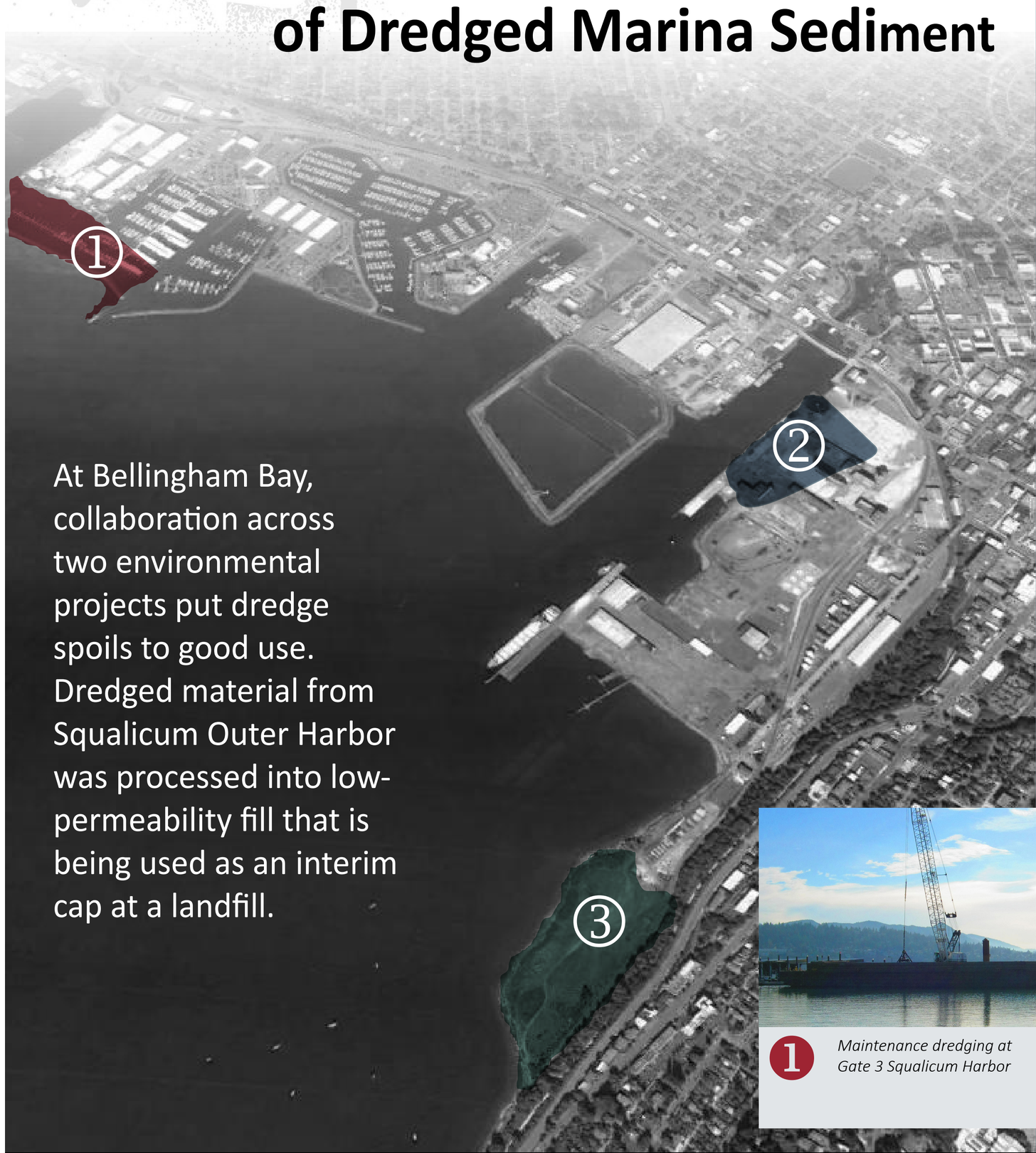
Beneficial Reuse

of Dredged Marina Sediment



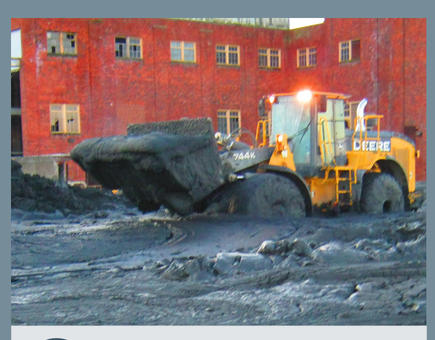
At Bellingham Bay, collaboration across two environmental projects put dredge spoils to good use. Dredged material from Squalicum Outer Harbor was processed into low-permeability fill that is being used as an interim cap at a landfill.

A Tale of Two Projects in Bellingham Bay

Landau Associates helped engineer a collaborative course of action across two environmental projects at the Port of Bellingham that beneficially reused stabilized, dredged sediment from outer Squalicum Harbor at the Cornwall Avenue Landfill, Model Toxics Control Act (MTCA) site. The Washington State Department of Ecology (Ecology) approved an interim action to use the stabilized dredged sediment as part of a capping system to reduce the amount of stormwater infiltrating through the landfill site where it might pick up contaminants before entering Bellingham Bay.

In 2012, the Port of Bellingham performed maintenance dredging and replacement of Docks F and G at its Squalicum Harbor Gate 3 facility in Bellingham, Washington. Approximately 47,500 cubic yards of accumulated sediment in the dock and channel areas of the harbor were dredged. The sediment was tested and deemed unsuitable for open-water disposal in Puget Sound due to dioxin concentrations that exceeded the disposal guidelines. Landau Associates suggested to the Port that an alternative to disposing of the material in an operating landfill would be to beneficially reuse the material as a component of a capping system over the former landfill on Cornwall Avenue. The dredged sediment was transported by barge from the marina site to a transfer site where it was offloaded and conditioned using an admixture to address excess water using a pug mill mixing operation. The conditioned material was then hauled and placed in stockpiles on the landfill site for potential future use as a component of the permanent landfill cover. The beneficial reuse of the dredged sediments was successful in reducing costs and environmental impacts that would have occurred if the material was hauled to an operating landfill, and in contributing to the remediation process for a closed landfill.

1 *Maintenance dredging at Gate 3 Squalicum Harbor*



2 *Handling saturated dredged material at the sediment processing and stabilization area*

3 *Seaming the geomembrane over the stabilized sediment stockpile at the Cornwall Avenue Landfill Site*

Reid Middleton 1953 – 2013 · Washington State Department of Natural Resources · Department of Ecology State of Washington · City of Bellingham Washington · Port of Bellingham Washington State · Landau Associates · ACEC American Council of Engineering Companies

American Council of Engineering Companies (ACEC) Best in State Silver Award

The poster image above was part of a 2014 winning entry which earned Landau Associates a Silver Award for Originality and Innovation from the American Council of Engineering Companies (ACEC)–Washington for their work to engineer a collaborative course of action to stabilize and beneficially reuse sediment dredged from outer Squalicum Harbor as part of the capping system at the Cornwall Avenue Landfill site that is being cleaned up under the Washington State Model Toxic Control Act regulations.

Next Steps:

During the summer of 2015, representative samples of the stabilized sediment will be collected from the stockpiles and tested to evaluate the physical properties of the material after curing for 3 years, and help determine the level of construction effort that will be required to adequately rework and compact the material to function as a low-permeability layer component of the final capping at the Cornwall Avenue Landfill MTCA site.

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Project Summary

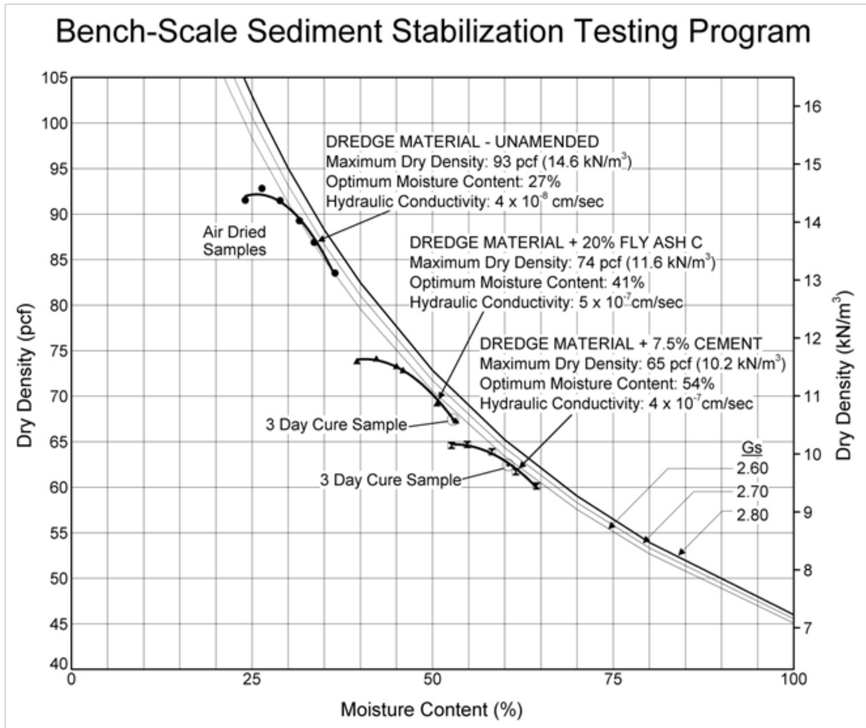
Project Goals

The overall goal for the Gate 3 sediment processing and stabilization project was to moisture condition the saturated, fine-grained dredged material and produce a relatively homogeneous material that could maintain a friable, soil-like consistency suitable for future use as a low-permeability soil component of the capping system at the Cornwall Avenue Landfill site in Bellingham, Washington

Sediment Stabilization Testing Program

Bench-scale laboratory tests were conducted to determine the type and amount of additive that would be required to turn the saturated, fine-grained sediment into a friable soil-like material. The Gate 3 sediment was a soft clayey silt (MH) with a moisture content of about 80 percent and a wet bulk density of about 96 pcf (1.3 tons/cy). Sediment stabilization mix design testing included mixing wet sediment with various percentages of Class C fly ash, Type I/II Portland Cement, cement kiln dust, lime, lime kiln dust, and Class F fly ash, with the addition of dry absorbent based on a percentage of the wet weight of the unamended sediment. It was determined that use of Type I/II Portland Cement was the most cost effective additive for stabilization of the Gate 3 dredged material.

Initial test results indicated that Gate 3 sediment amended with 7.5 percent cement might be suitable if the stabilized material was going to be placed and compacted soon after transport to the Cornwall Avenue Landfill, MTCA site. However, the final mix design had to account for both an initial setting time prior to transport to the landfill site, and for a multi-year curing time in covered stockpiles prior to future regrading and compaction as part of the final low-permeability cap for the landfill. Supplemental mix design testing indicated that sediment amended with 4 to 5 percent cement would be more appropriate for stabilizing sediment that needed to be stockpiled for several years. Accordingly, sediment stabilization was specified as addition of approximately 5 percent Type I/II Portland Cement based on the wet weight of the unamended sediment.



Sediment Processing and Stabilization

Sediment processing and stabilization started with offloading the dredged material from the barges into a lined and bermed material processing area located adjacent to a pier at the former Georgia Pacific West Mill site. The saturated material was transferred by front-end loader into a vibratory screen to remove oversized debris, and then fed into a mechanical pug mill batch plant where it was blended with approximately 5 percent Portland Cement by wet weight of sediment.

Blended Material

The blended material discharged from the pug mill batch plant was temporarily stockpiled in a containment/storage area and allowed to "set" for several days until it achieved a soil-like consistency. The stabilized sediment was then loaded into trucks for transport to the Cornwall Avenue Landfill site for placement under covered stockpiles.

Interim Placement and Environmental Controls

The stabilized sediment was placed in two large interim placement areas on the Cornwall Avenue Landfill MTCA site. Environmental control measures at the landfill site included construction of a containment berm along the shoreline, installation of a passive landfill gas collection and venting system below the stockpiled material, construction of lined roadways and drainage ditches, and installation of a scrim-reinforced geomembrane cover over the stabilized sediment stockpiles to prevent contact with stormwater and limit stormwater infiltration through the underlying landfill refuse.

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