

**NW Natural, Former “Gasco” MGP Site
Investigative Methods to Assess DNAPL & Dissolved
Phase Transport to the Willamette River**

**2008 NARPM Conference
Groundwater Technical Support Project Forum**

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**Oregon Department of Environmental Quality
www.oregon.gov/deq/**



Presentation Overview

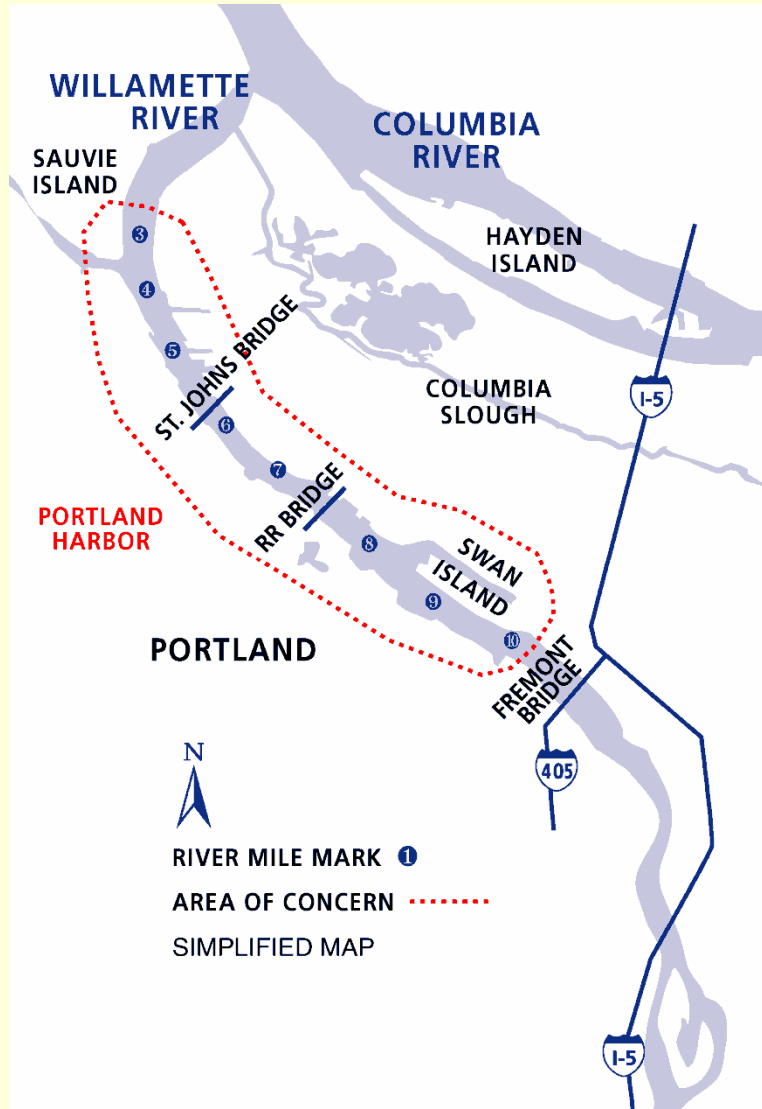
- Brief Introduction to Portland Harbor
- Overview of former Gasco MGP site vicinity, background, and investigation status
- Description of approaches and methods used to evaluate DNAPL and dissolved phase contaminant migration to the Willamette River
- Discussion of investigation findings and data uses

Portland Harbor, Background & Key Dates

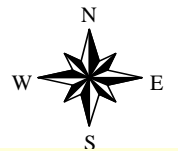
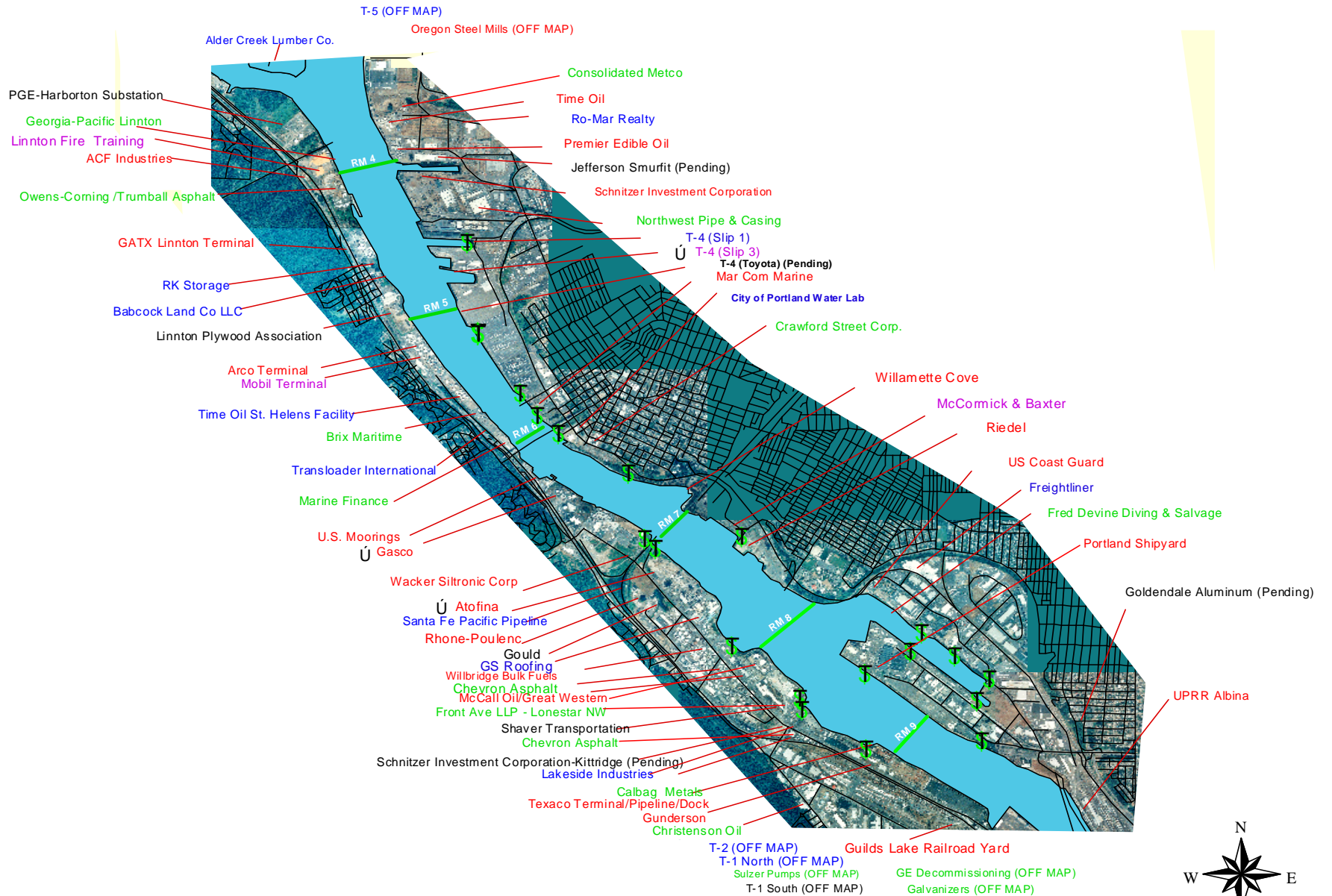
- Economic hub for Oregon and the region
- Heavily industrialized over the past 100 years
- Many types of industries
 - ship repair & maintenance
 - pesticide manufacturing
 - wood treating
 - bulk petroleum storage



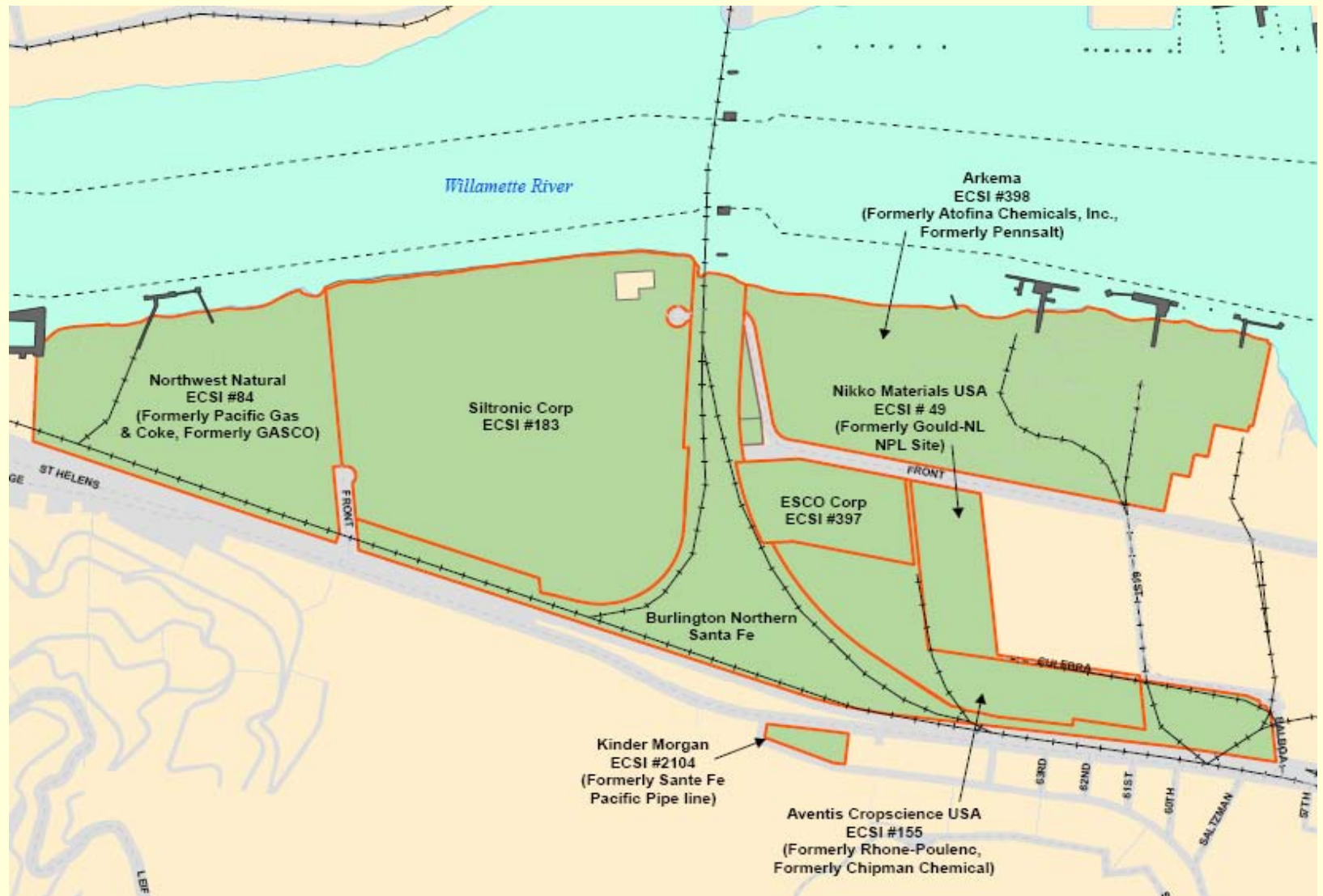
Background & Key Dates (cont.)



- 1997 EPA/DEQ study found highly contaminated sediments within 5.7 mile stretch (RM 3.5 to 9.2) of the lower Willamette River
- Contaminants of interest include metals, polycyclic aromatic hydrocarbons, polychlorinated biphenyls (PCBs), chlorinated pesticides, and dioxin
- Listed on National Priorities List in December 2000 for sediment contamination and water quality impacts
- MOU signed by governmental parties February 2001



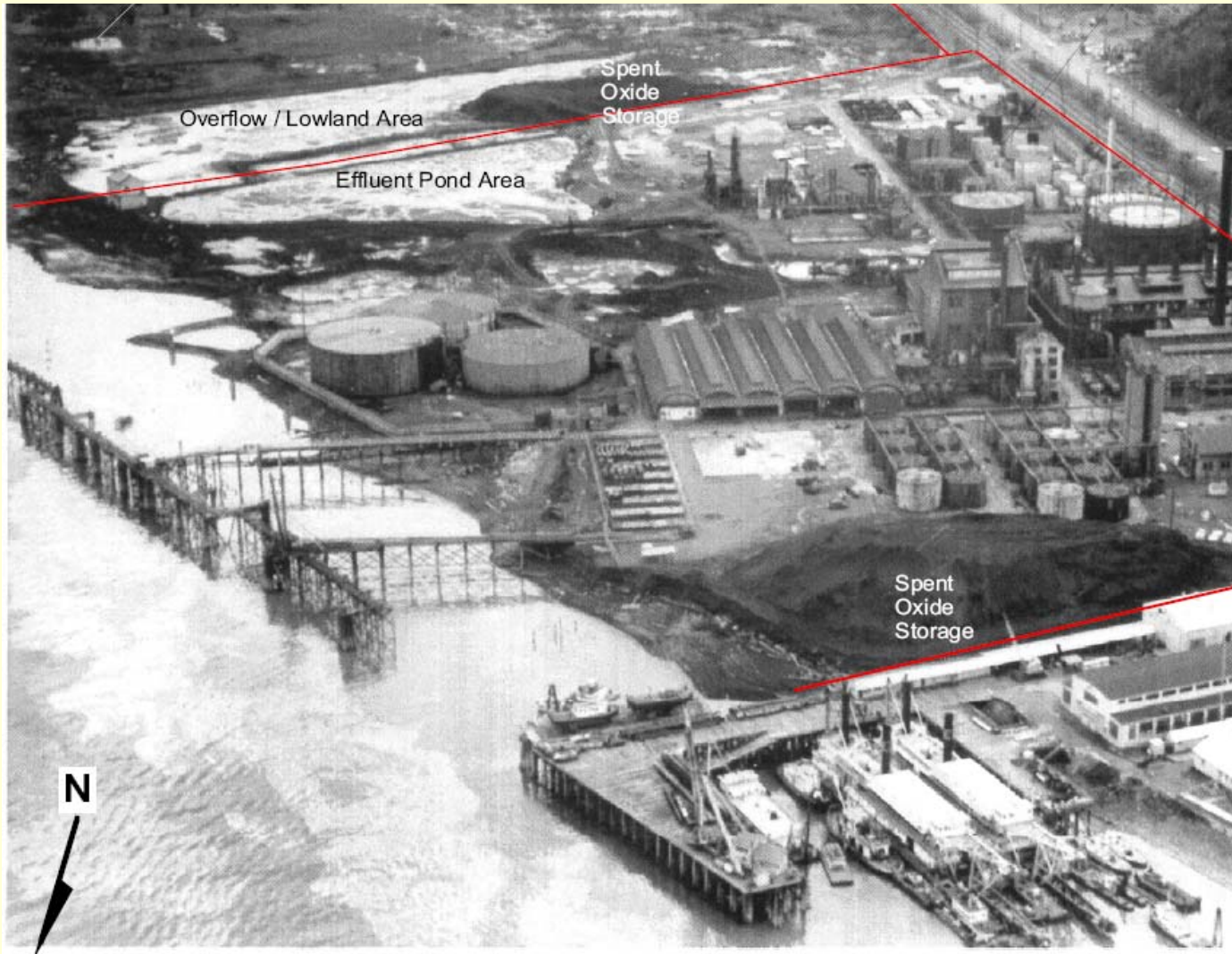
Former Gasco MGP Site Vicinity (RM 6 to 7.5)



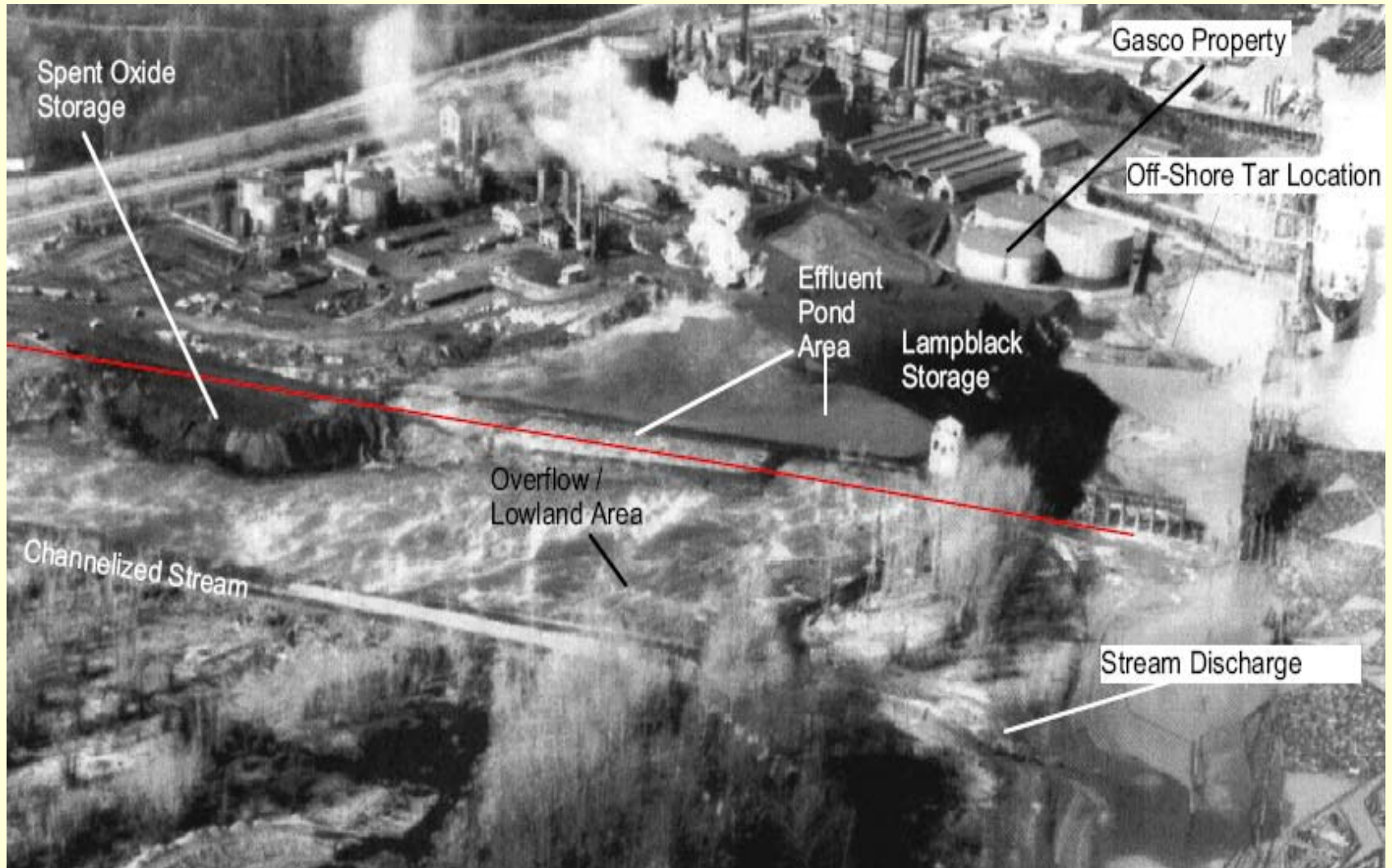
Former Gasco MGP Site Background

- NW Natural and Siltronic properties occupy approximately 45 and 85 acres, respectively, and are collectively considered the “Gasco Site”
- NW Natural (then known as Portland Gas & Coke [PG&C]) operated the Gasco MGP from 1912 until 1956, including using the northern portion of the Siltronic Property as an effluent overflow pond
- During plant’s operational life, nearly 3 billion gallons of heavy residual fuel oil were processed into approximately 300 billion cubic feet of gas for heating and lighting Portland
- Site produced MGP waste was placed in piles (lampblack, spent oxide, and gas purifier piles) and discharged to ponds (effluent discharge, settling, storage, and overflow ponds) located in non-production areas

Gasco MGP Site, mid 1950's



Gasco MGP, mid 1950's



Current Operations

- Gasco MGP historic production areas correspond roughly to the locations of the current operations
- Current site operations include NW Natural liquid natural gas plant, and the Koppers, Inc. and Fuel and Marine Marketing leaseholds, Siltronic micro-electronics facility



Site Investigation Status

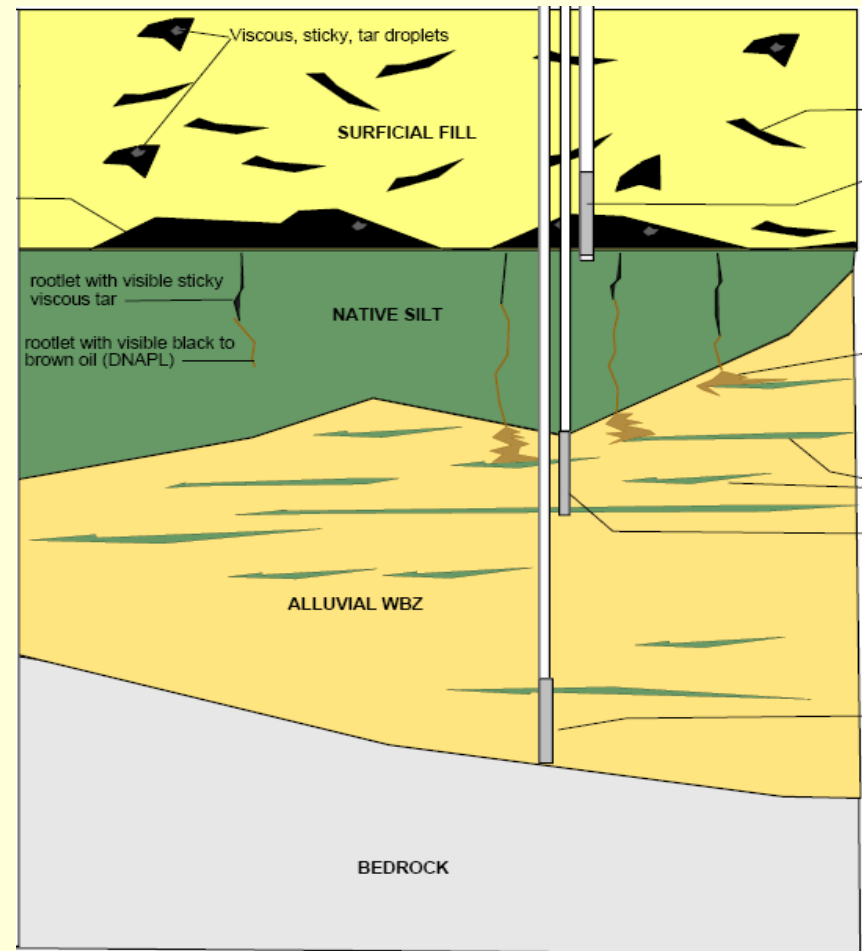
Previous site investigations have determined that:

- Upland geology
 - 20-30 feet of fill material (dredge spoils) overlie an 80-200 ft thick coarsening downward alluvial deposit of interbedded silts and sands underlain by basalt bedrock
- MGP waste and contamination have impacted the fill water-bearing zone (WBZ) and underlying alluvial WBZ throughout the former production and waste management areas
- The fill WBZ and alluvial WBZ are complete groundwater contaminant transport pathways from the uplands to the Willamette River
- Dissolved MGP constituents are present in groundwater and TZW at concentrations that significantly exceed federal and state risk-based criteria
- Historic direct discharge and deposition of MGP contamination has impacted river sediments

Site Investigation Status (cont.)

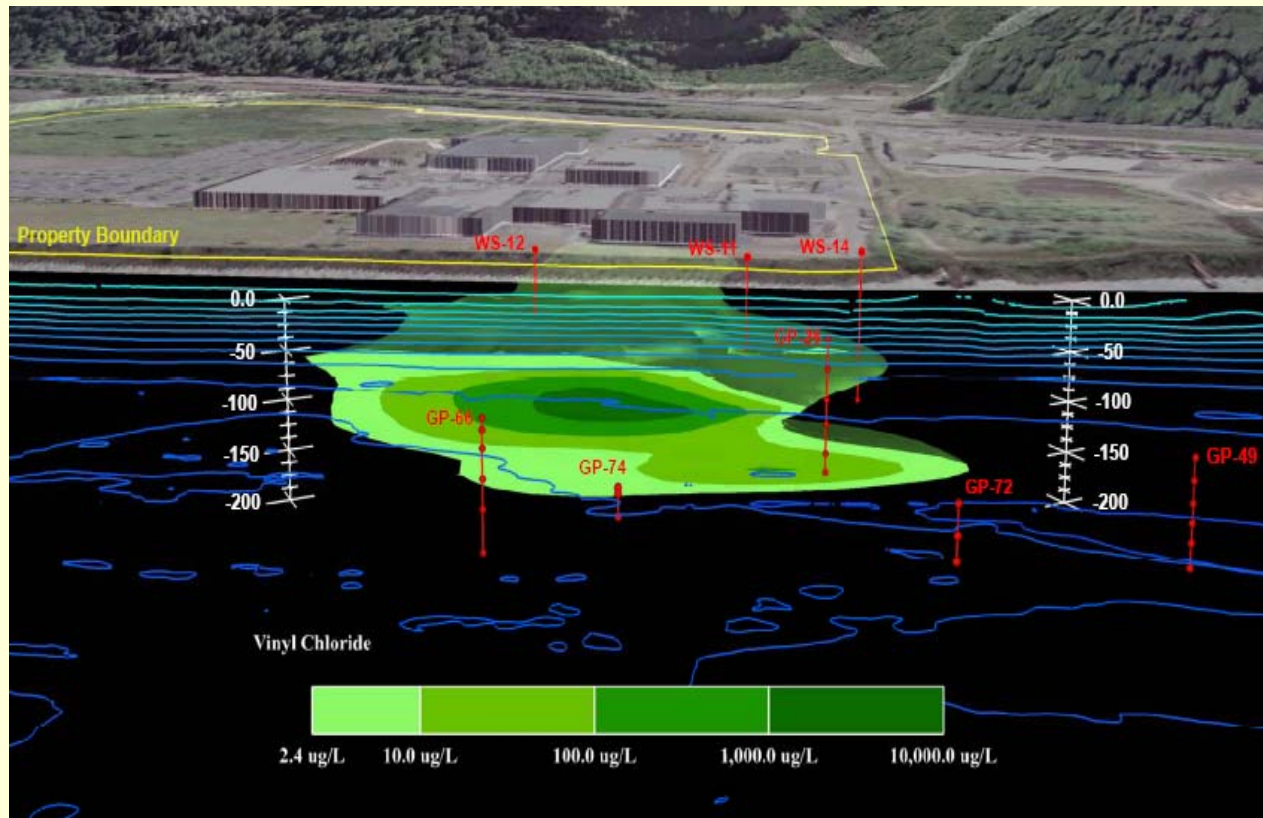
Conceptual model for DNAPL migration

- Mobile DNAPL in the fill unit and upper silt unit has penetrated into the alluvium beneath the former effluent ponds and discharge areas
- DNAPL occurring in fill and alluvium has a high potential to migrate into the Willamette River in the southern portion of the Gasco Site and in the northern portion of the Siltronic Property



Site Investigation Status (cont.)

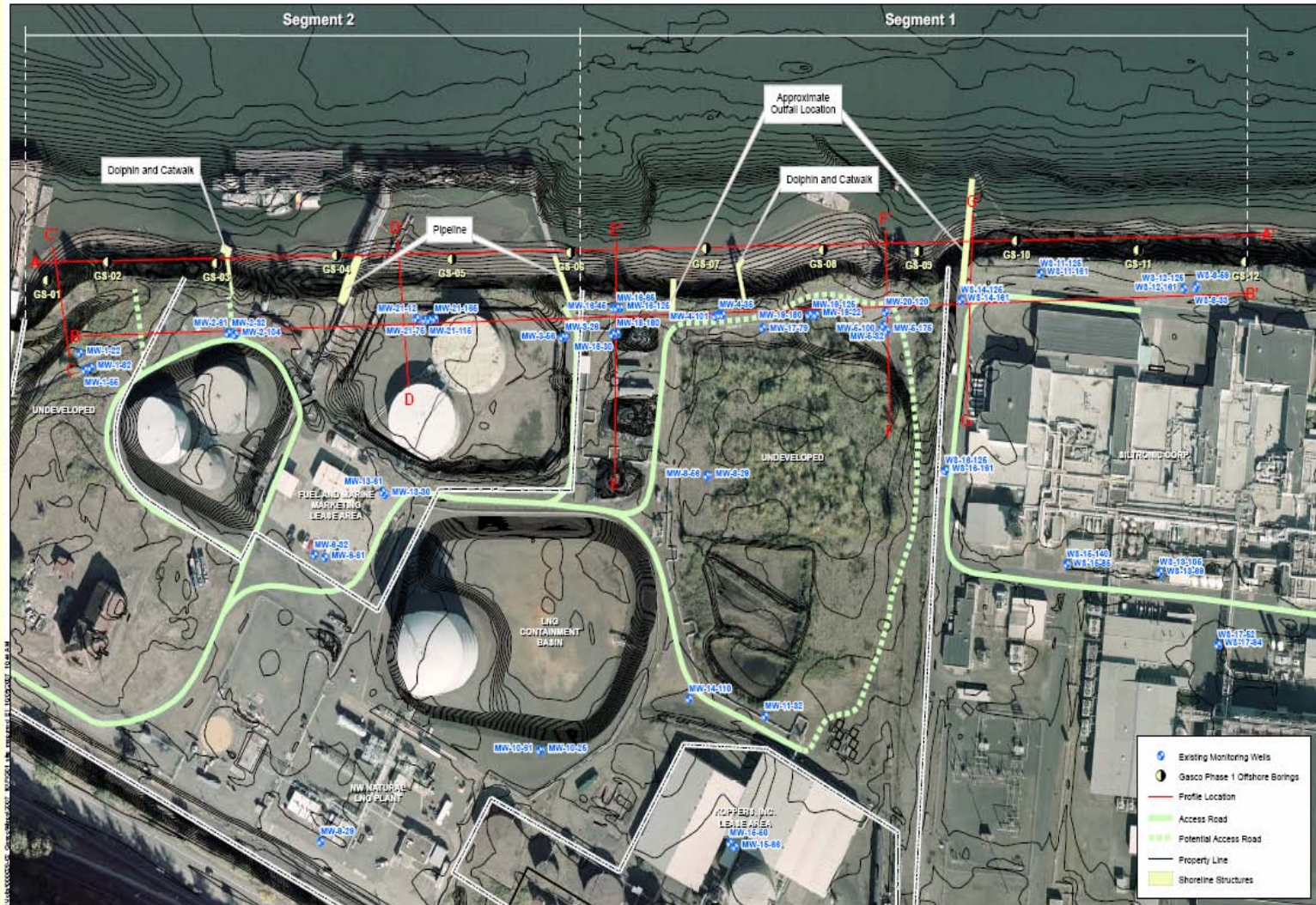
- In the northern portion of the Siltronic Property, VOC contamination in groundwater commingles with MGP waste/contamination in the alluvial WBZ



Site Investigation Status (cont.)

- The shoreline of the former Gasco site and the northern portion of the Siltronic Property were identified as high priorities for source control and divided into two segments:
- **Segment 1:** Coincides with the heaviest MGP-related impacts identified near the river, including DNAPLs, impacted riverbank soils, and contaminated groundwater
 - Also includes groundwater contamination caused by Siltronic that has commingled with MGP-related DNAPL and groundwater contamination
- **Segment 2:** Extends downstream to the property line with US Moorings, identified as a high priority based on concentrations of MGP chemicals of interest (COI), particularly cyanide, in riverbank soils and groundwater.

Shoreline Segments 1 and 2



Site Investigation Status (cont.)

- Most recently, NW Natural conducted uplands and in-water work to provide information for:
 - Assessing uplands contaminant transport pathways to the river (e.g., direct discharge, groundwater)
 - Supporting uplands source control measures evaluations and planning
 - Assisting the planning of in-water work contemplated by EPA and NW Natural
 - Evaluating potentially complete and/or significant human health and ecological exposure pathways

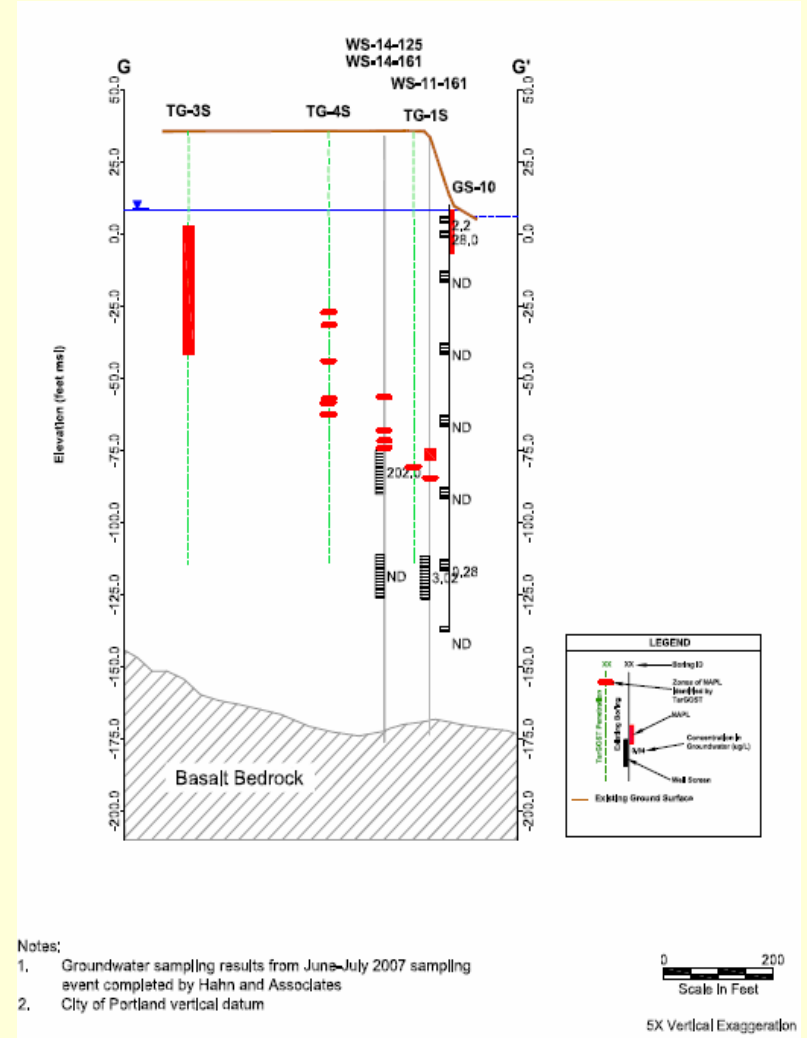
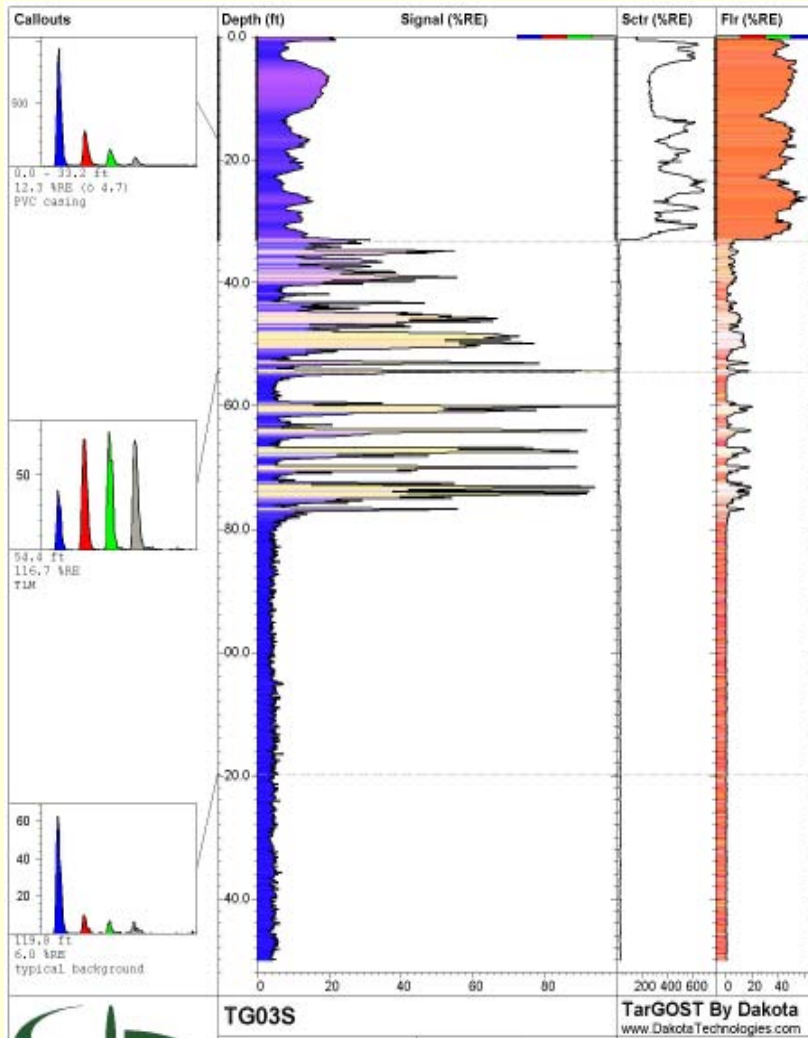
Groundwater to Surface Water Investigation Objectives

- Track groundwater contamination from the uplands to beneath the river and into transition zone water (TZW)
- Understand how groundwater and TZW concentrations may be related to direct historical deposition of MGP waste in the river
- Assess variability of chemical concentrations in TZW due to tidal fluctuations in the Willamette River
- Further assess direction and quantify groundwater flux into river
- Assess transport and transformation of cyanide from uplands groundwater to TZW and surface water

Groundwater to Surface Water Investigation Approach

- **Uplands** - continuous stratigraphic and DNAPL mapping to greater than 200 feet below ground surface (bgs) using sonic drilling equipment, and combined cone penetrometer and laser-induced fluorescence (LIF) logging methods (i.e., Targost®)
- **In-water:**
 - High-resolution reconnaissance level groundwater and transition zone water (TZW) sampling using barge-mounted sonic and/or push-probe drilling equipment
 - Visual observations and sample analysis to assess extent of direct discharge impacts in river sediments
 - Tidal cycle TZW and surface water column sampling
 - Seepage meter groundwater flux monitoring

Upland LIF Logging & DNAPL Mapping



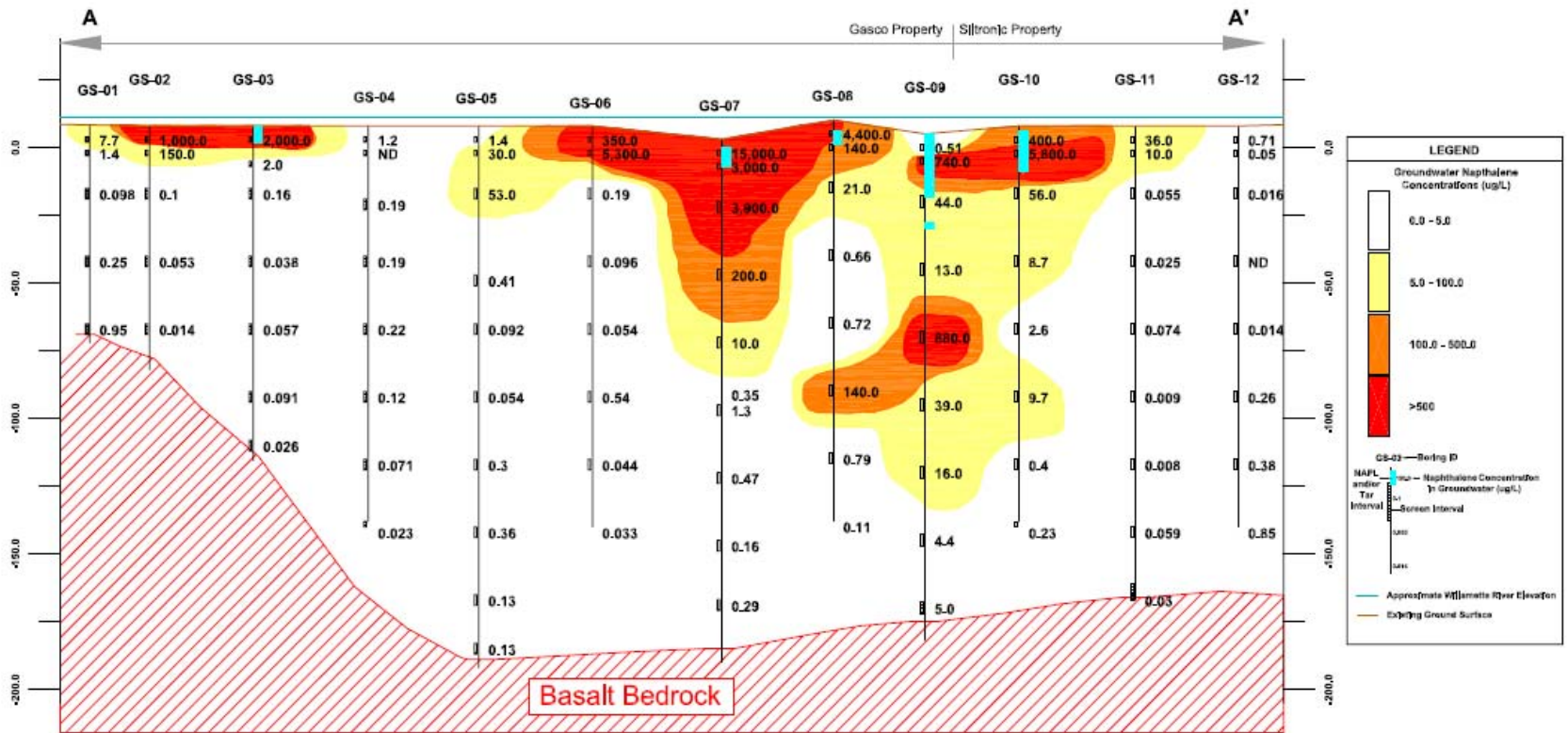
Upland LIF Logging & DNAPL Mapping (cont.)

- LIF logging provided significant information for SCMs planning along shoreline segments 1 and 2
- Depth of mobile DNAPL in alluvial WBZ increases near the NW Natural & Siltronic property line along Segment 1 from:
 - Less than 60 feet msl in the southern portion of the NW Natural Property, to
 - Greater than 60 feet msl in the Siltronic portion of Segment 1
- Absence of mobile DNAPL in the fill and alluvial WBZs along Segment 2

In-water Investigation Field Sampling Plan

- Drill 42 borings (seven to basalt bedrock) using barge-mounted sonic or push-probe equipment along four offshore transects
- Collect more than 200 groundwater samples and over 100 sediment samples
- Install seven ultrasonic seepage meters to measure seepage rates over multiple tidal cycles
- Collect 30 TZW samples over multiple tidal cycles from three mini-piezometers, including 12 near bottom river water samples for comparison purposes
- Collect 180 samples from the Willamette River water column:
 - 20 offshore locations;
 - 3 depth intervals within the water column (i.e., near surface, mid-depth, and near bottom);
 - 3 tidal periods (ebb, slack high, and slack low),
 - analysis of total cyanide, amenable cyanide, free cyanide, selected metals, and conventional parameters

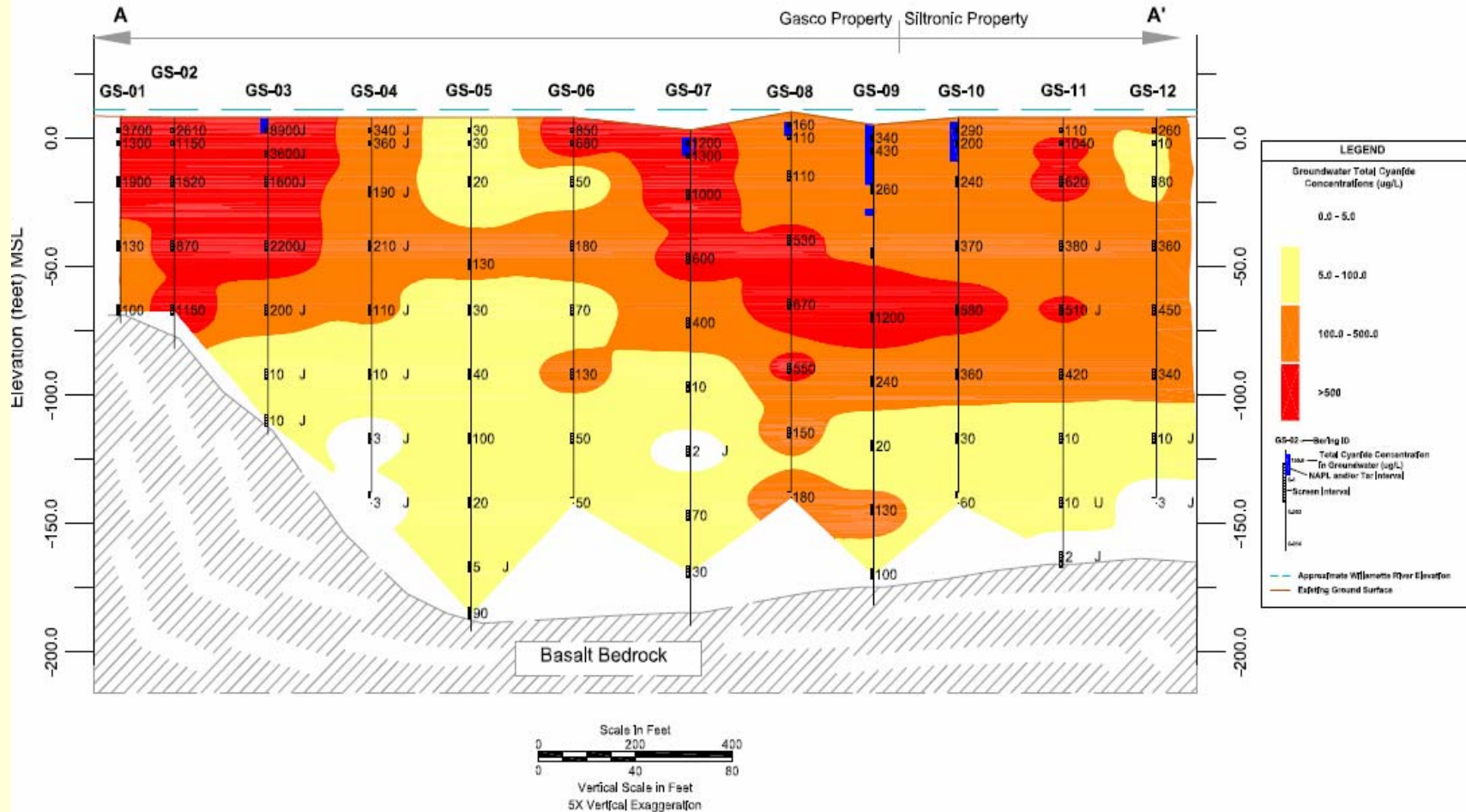
Track Groundwater Plumes (ex., naphthalene)



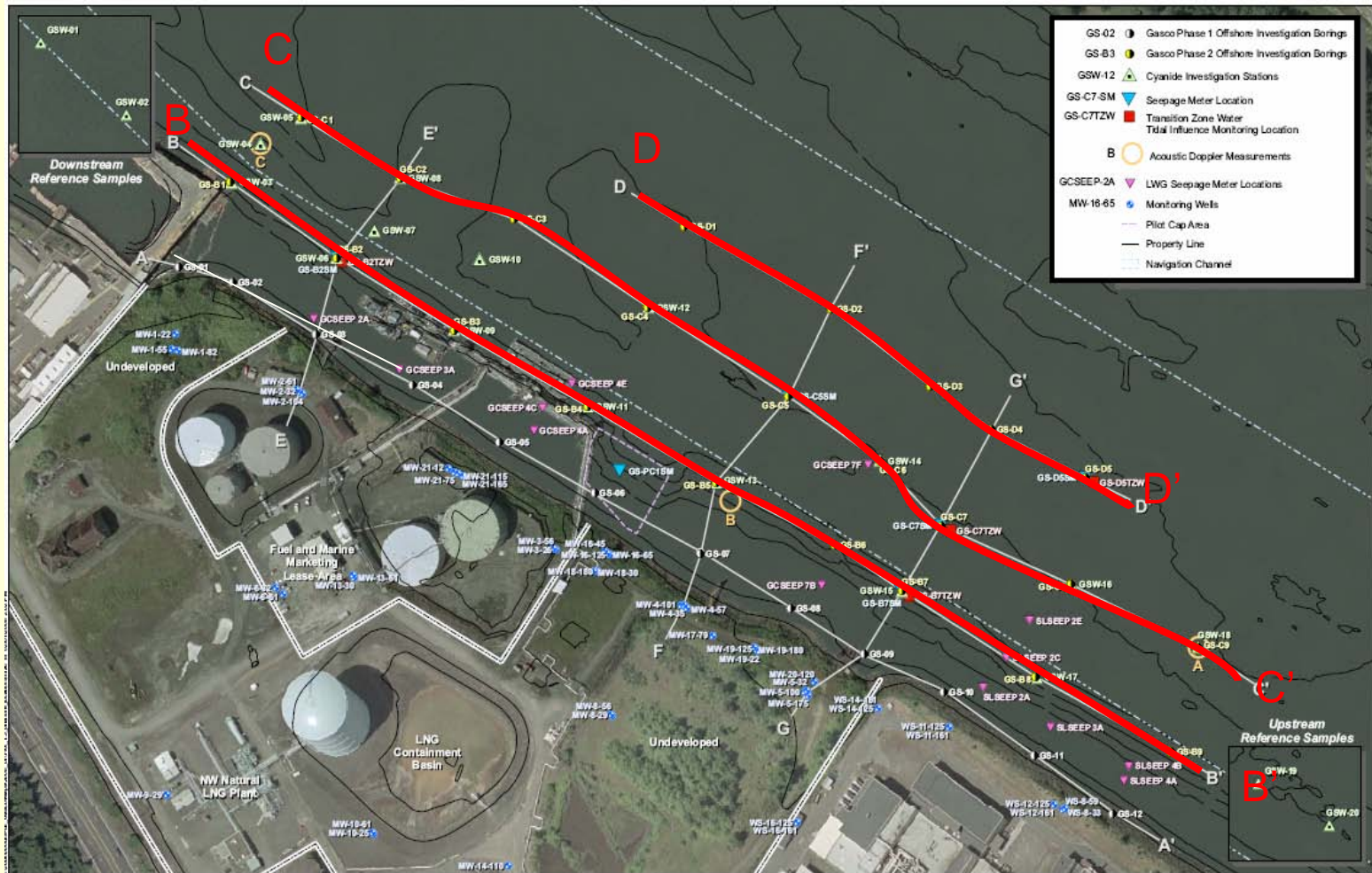
- Notes:
1. Vertical Datum: City of Portland
 2. Horizontal Datum: Oregon State Plane NAD(83)
 3. See Boring Logs for Sample Details

0 200
Scale in Feet
5X Vertical Exaggeration

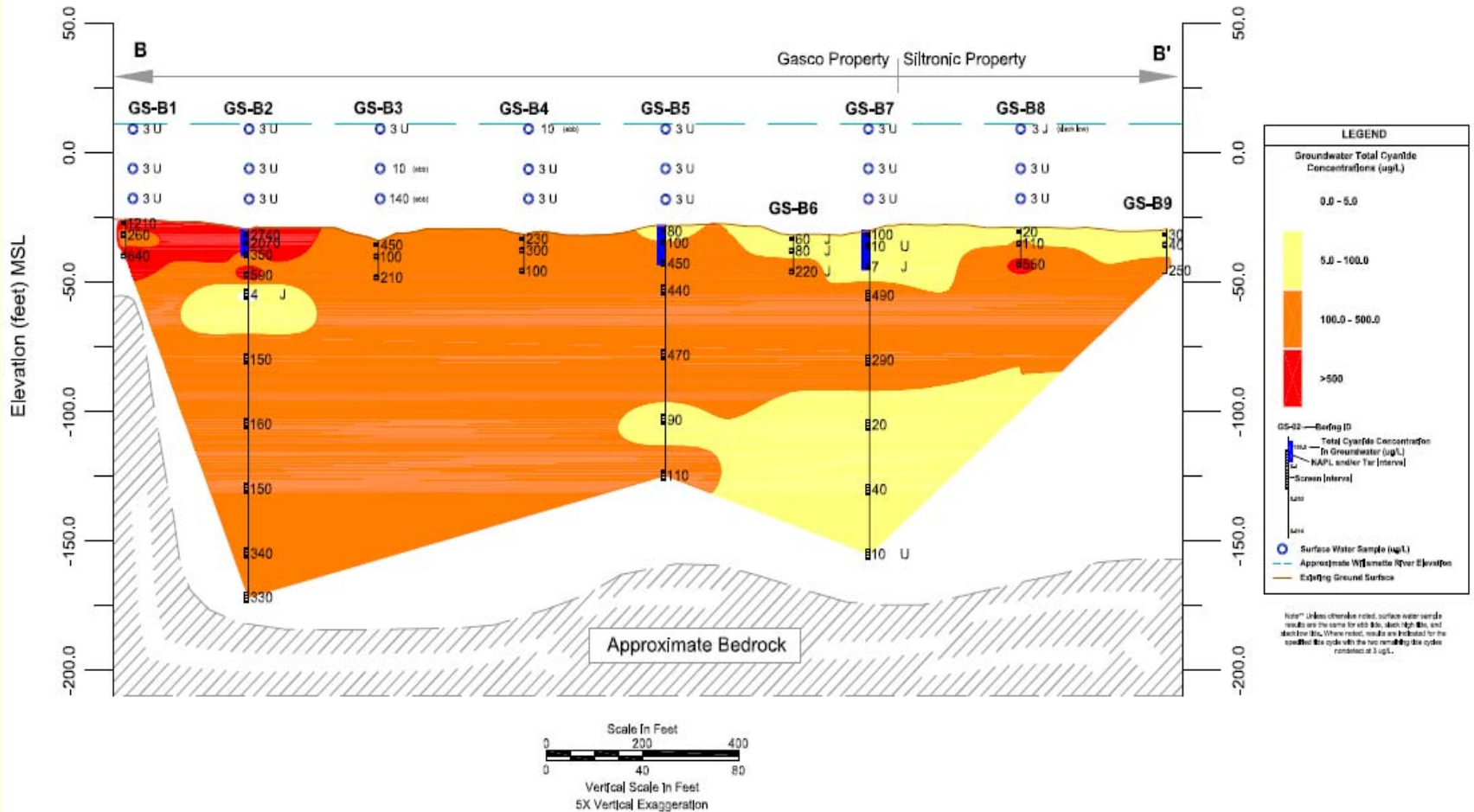
Track Groundwater Plumes (ex., total CN looking towards river)



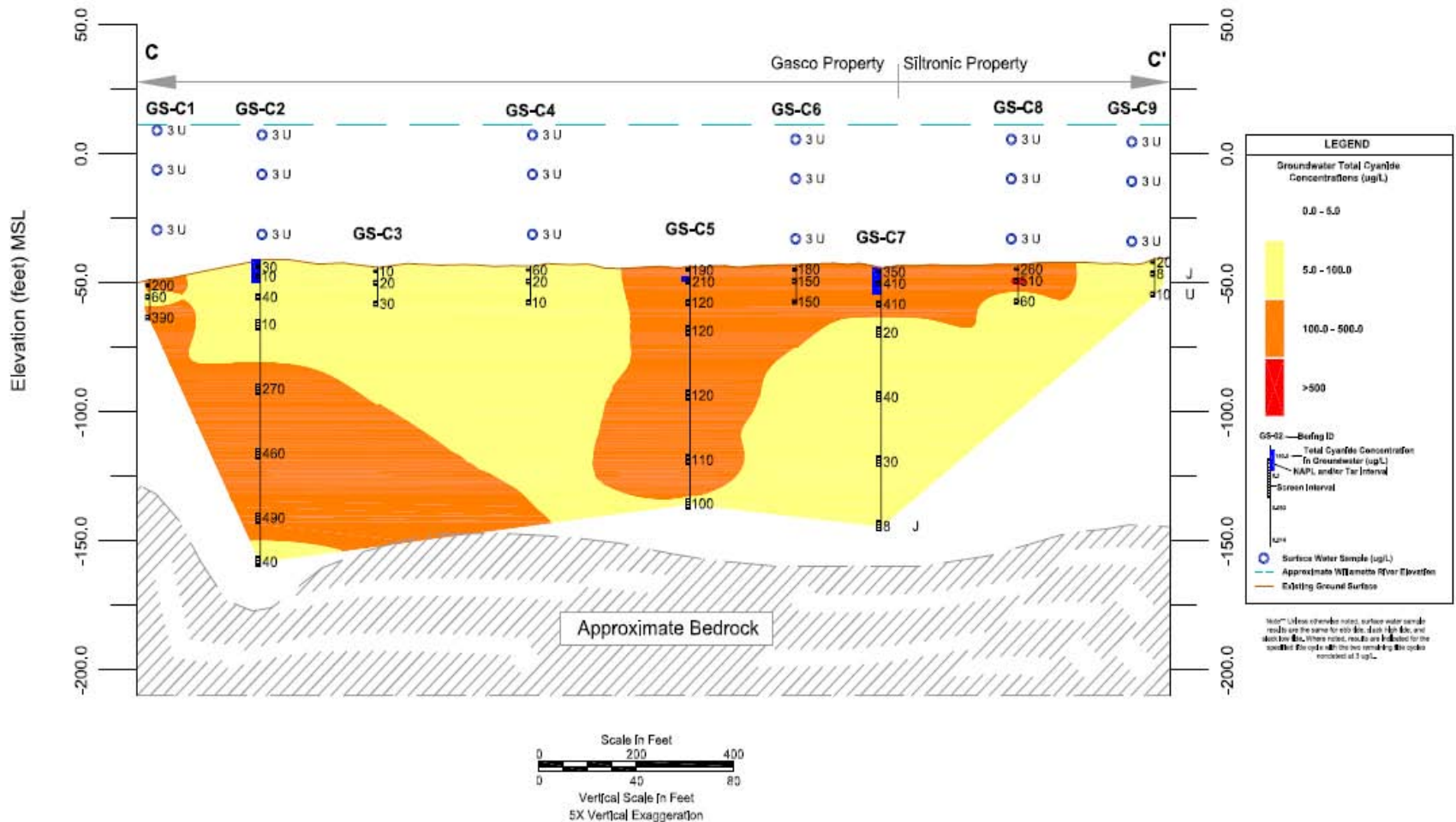
In-water Investigation Results



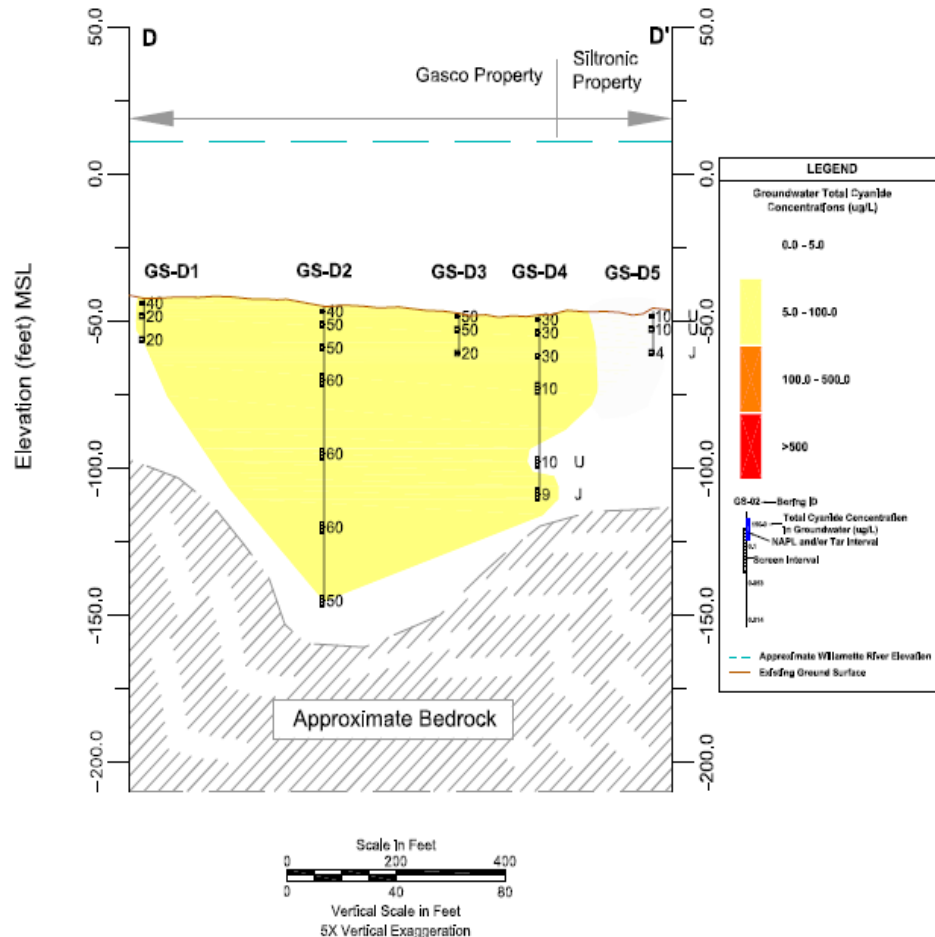
Track Groundwater Plumes (ex., total CN)



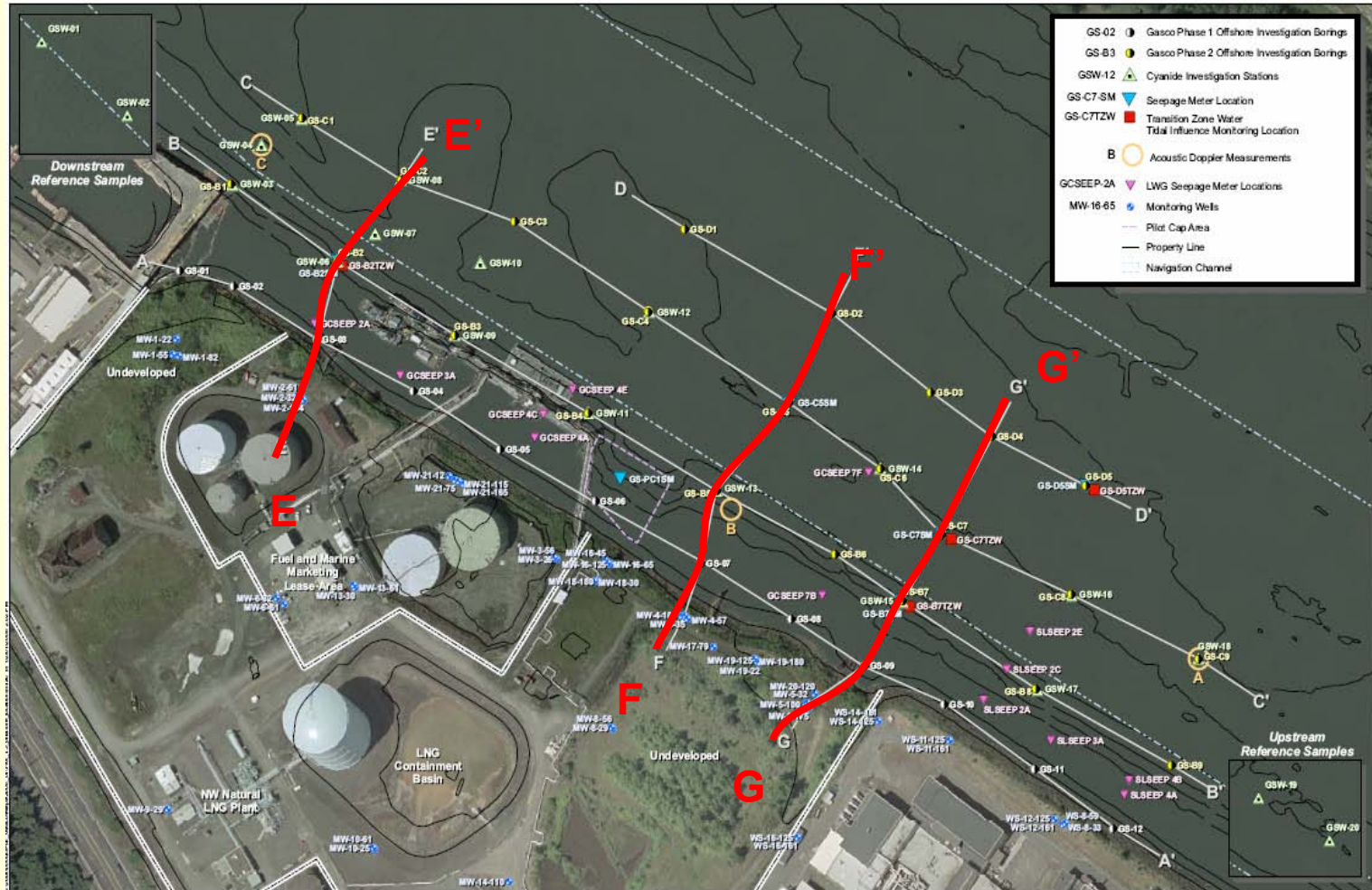
Track Groundwater Plumes (ex., total CN)



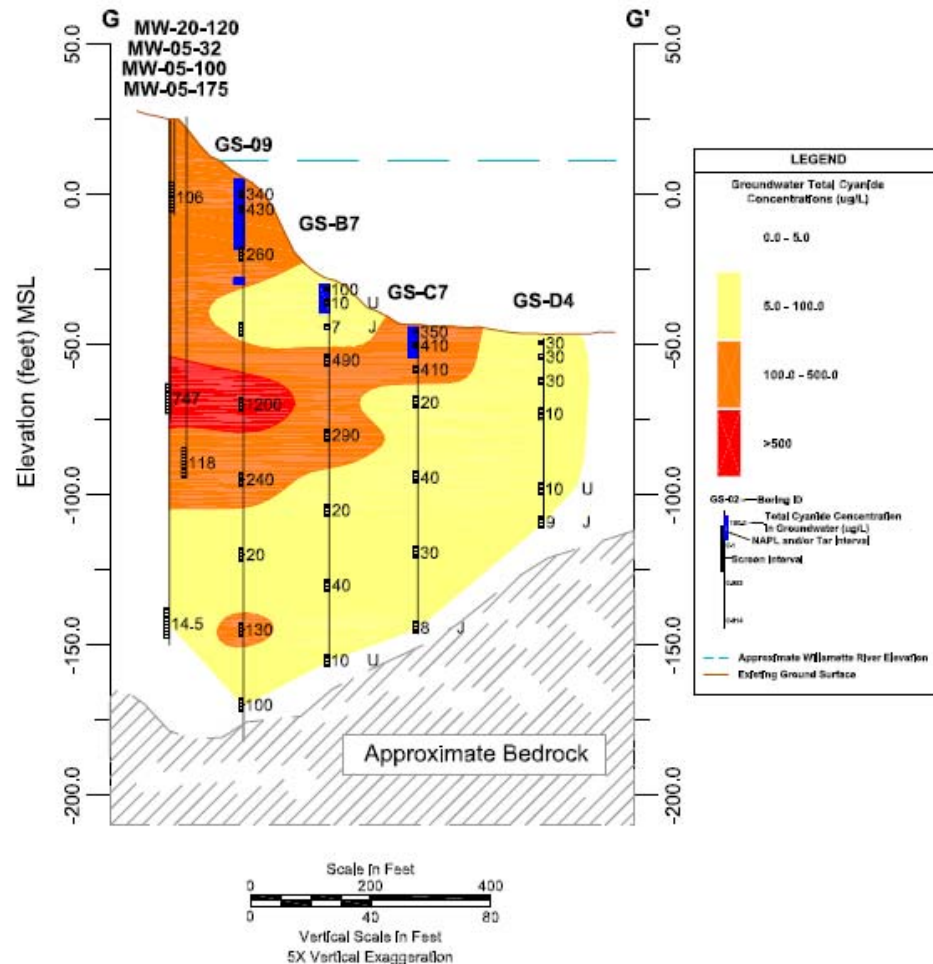
Track Groundwater Plumes (ex., total CN)



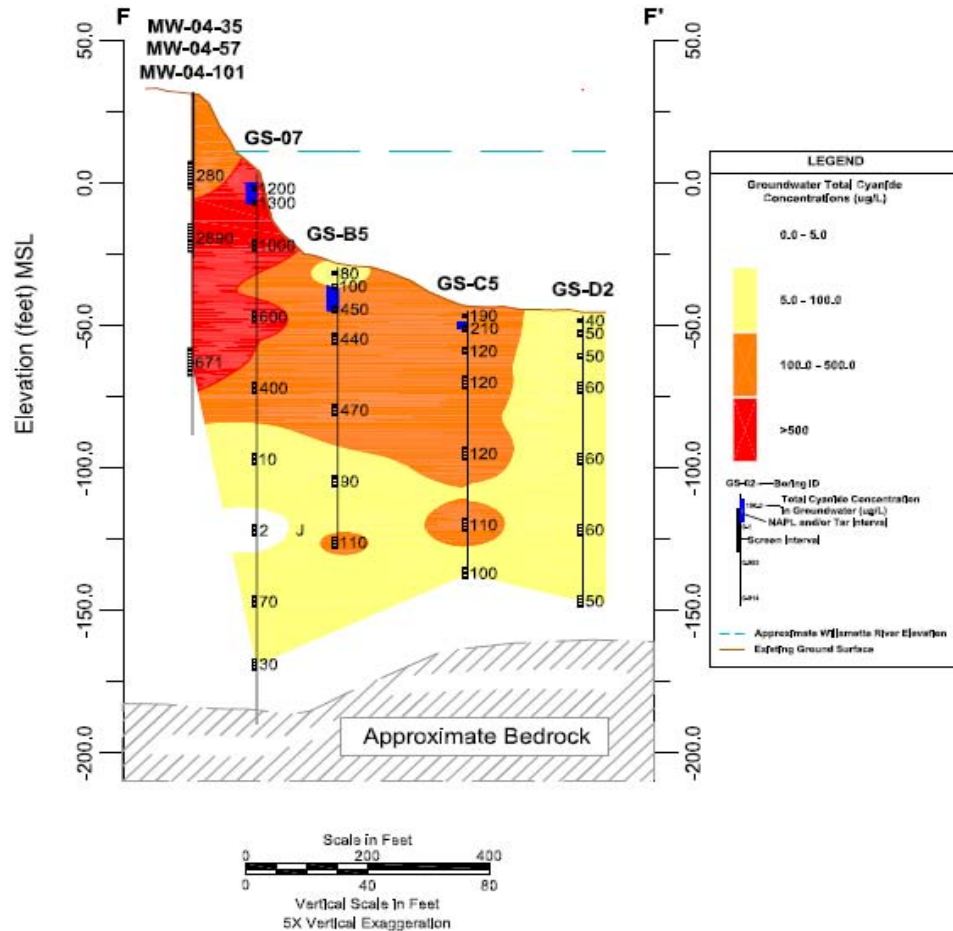
In-water Investigation Plan (cont.)



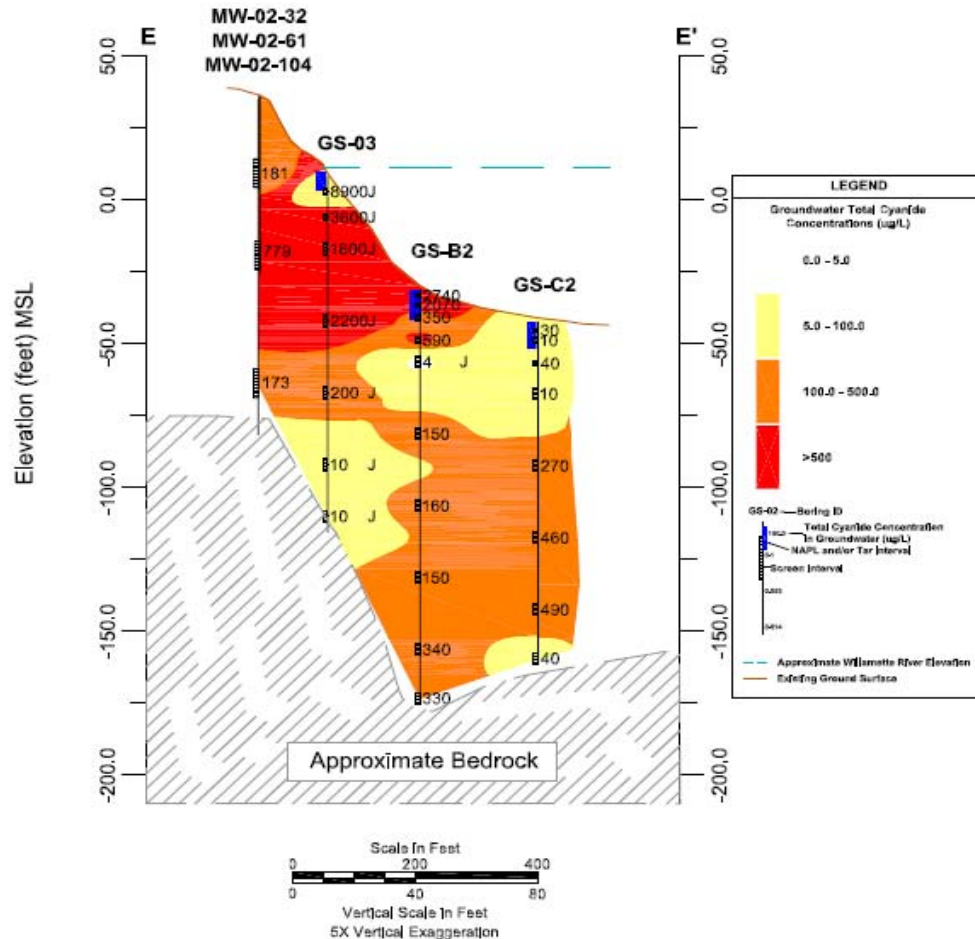
Track Groundwater Plumes (ex., total CN)



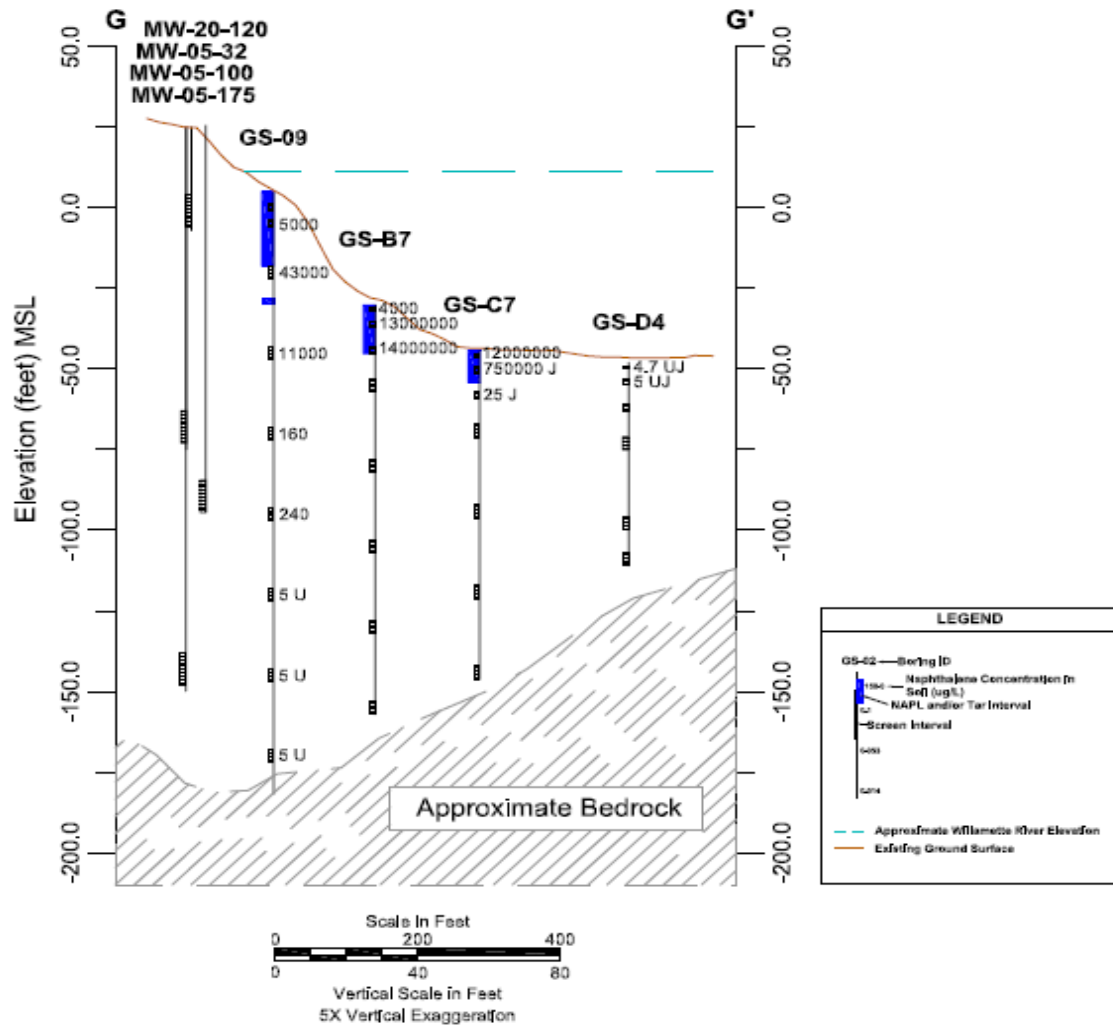
Track Groundwater Plumes (ex., total CN)



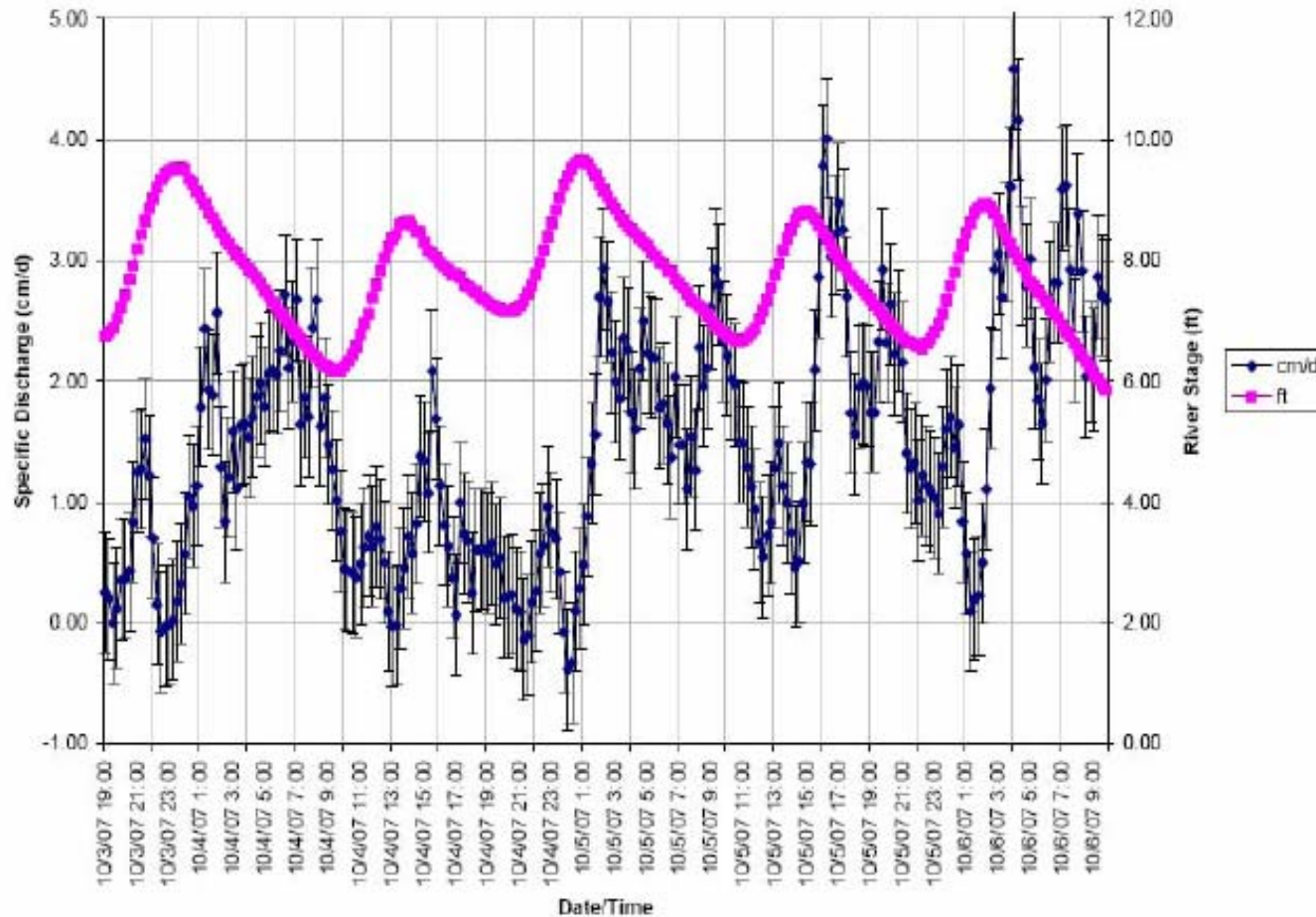
Track Groundwater Plumes (ex. Total CN)



Direct Discharge Impacts

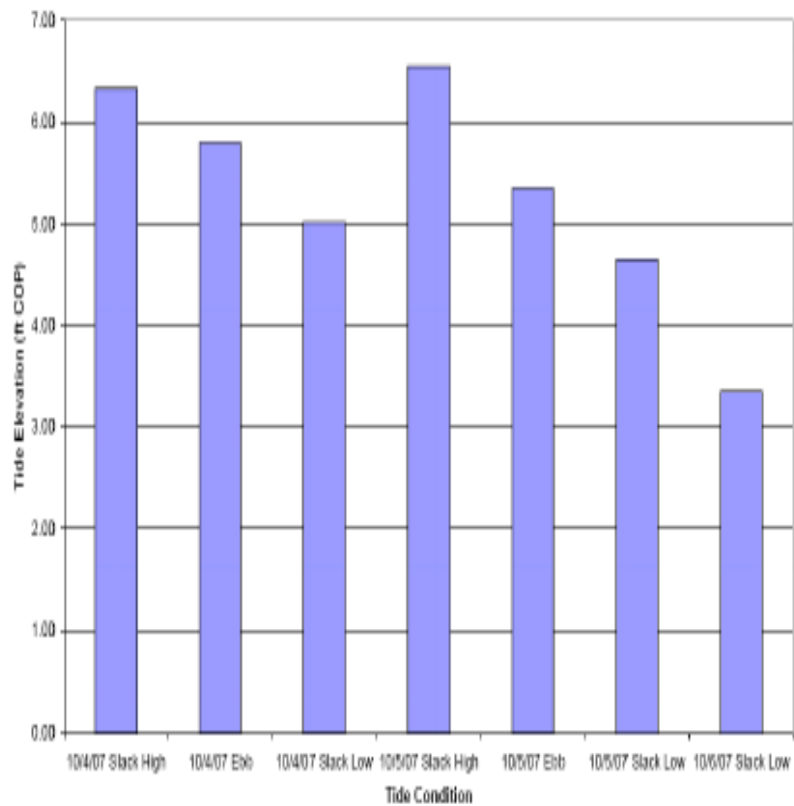


Groundwater Flux to/from River

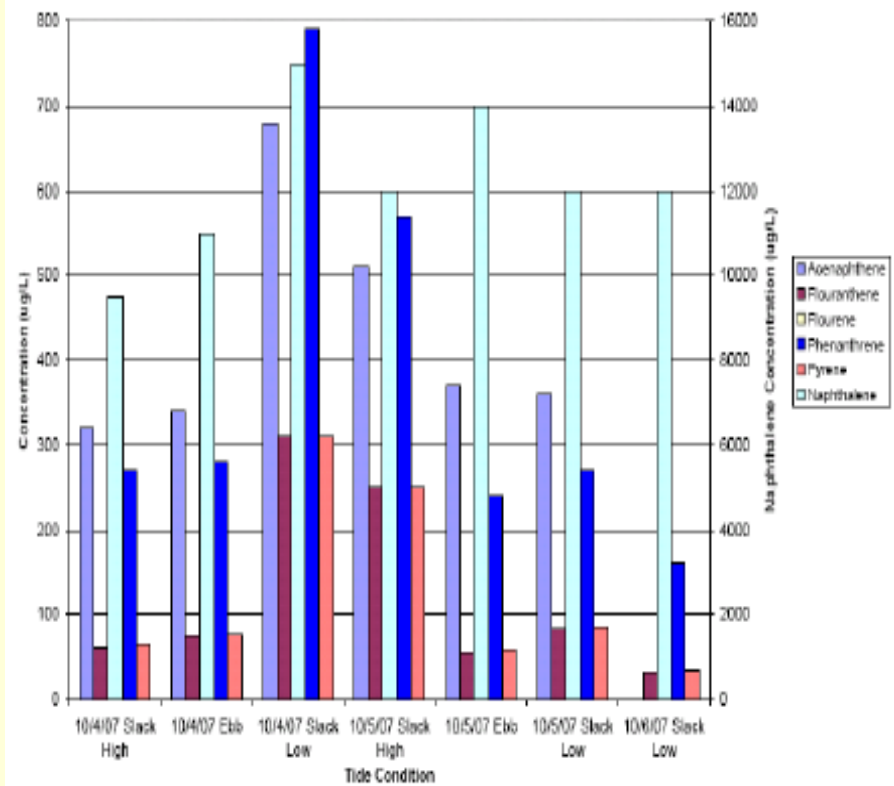


Tidal TZW Sampling

Tide Elevations



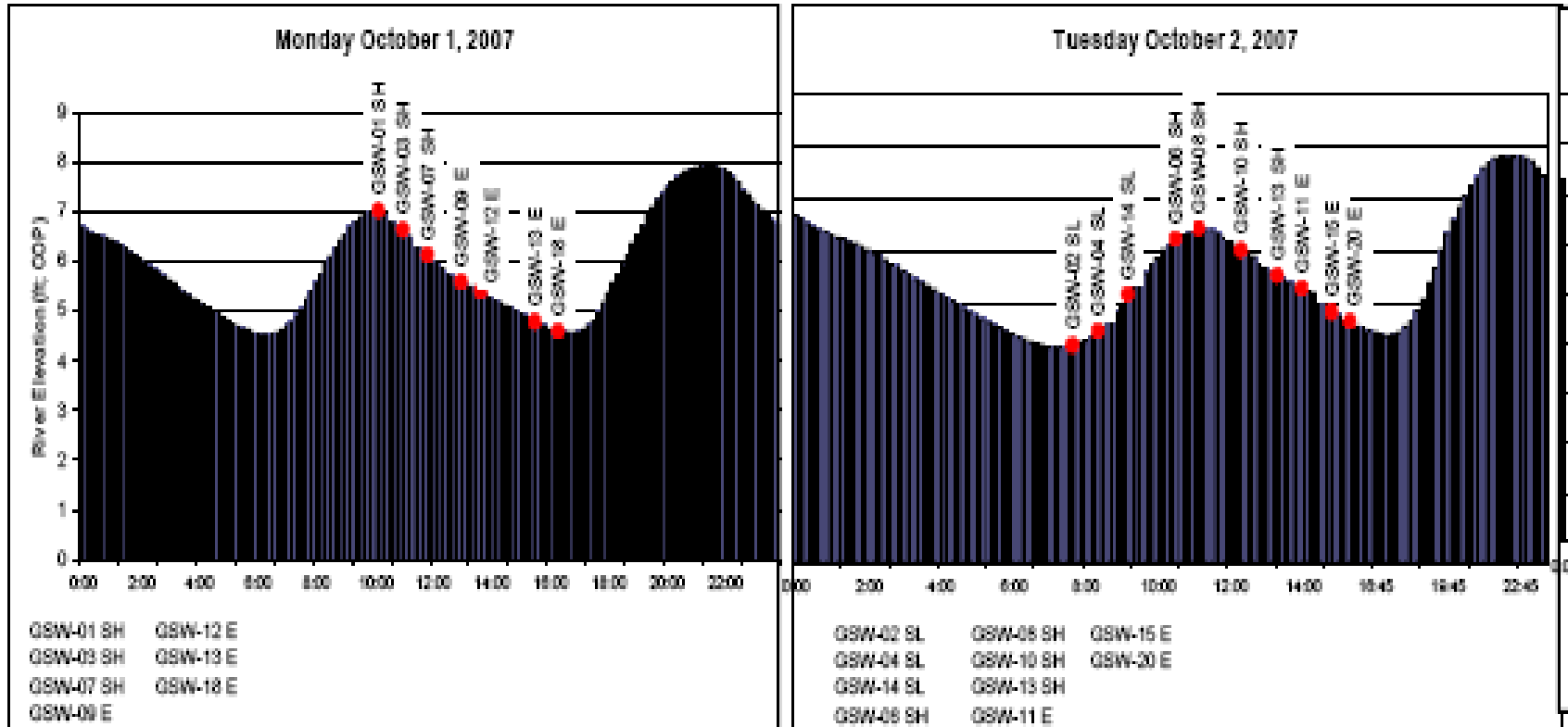
Transition Zone Water PAH Concentrations



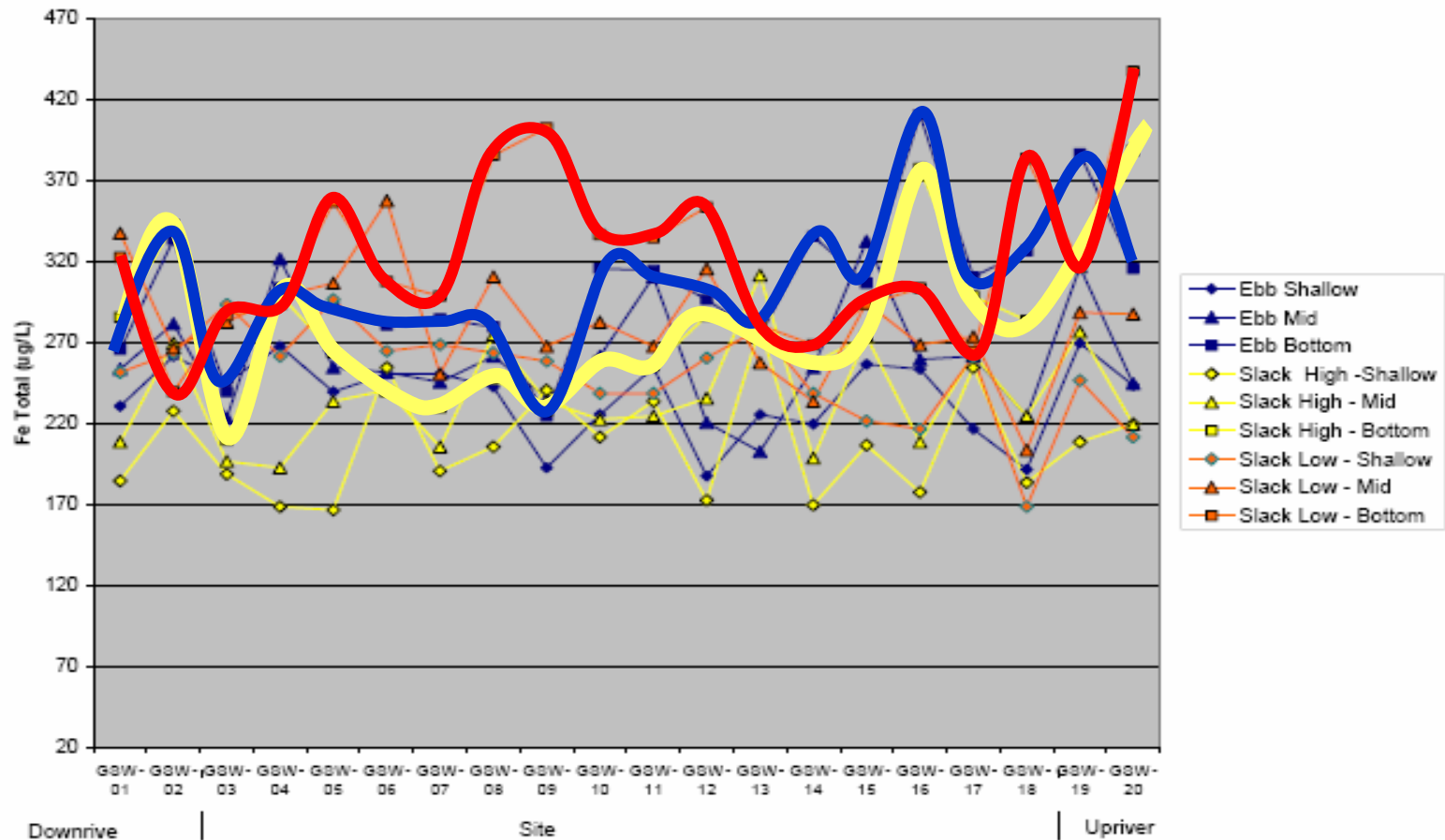
Tidal Cycle Surface Water Sampling

Slack High – Ebb Tides

Slack Low-Slack High-Ebb Tides



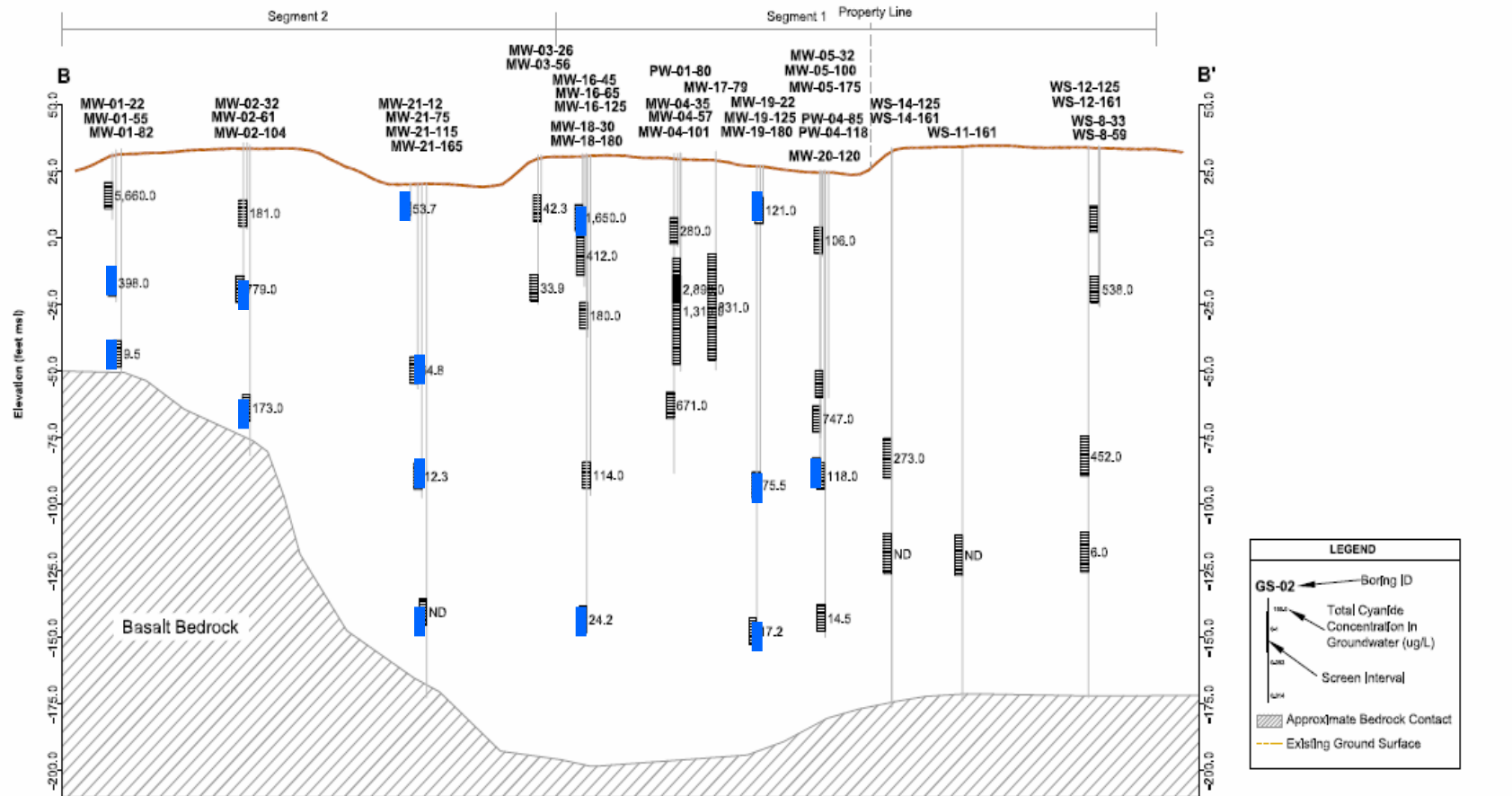
Surface Water Column Sampling (ex., total iron)



Data Uses

- Interpret stratigraphy and delineate nature and extent of contamination along the shoreline and under the river
- Upgrade network of top-of-bank monitoring wells to support future evaluations of contaminant transport to river (e.g., mass flux)
- Confirm conceptual site DNAPL migration model: 1) former effluent ponds are sources of mobile DNAPL, 2) DNAPL migrates towards river and downward, and 3) distribution and movement is stratigraphically influenced
- Allow MGP COI fluxes to/into the river to be estimated
- Provide data for preliminary SCMs design and support in-water removal action planning

TOB Monitoring Well Network-AFTER

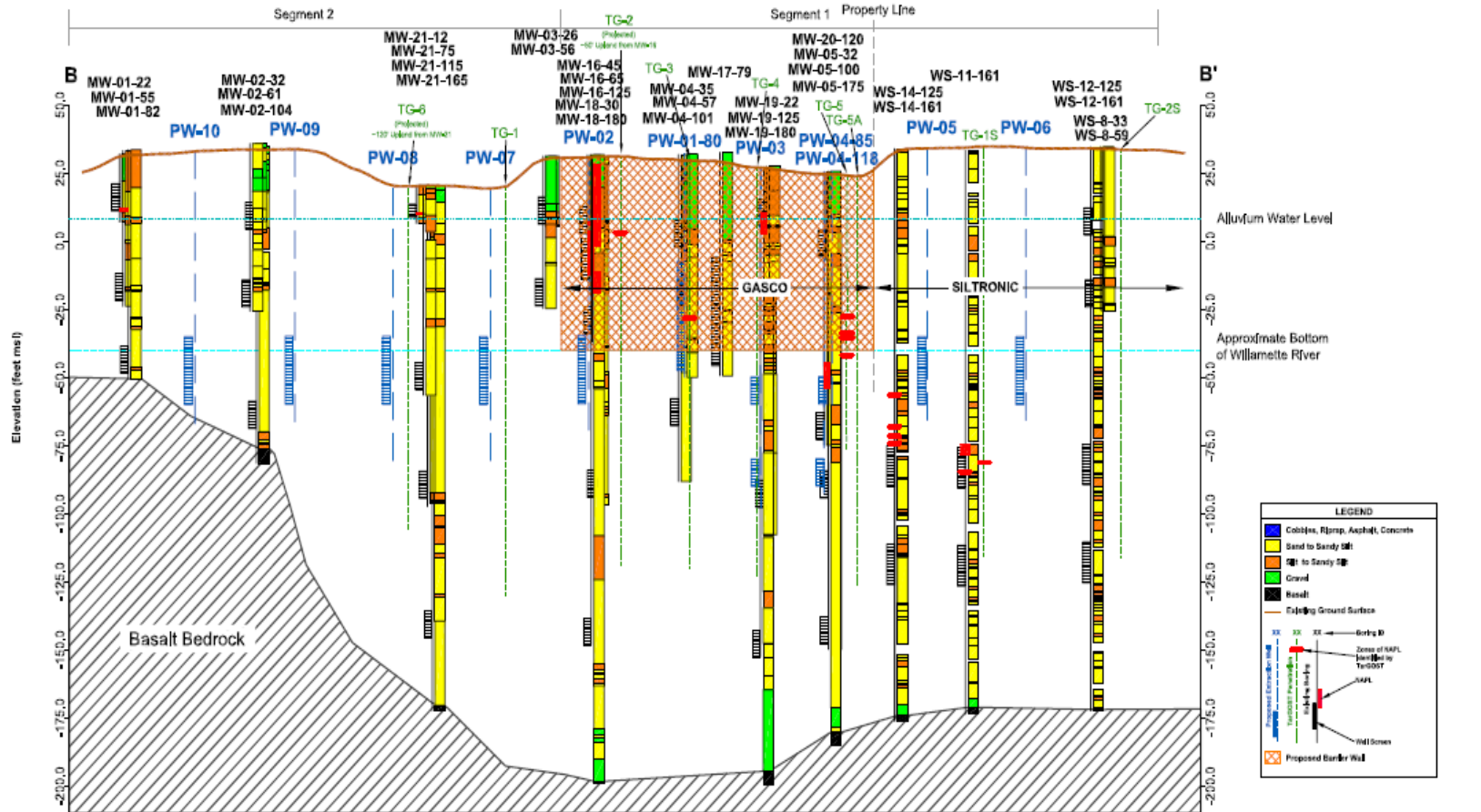


Notes:

1. Groundwater sampling results from June-July 2007 sampling event completed by Hahn and Associates
2. City of Portland vertical datum



Recommended SCM Alternative - combine vertical barrier w/ hydraulic control/containment (preliminary lay-out)

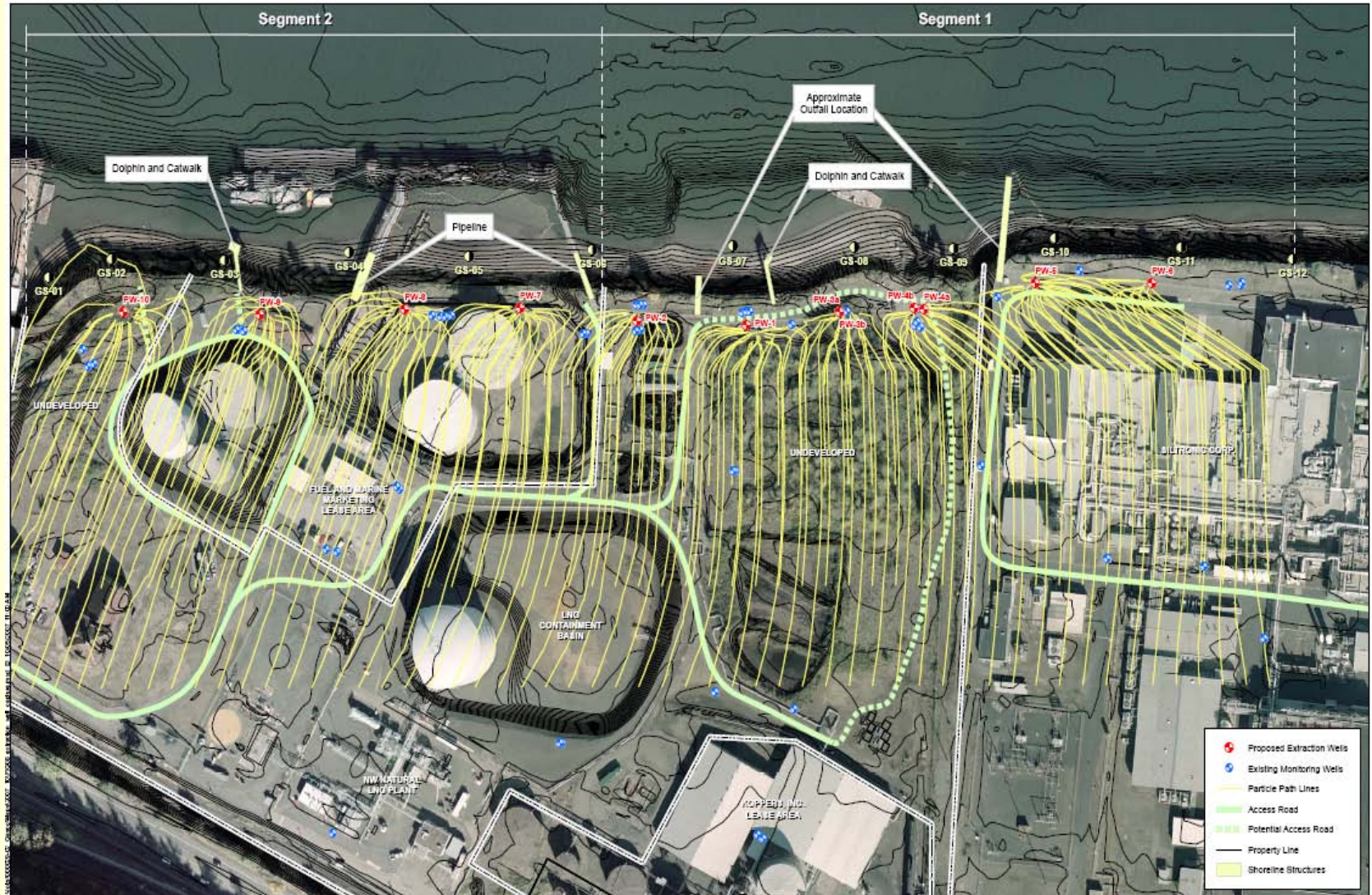


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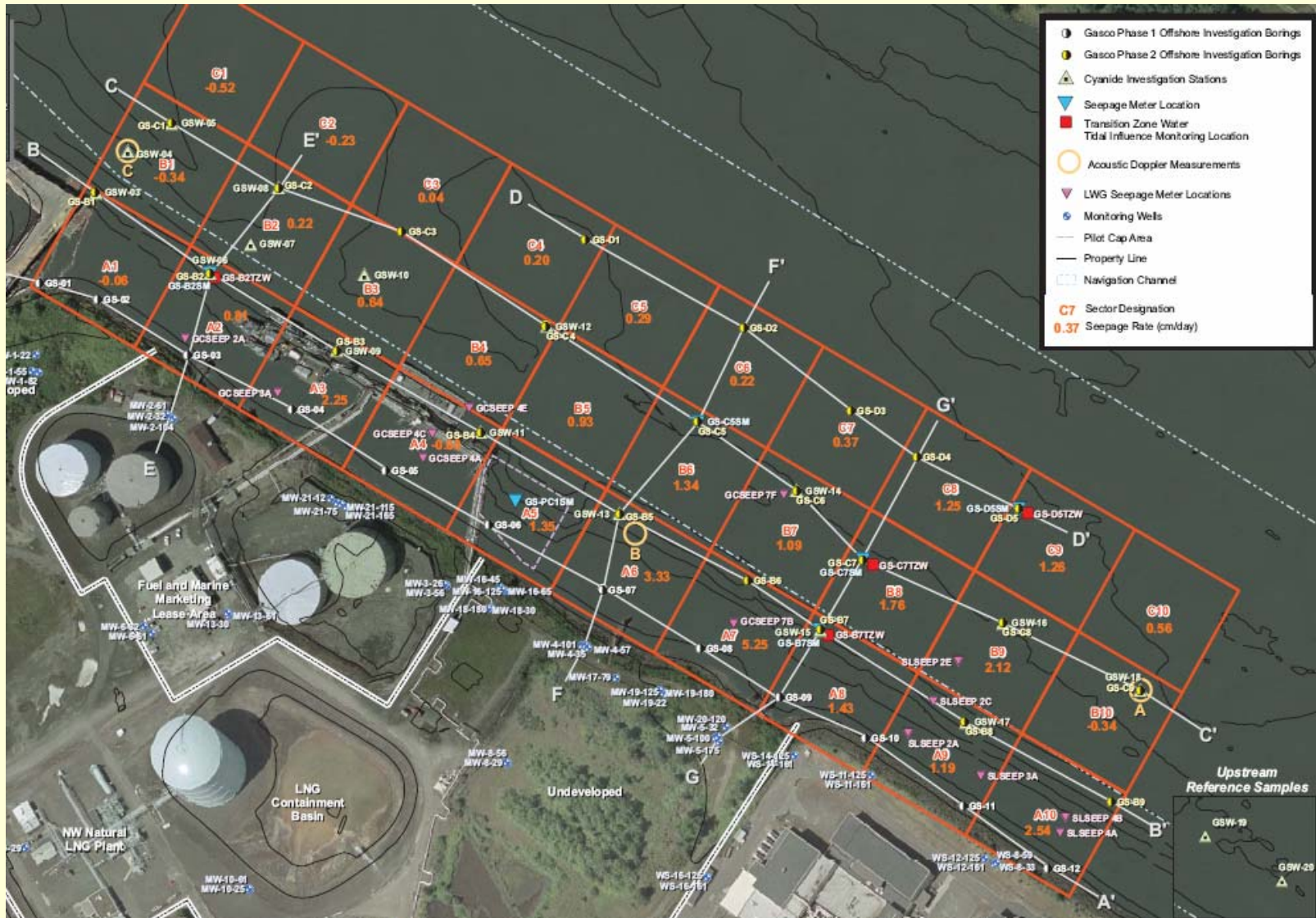
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Groundwater Flux



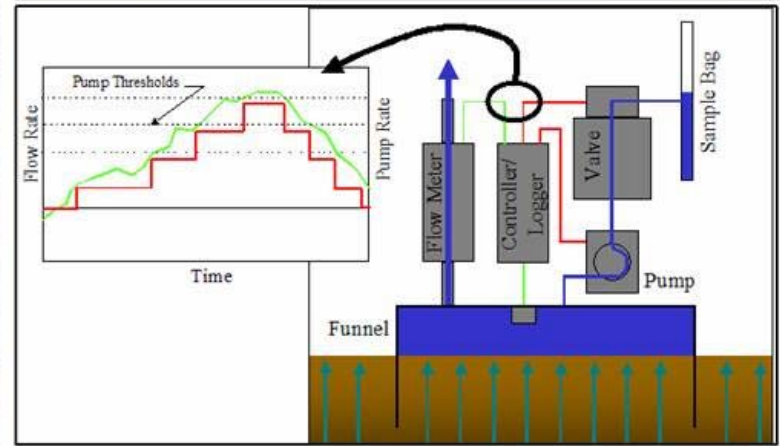
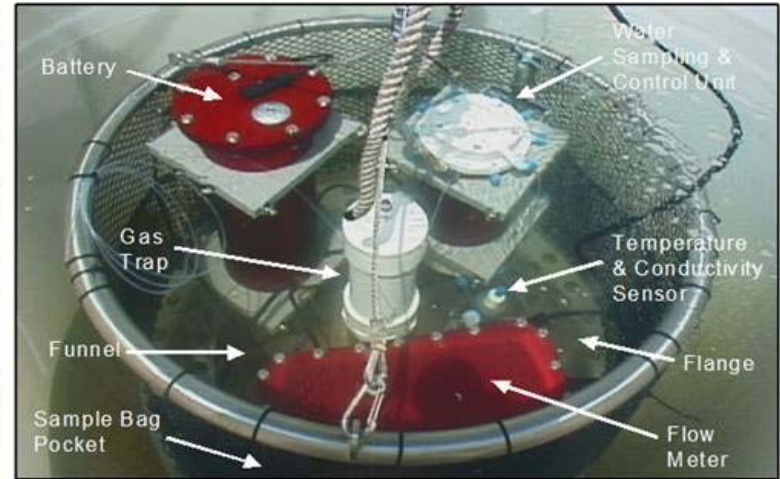
Principal References Used

- “Offshore Investigation Report – NW Natural ‘Gasco Site’,” February 2008
- “Groundwater/DNAPL Source Control Focused Feasibility Study – NW Natural ‘Gasco’ Site,” October 12, 2007 (amended November 9th)
- “Remedial Investigation Report, NW Natural-Gasco Facility, 7900 NW St. Helens Road, Portland, Oregon,” April 30, 2007
- “Remedial Investigation Report, Siltronic Corporation,” April 16, 2007

For soft copies of documents go to:

<http://yosemite.epa.gov/r10/cleanup.nsf/6d62f9a16e249d7888256db4005fa293/30e48bd949cf7508882571420008affd!OpenDocument>

Zebra-Tech, Ltd. Seepage Meter



Van Dorn Sampler

