



# Port of Tacoma PROJECT

STRIKES A BALANCE BETWEEN  
DEVELOPMENT AND ENVIRONMENT

*A landmark cleanup and redevelopment achievement, the Sitcum, Blair, Milwaukee Project for the Port of Tacoma in Washington State struck a balance between environmental protection and economic vitality. It pushed traditional engineering and construction techniques to new limits. Foster Wheeler's subsidiary, Hartman Consulting, won the contract as design engineer of record, providing engineering for dredging, material transport, placement, and water quality analysis.*

The project achieved multiple objectives by linking the Sitcum and Blair waterways cleanup actions with the need to expand navigation uses in the Blair Waterway and create land for terminal use in the Milwaukee Waterway. Design of the Milwaukee fill had to meet U.S. government EPA CERCLA criteria for long-term protection of human health and the environment. The project plans included:

- Design of dredging plan to remediate contaminated sediment in the Sitcum and Blair waterways and to dredge the Blair Waterway.
  - Engineering design analysis to place 868,000 cubic yards of contaminated sediment and capping material in the Milwaukee Waterway, including evaluation of berm construction; placement, confinement, and capping of contaminated sediment; and analysis of structural fill.
- This beneficial use of contaminated sediment created 23 acres of new container cargo marshalling land. The project also unlocked over 300 acres of land for future container

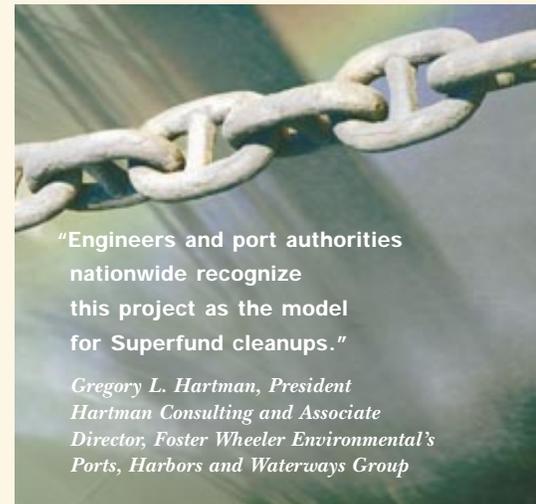
terminal development.

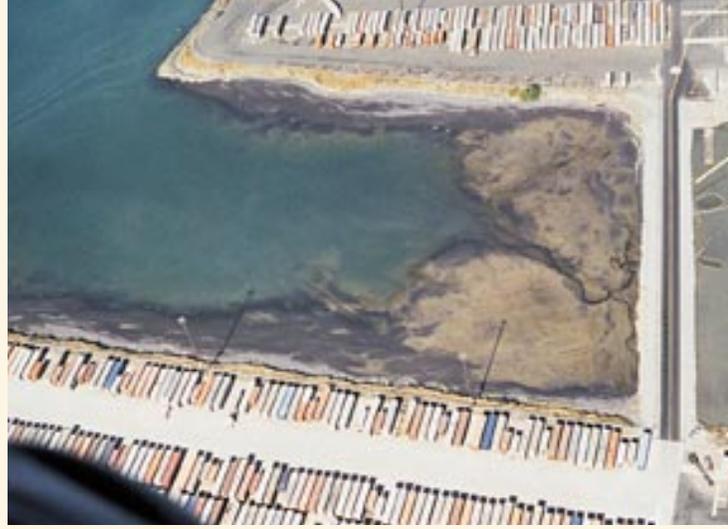
- Water quality impact assessment from construction activities.
- Preparation of construction plans and specifications, cost estimates, and construction quality assurance plan.
- Regulatory assistance.

According to Gregory L. Hartman, President of Foster Wheeler subsidiary Hartman Consulting, “Engineers and port authorities nationwide recognize this project as the model for Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sediment cleanups.”

The project cleaned up more than 225 acres of contaminated submerged lands in the Sitcum and Blair waterways. It deepened the Blair Waterway, which gives the Port the long-term capability to handle at least a million additional container twenty-foot equivalent units (TEUs) per year. The long-term impact is new economic opportunity created for the entire Puget Sound region.

Commenting on the project, Margaret Justus, EPA Project Manager said, “This project provides a balance where there are benefits to both the environment and to the development plans of the Port. This settlement allows Tacoma to continue in its role as a leading port in the Pacific Northwest.” ❧❧





## Innovation in Technology Applications & Management

Innovative project management and technical approaches, coupling cleanup of the Sitcum and Blair Waterways with marine terminal expansion, produced benefits that far surpassed those possible had the projects been undertaken independently. Richard Gilmer, Port of Tacoma Director of Environmental Affairs, summarized the benefit, “From an economic perspective, the project is a winner. It would be far more expensive to solve these problems separately.”

### Innovative Sediment Management

The project involved dredging of 868,000 cubic yards of contaminated sediment and using it as fill in another waterway. The contaminated sediment was placed below groundwater and then capped (confined) with clean dredged sand.

To manage contaminant loss, traditional approaches require installation of slurry walls and impermeable membranes. Site-specific contaminant behavior studies indicate that if

contaminated sediment is kept wet and anoxic (without oxygen), contaminants will remain bound to the sediment matrix reducing the potential for migration. Utilizing this research, the Hartman design kept contaminated sediment below the groundwater table and avoided the extensive costs associated with installing liners and barriers. Recent groundwater monitoring results confirmed the design’s validity.

Other ports and regulatory agencies are evaluating this innovative use of existing technology for application worldwide. This project established the precedent for safe and cost-effective confinement of contaminated sediment in large nearshore fills.

### Innovative Construction Components

#### Construction of a berm across the Milwaukee Waterway:

Initially, only the submerged base of the berm was constructed. This innovative construction step allowed mechanical dredging and bottom-dump barge disposal of sediment behind the berm and simultaneous dredging and



This project demonstrates that large nearshore fills can safely and cost effectively confine contaminated sediment, and the technique is applicable worldwide.



*Innovative design approaches to dredging and construction allowed safe confinement of contaminated sediment in nearshore fills.*

construction of the mitigation area in front of the berm. The berm was then raised to full design height and remaining sediment was hydraulically placed behind the confining berm.

**Controlled placement of contaminated sediment in the Milwaukee fill:**

In addition to the containment of contaminated sediment below the groundwater table, sequencing of construction confined more contaminated sediment deeper in the fill.

“This is unique,” said Bob Lofgren, Project Manager for Manson Construction & Engineering Company. “Normally, we would dredge an entire area to the desired depth then move to the next.”

In this project, however, Sitcum sediment was placed first—the most contaminated sediment, followed by less contaminated sediment from Blair dredging. In many locations, this involved scalped vertical dredge cuts. ❦



*Upon completion, the Port of Tacoma Project successfully coupled cleanup and improved navigation with marine terminal expansion.*

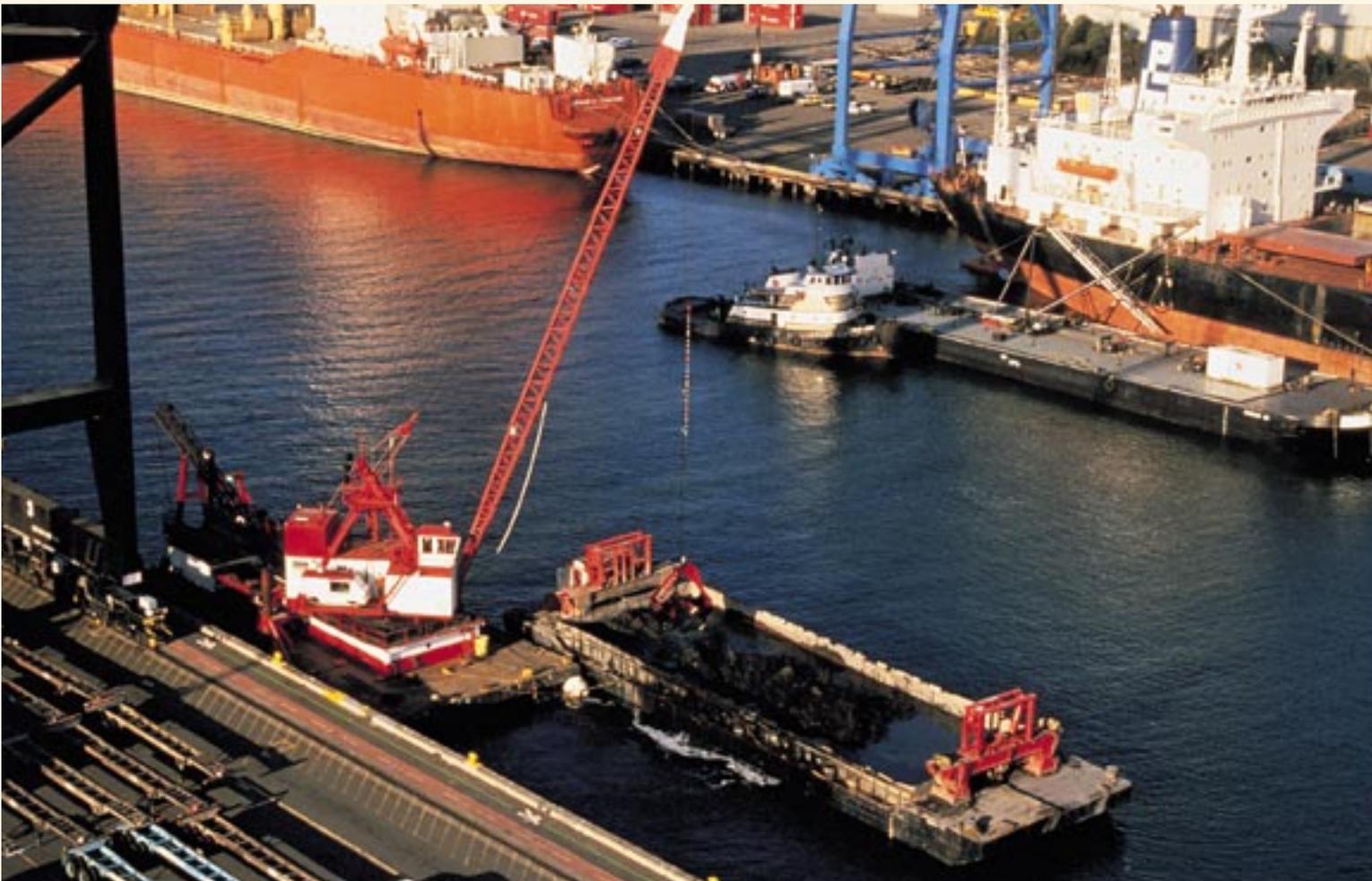


**Beneficial use of dredged material:**

Clean, sandy sediment dredged from the Blair Waterway was used to confine contaminated sediment in the Milwaukee Waterway and to restore 20 acres of aquatic habitat at its mouth. Material normally regarded as “spoils” was converted to high value use.

**Innovative Liability Management**

Based on the strength of our design, the Port (in consultation with Hartman) determined that the dredging contractor would not be liable for potential long-term contaminant release from the Milwaukee fill. Removing this formidable risk from the contractor’s bid resulted in significant cost savings.





## Technical Value to Engineering Profession:

This project advances the engineer's art by redefining dredge engineering and contaminated sediment confinement design. The project demonstrates that:

- In using carefully controlled dredging and material handling, contaminated sediment can be used beneficially to create valuable marine terminal land.
- By containing contaminated sediment below groundwater, chemical mobility will be controlled, eliminating need for other more costly controls.
- Standard contractors and equipment can be used to remediate contaminated sediment without adverse environmental impact. It is not necessary to control the contaminated sediment dredging and disposal separate from the other construction.

As a whole, the project shows that nearshore disposal is a cost-effective confinement option with worldwide applicability.

### Environmental/Economic Considerations:

The project produced a cleaner, safer, and more economically viable Port. Dredging and confinement of contaminated sediment in the Sitcum and Blair Waterways eliminated exposure to aquatic marine organisms and removed the potential for human exposure via contaminated fish consumption. Mitigation actions restored high value aquatic habitat.

As Pacific Rim trade continues to flourish, prime container cargo terminal space on the Blair Waterway (made available by this project) can be developed. This expansion promises jobs in construction, cargo handling, and transportation well into the next century.

### Complexity and Creativity:

Standard dredging practices would have generated material in excess of available capacity, and specialized equipment or practices were not appropriate for two reasons:

- Adequate production rates to complete work prior to closure of seasonal construction periods ❖❖



This project advances the engineer's art by redefining dredge engineering and contaminated sediment confinement design.

(imposed to protect fish life) could not be achieved.

- Opportunity for competitive construction bidding and associated cost effectiveness would be lost.

In response to these challenges, Hartman utilized sediment chemical testing data that showed highly variable sediment contamination patterns throughout the Sitcum and Blair waterways. The Hartman dredging plan identified staggered dredge cuts (i.e., precise vertical and horizontal boundaries based on capabilities of standard dredging equipment) to discretely remove the contaminated sediment and not underlying clean material. This creative design, unique to the industry, reduced volume sufficiently to confine all contaminated sediments below groundwater.

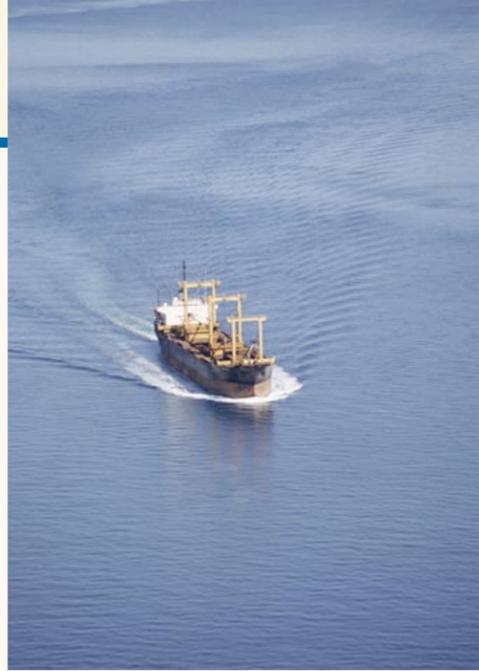
### Exceeding Client's Needs:

This project exceeded the Port's expectations in all critical aspects (regulatory criteria, cost, technical feasibility, and desired results).

By achieving cleanup at a unit cost of approximately \$8 per cubic yard, expenses were far less than typical remediation costs.

The newly created terminal area, in turn, will generate further economic benefit. The dramatically improved navigable conditions in the Blair Waterway open the area to significant future harbor improvements.

From a customer service standpoint, the project also was responsive to tenants of the Port. For example, Sealand, a critical Port shipping tenant, continued operations unimpaired throughout construction. ■



## FOSTER WHEELER'S Port of Tacoma Project Wins Engineering Award

### Winner of the Grand Award

in the Engineering Excellence Awards Competition of the Consulting Engineers Council of Washington, Foster Wheeler's subsidiary Hartman Consulting pushed the limits of innovative engineering design in the landmark cleanup and redevelopment project for the Port of Tacoma's Sitcum, Blair and Milwaukee Waterways. The innovative design solution combined the cleanup of the Sitcum and Blair waterways with the marine terminal expansion.

As the Grand Award winner, this project will now compete at the national level for one of the twenty-four program awards presented by the American Consulting Engineers Council, including the coveted Grand Conceptor Award.

According to Gregory L. Hartman of Hartman Consulting, engineers and port authorities nationwide recognize this

project as the model for Superfund sediment cleanup projects. As the dredging and material-handling design engineer of record, Hartman Consulting achieved a variety of business and environmental objectives:

- Cleaned up and identified beneficial use of contaminated sediment
- Developed 23 acres of vitally needed new container cargo marshalling land
- Unlocked over 300 acres of land for future container terminal development
- Improved navigation of the Blair Waterway
- Restored 20 acres of vital aquatic habitat
- Created new economic opportunity for the entire Puget Sound region.

This project helped the Port solve a critical environmental problem. And by keeping the cost well below average for remediation, the project also was a gold medal winner for the Port.

### Foster Wheeler Environmental's Ports, Harbors and Waterways (PH&W) Services

#### Waterway Engineering

**O**ur coastal engineering section designs shore protection systems, breakwaters, jetties, and structural fills. Waterway engineering services include dredging design, navigation channel development, port/terminal siting and layouts.

#### Port and Marine Facilities Engineering

**W**e have worldwide experience in conducting feasibility and siting studies and designing marine terminals, piers, wharves, small craft facilities, service breakwaters, jetties, and pioneer/construction ports, structural fills, and innovative shore protection methodologies.

#### Sediment Management

**P**H&W offers specialized, award-winning expertise in sediment remediation as well as dredging design, material management, disposal, and permitting.

#### Environmental/Regulatory Services

**W**e take a proactive approach to regulatory compliance and permitting, enabling our clients to work effectively with regulators to achieve their project goals. We perform technical assessments and write detailed Environmental Impact Statements for complex port and harbor projects.

#### Construction Services

**W**e can create a construction plan to meet the needs of the most complex projects, serving as construction manager, general contractor, or lump-sum turnkey contractor.

#### Field Investigations

**F**acilities and Waterway Siting, ocean/coastal/river processes, hydrographic, marine geophysics, oceanographic and environmental studies. Our in-house survey group conducts studies worldwide using state-of-the-art systems developing engineering ready products.

Please contact:  
**Rick Della**  
Director of Services  
1-425-688-3818  
Rdella@FWENC.com

**Greg Hartman**  
Associate Director  
1-425-688-3739  
Ghartman@FWENC.com

**Bill Elmer**  
Program Manager  
1-425-688-3792  
Belmer@FWENC.com