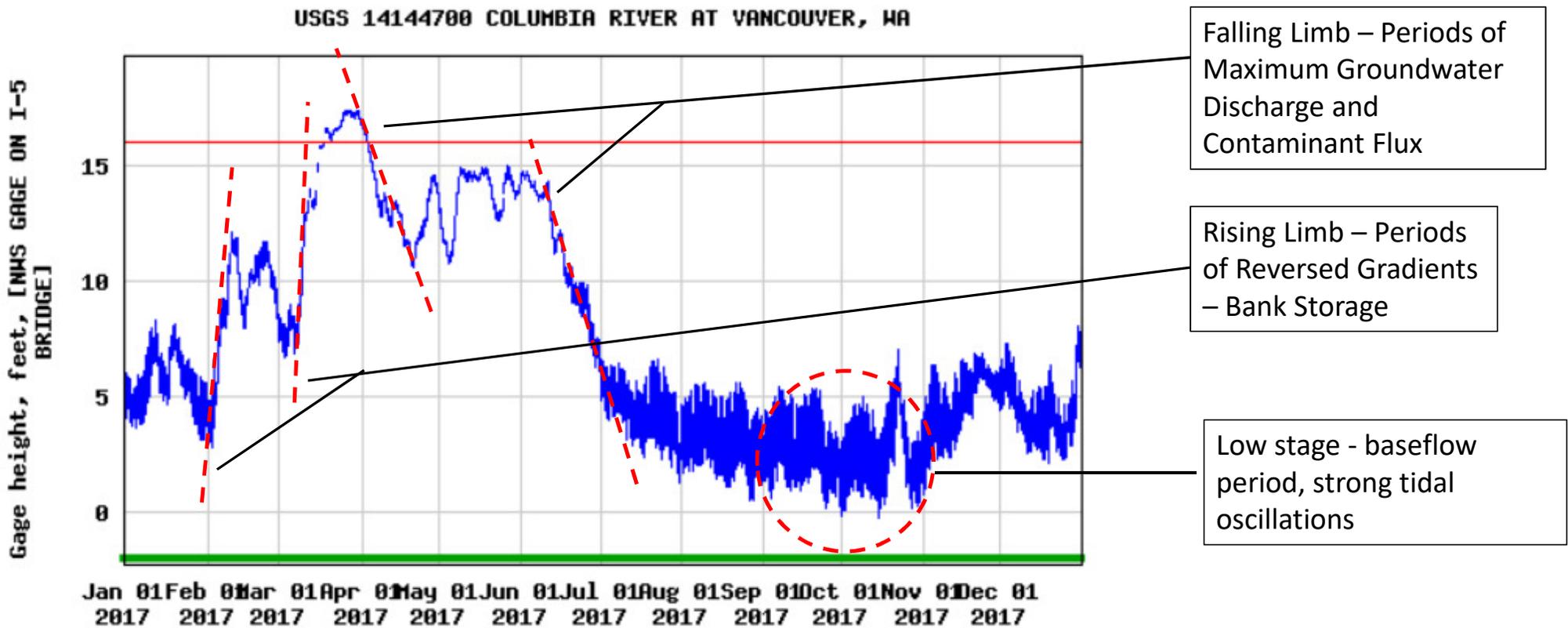


Crayfish (3.5" bss)

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# Selecting the Period for Sampling



# Seasonal Changes in River Stage

- approximately 15 feet in 2017



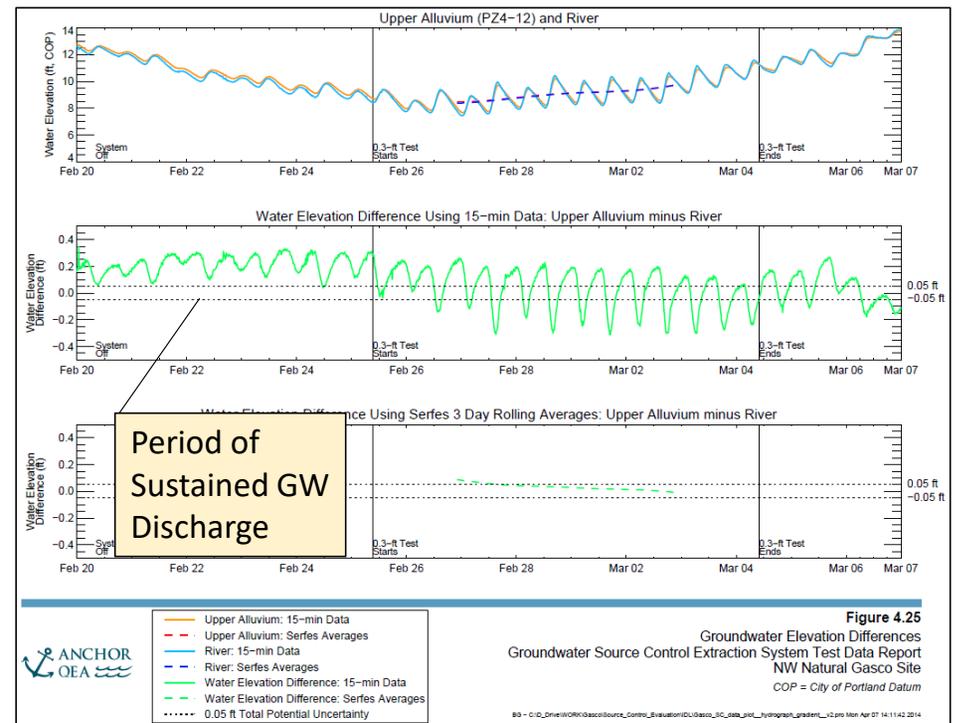
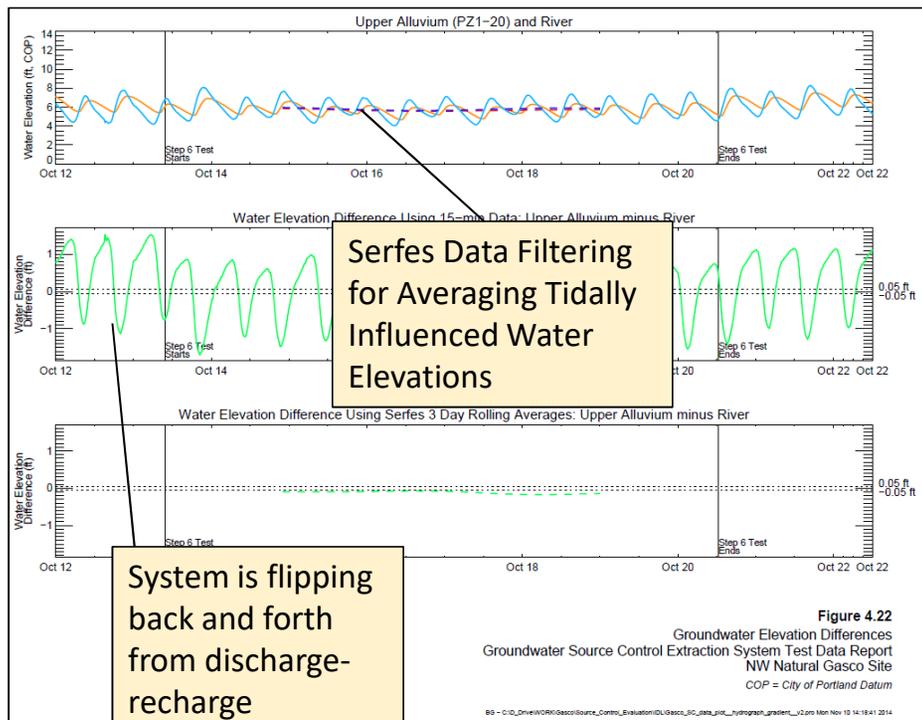
**October 1, 2009**



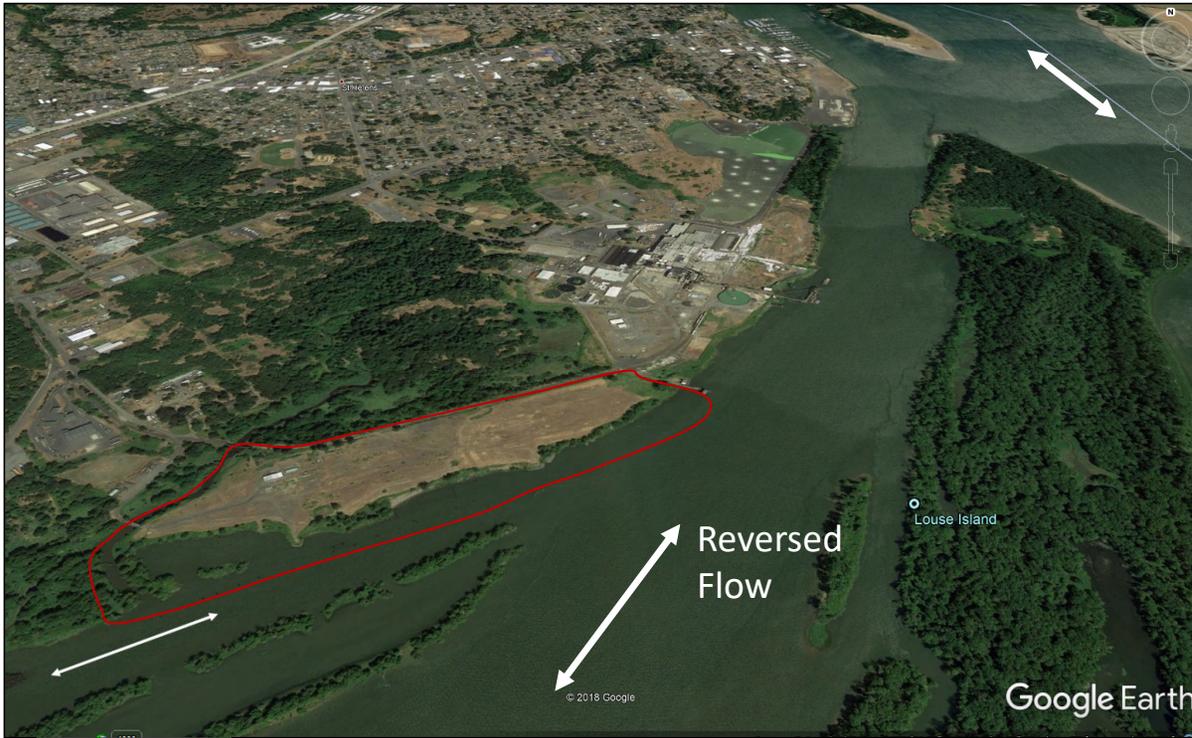
**June 29, 2011**

# Continuous Elevation Monitoring of GW and SW - Seasonal Gradient Analysis

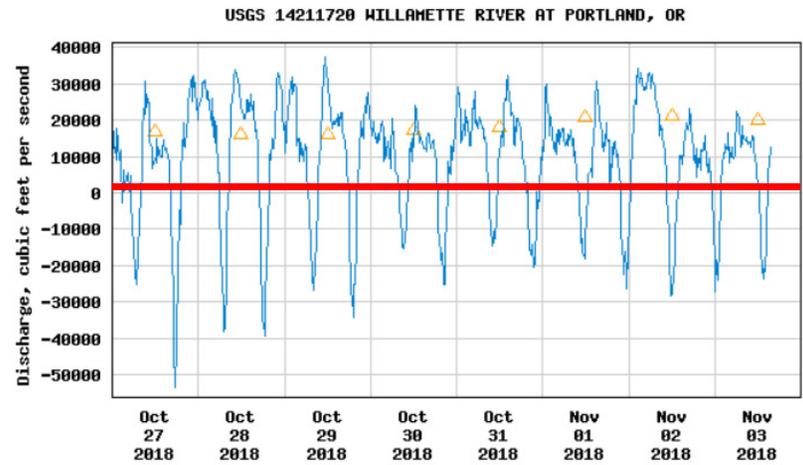
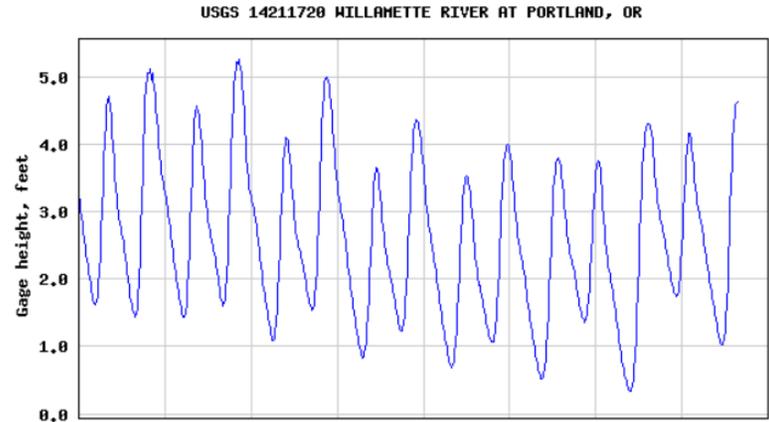
Hydrographs from GASCO Site located 15 miles upstream



# Selecting the Sampling Duration



## Diurnal Tidal Oscillation in River Stage and Reversal of Flow

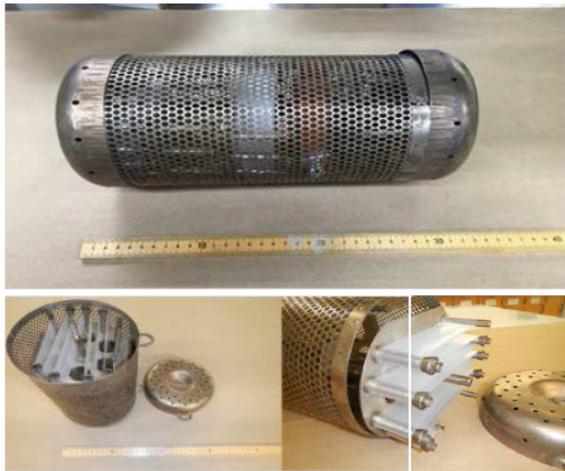


## Summary of Findings and Decisions

- Biologically Active Zone at a minimum extends to 30 cm below the sediment surface. Sampling depth chosen to evaluate impairment of aquatic habitat - 22.5-27.5 cm bss
- No areas of focused GW discharge identified. Data interpretation is uncertain.
- Based on bathymetry, positioned several porewater sampling locations to evaluate horizontal transport of dissolved-phase contamination
- Based on GW-SW gradients, water temperature, and logistics - July and October chosen for sediment porewater sampling
- Pore-water initially analyzed using the ASTM method D7363-13a Method for Determination of Parent and Alkyl Polycyclic Aromatics in Sediment Pore Water Using Solid Phase Micro-Extraction (SPME)
- Shifted to polyethylene (LDPE) strips for 3<sup>rd</sup> round of pore-water sampling to provide longer-term 28-day exposure period for evaluating chronic ecological risks during periods of high tidal fluctuation

# Sampling Devices

Surface Water Sampling Cage Containing LDPE Media



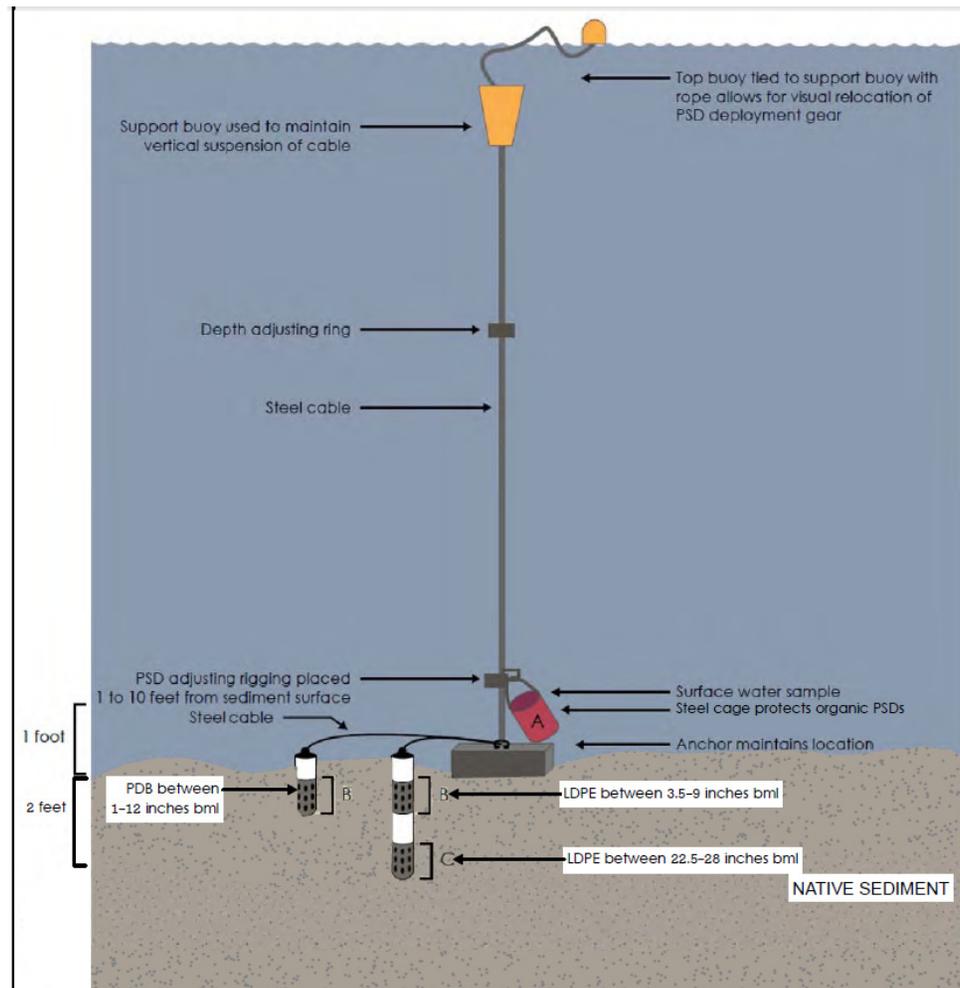
Sediment Probe with PDB



LDPE wrapped  
column within  
the sediment  
probe

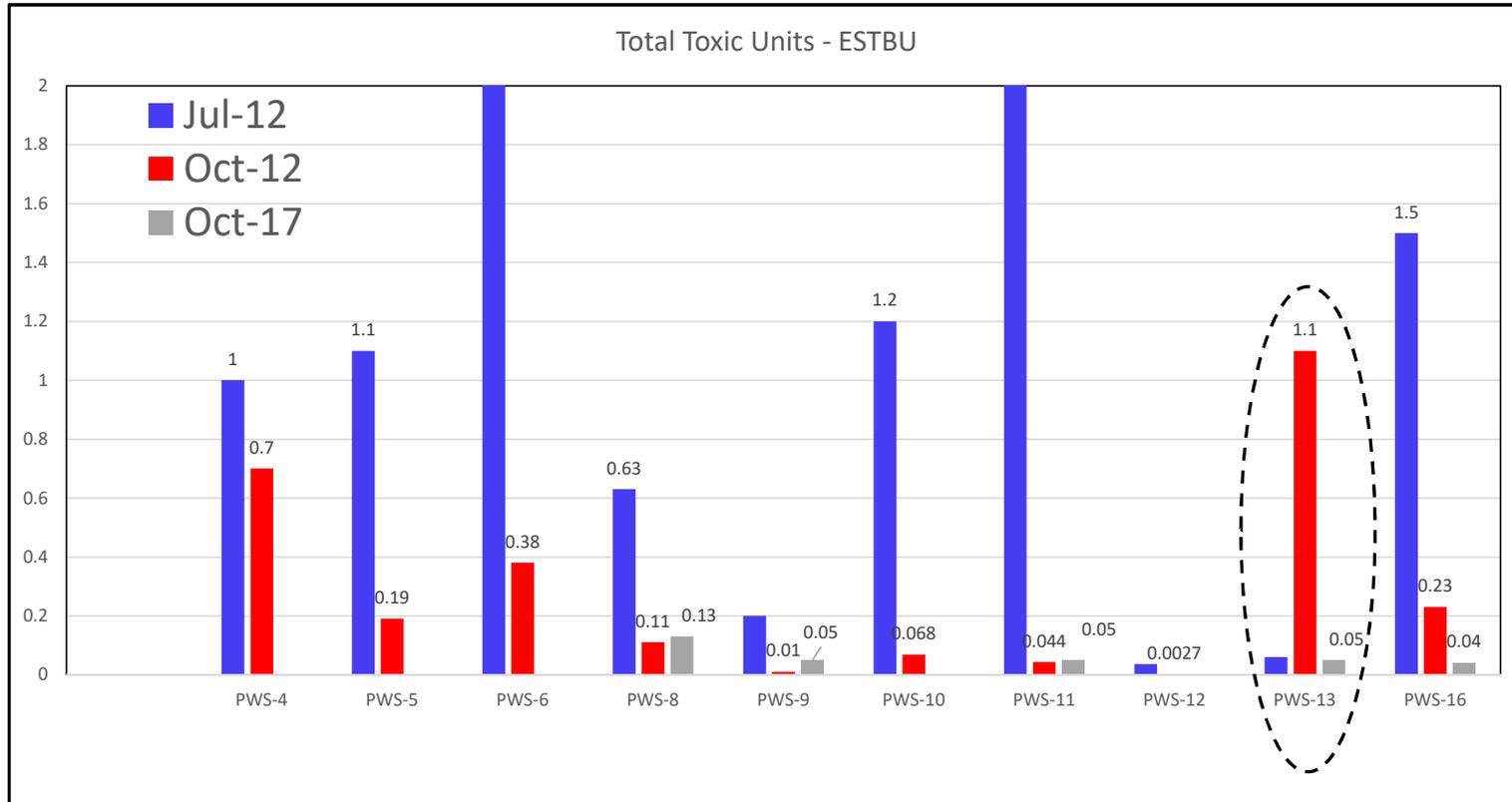


# Deployment of LDPE and PDB Samplers

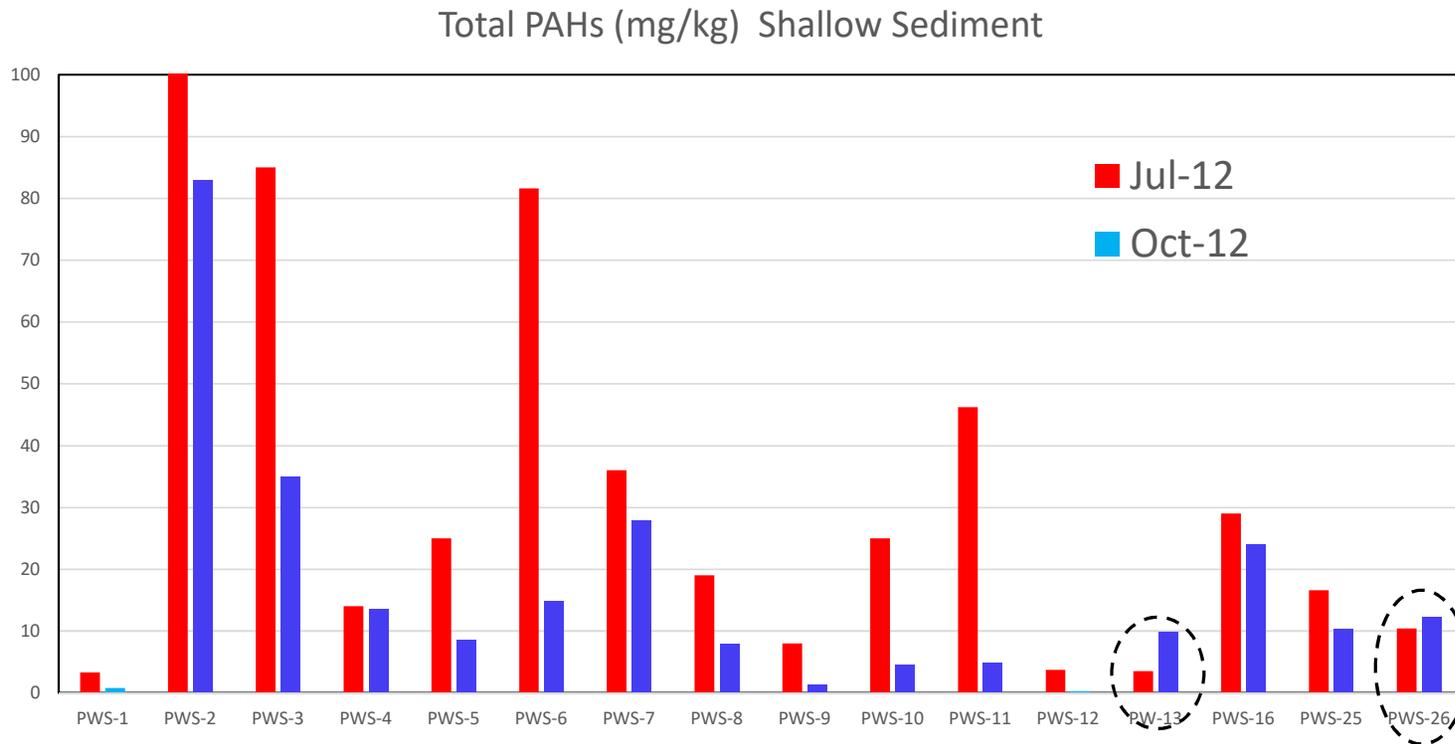


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 EPA GW-SW Interaction Workshop, November 16, 2018;  
 Henning Larsen R.G., Oregon DEQ

# Seasonal Variability in Porewater Concentrations



# Seasonal Variability in Shallow Sediment PAH Concentrations



### Vertical Distribution of Freely Dissolved PAHs in Porewater (IWTUs)

