

Site Name: Former Portland Gas Manufacturing Site

Location: Portland, Oregon

Type of Site: Former manufactured gas plant along river

Contaminants of Concern: Oily or tar-like materials, PAHs, TPHs, BTEX, cyanide, metals

Remedy: Dredging, amended capping, enhanced natural recovery, monitored natural recovery

Current Site Status: Post-remediation long-term monitoring

Case Study Objectives: To provide an overview of the site and the capping element of the remedy. This case study focuses on aspects of the design, construction, and long-term monitoring program.

Site Description: The former Portland Gas Manufacturing (PGM) Site is located along the west bank of the Willamette River in downtown Portland, Oregon, upriver from the Portland Harbor Superfund Site. The site was the location of a manufactured gas plant (MGP) that occupied several city blocks adjacent to the Willamette River and extended onto a wharf over the river. The former gasworks area is in an upland area that is physically separated from the river by a seawall that was constructed by the City of Portland between 1927 and 1929. Construction of the seawall undermined the stability of the riverbank and overlying PGM structures, resulting in the collapse into the river of large sections of buildings and riverbank soil that were then apparently side-cast to deeper water, forming an offshore debris mound. The portions of the upland site where most of the gas manufacturing occurred are currently occupied by Waterfront Park, city streets, and bridge access ramps.

Site Investigation and Conceptual Site Model Summary: Investigations at the PGM site began in 1987 and had several phases. Upland and in-water investigations included known or suspected MGP contaminants, including BTEX, semivolatile organic compounds (including PAHs), TPHs, metals, and cyanide. In-water remedial investigations were conducted between 2009 and 2014. These included bulk sediment, porewater, and surface water sampling; geophysical surveys; and diver surveys. Sampling results identified evidence of sheen, oily, or tar-like materials and exceedances of risk-based criteria for MGP-related constituents. A predesign investigation was conducted in 2017. The in-water investigation results showed that the highest concentrations of COCs were present at the base of the seawall, beneath the offshore debris mound, and in the intervening area. In some areas, MGP waste was covered by cleaner sediment as a result of ongoing sedimentation and natural recovery.

Remedy Design and Construction: In-water areas that were determined to pose the highest risk were addressed through active remediation, including dredging and amended capping. Lower or more moderate contamination in surface sediments was addressed with enhanced natural recovery and monitored natural recovery. Two cap configurations were used at the PGM site. An armored treatment cap composed of a 1-foot-thick GAC-amended CIL overlain by a 1-foot-thick erosion protection layer was used in areas subjected to propwash. An unarmored 1-foot-thick GAC-amended treatment cover was used in areas that were expected to be depositional that had exhibited recovery over time.

Modeling was used to identify the appropriate composition and thickness of cap material for the CIL that would be sufficient to provide long-term protection (100 years minimum) of surface sediment and transition zone water in the bioturbation zone. The bioturbation zone was assumed to consist of 10 cm of sediment over the CIL and was represented as either armor or deposited sediment, depending on the cap configuration. A model sensitivity analysis was used to determine the effects of groundwater seepage rates, chemical partitioning coefficients, and chemical biodegradation rates. The resulting cap design required that all GAC-amended caps be constructed with a minimum 4% GAC by weight.

Remedy Design and Construction (continued):

During construction, the GAC content was measured ex situ (prior to placement). Ex situ results showed that the cap material was super-amended, by design, at 10% GAC by weight. In total, 12 in situ samples of capping materials were tested to verify that the minimum GAC content was maintained during material placement. In situ GAC content was measured at contents ranging from 7.8% to 18.3% by weight (average of 11.7%). These results indicated that the as-built GAC content exceeded the design requirements and there was little or no loss of GAC during placement, which is largely attributed to strict GAC saturation protocols and submerged bucket placement techniques.

Construction monitoring results showed that all cap areas met their required 12-inch thicknesses and that some areas received 18 or more inches of cap materials. Cap thicknesses were verified by multibeam bathymetric progress and acceptance surveys. Catch pans were deployed to provide a second independent check to corroborate bathymetry survey results.

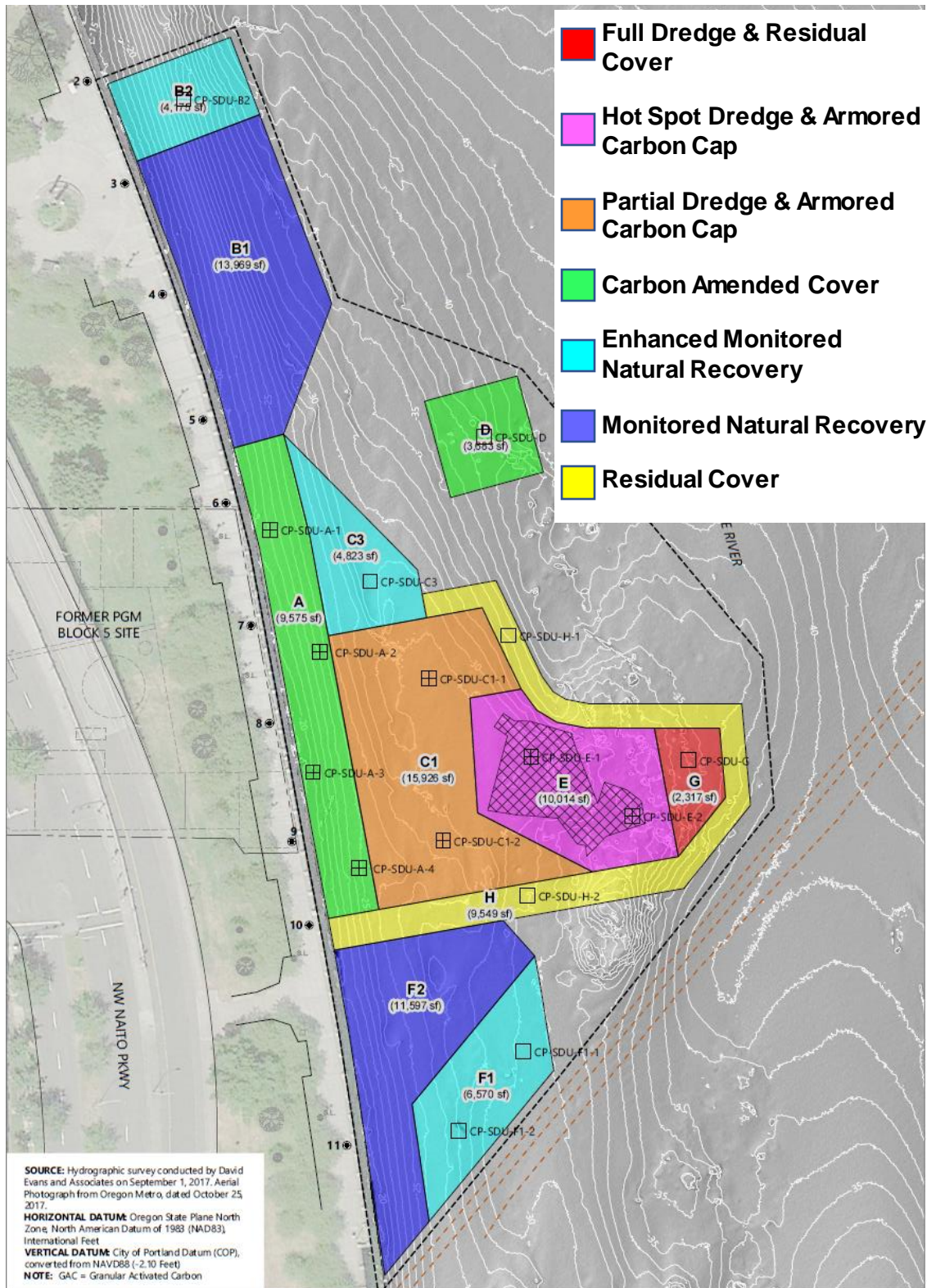
Post-Remedy Monitoring: Record of Decision (ROD) cleanup levels for sediment, transition-zone water (porewater), and surface water apply to the project. Sediment cleanup levels for benthic toxicity will be evaluated on a point-by-point basis, whereas cleanup levels for bioaccumulation will be evaluated on a sitewide SWAC. A similar approach is used for assessing transition zone and surface water. Four manhole-type sampling ports with pre-installed piezometers were placed within the armored part of the cap to facilitate post-remedy porewater sampling.

The initial monitoring program specified long-term monitoring events over an initial period of 10 years, with more frequent monitoring scheduled during the earlier post-construction years. Events were planned at Year 0 (post-construction baseline in 2020), Year 1, Year 2, Year 5, and Year 10. The monitoring schedule beyond 10 years will be determined based on a review of the first 10 years of monitoring results. Long-term monitoring is ongoing.

References:

- Anchor QEA, LLC. 2020. Revised Final Design Report, Version 4. Former Portland Gas Manufacturing Site. March 2.
- Anchor QEA, LLC. 2021. Project Completion Report. Former Portland Gas Manufacturing Site. October 28.
- Oregon Department of Environmental Quality. 2017. Record of Decision—Selected Remedial Action for Former Portland Gas Manufacturing. Portland, Oregon. June.

Figures/Photos (used with permission):



Site plan.

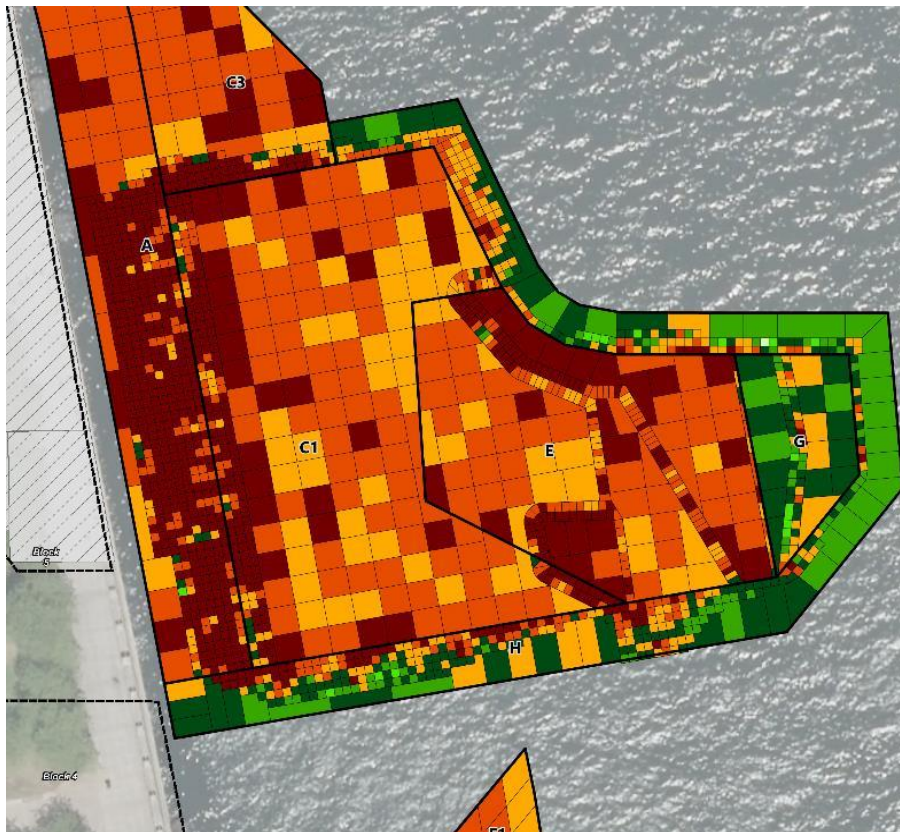
Figures/Photos (used with permission):



Cap material.



Cap material placement.

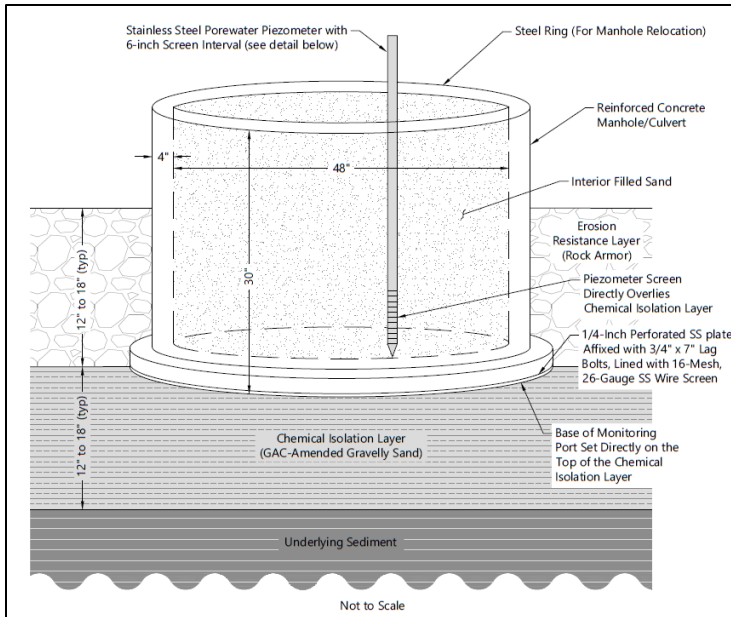


Cap thickness verification.

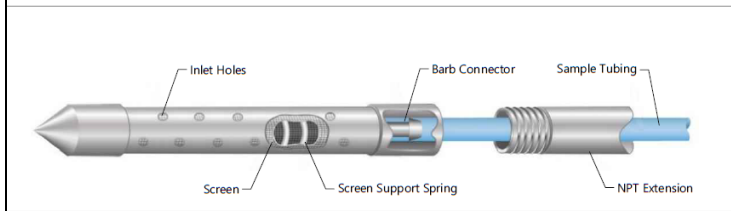
Cap Thickness in Inches

-  0.1 to 3
-  3.1 to 6
-  6.1 to 9
-  9.1 to 11.99
-  12.0 to 15
-  15.1 to 18
-  > 18

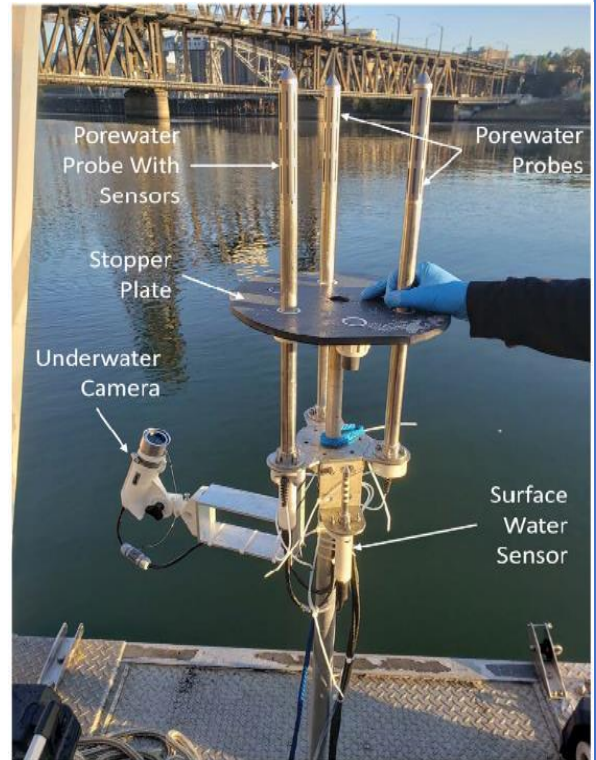
Figures/Photos (used with permission):



Not to Scale



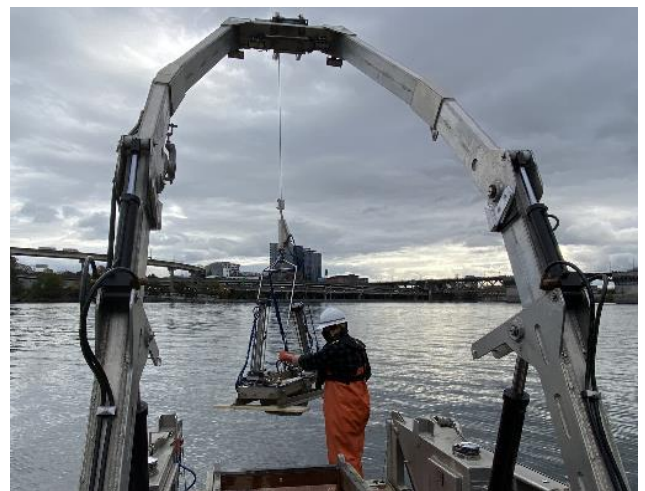
Stainless Steel Porewater Piezometer Detail.



Sampling Port.



Diver Assistance during Sampling Port Installation.



Sampling Port Installation.