Phase 1B Esquimalt Graving Dock Waterlot Remediation Design and Construction Challenges

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Presentation Overview

- Esquimalt Graving Dock (EGD) site description and background
- Phase 1B description and objectives
- Challenges
  - Remedial design
  - Construction tendering
  - Construction implementation
- Project performance
Site Description and Background

DND – Department of National Defence
EGD – Esquimalt Graving Dock

Constance Cove
EGD
DND Facilities
Esquimalt Harbour
Site Description and Background (cont.)
Site Description and Background (cont.)
Active Shipyard/Graving Dock Facility

- More than 50 vessel calls per year
Phase 1A – Under-pier Erosion Protection System

- Sheetpile wall prevents resuspension and transport of contaminated under-jetty sediment into Phase 1B area
- Constructed November 2012 to April 2013
Phase 1A – Under-pier Erosion Protection System (cont.)
Phase 1B – Open-water Dredging

• Dredging and disposal
  – 145,600 cubic meters (m$^3$)
• In-water slope armouring
  – 22,800 m$^3$
• Residuals management cover placement
  – 45,000 m$^3$
• Structure demolition and temporary relocations
• Construction June 2013 to March 2014
Phase 1B – Open-water Dredging (cont.)
Phases 1C and 2

• Phase 1C – Habitat compensation
  – Offsets impacts of alteration and isolation of under-pier habitat
  – Construction of new intertidal marsh fish habitat
• Phase 2 – Under-pier remediation
  – 40,000 m³ of contaminated sediment removal
  – October 2015 through October 2016
Key Phase 1B Objectives

• Remove maximum contamination practicable
  – Reduce federal financial liability and establish baseline
  – Reduce risks to human health and the environment
  – Meet federal and provincial standards

• Schedule
  – Minimize disturbance to operations
  – Complete in 10 months by March 2014

• Ensure high level of certainty in project outcome
  – Conservative, practical, and constructible design
  – Proven technologies
  – Qualified contractors
Design Challenges

• Development of remedial dredge design
• Dredge residuals management
• Construction sequencing and operations needs
• Water quality criteria and best management practices (BMPs)
• Geotechnical and structural restrictions
Remedial Dredge Design

• Construction sequencing to remove “hotter” contamination areas first
• Operational considerations
Remedial Dredge Prism Design

- Dredge design considerations

<table>
<thead>
<tr>
<th>Removal Scenario</th>
<th>Removal Volume (m$^3$)</th>
<th>Confidence Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminated Neatline (no OD)</td>
<td>71,250</td>
<td>50%</td>
</tr>
<tr>
<td>Contaminated Neatline + 0.3 m OD</td>
<td>98,444</td>
<td>70%</td>
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<tr>
<td>Contaminated Neatline + 0.5 m OD</td>
<td>116,573</td>
<td>85%</td>
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<tr>
<td>Dredge Prism Design (no OD)</td>
<td>117,336</td>
<td>90%</td>
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<tr>
<td>Dredge Prism Design + 0.3 m OD*</td>
<td>149,630</td>
<td>94%</td>
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<tr>
<td>Dredge Prism Design + 0.5 m OD</td>
<td>162,658</td>
<td>99%</td>
</tr>
</tbody>
</table>

Notes:
* Selected design criteria
m = meter; m$^3$ = cubic meter; OD = overdredge
Confirmatory Sampling

- Residuals management strategy included in design
  - Contingency actions during construction
Residuals Management at EGD

1. Dredged material

2. 10 cm grab
   50 cm composite core

3. Clean Sand Layer (30 cm)
   Propwash Mixing Zone (40 cm)

Design Depth

Post-dredge Condition

Post-dredge Condition with Residual Layer

Condition After Sand Placement

Surface After Sand Placement

Post Remediation Condition After Mixing

Clean Sand Layer (30 cm)

Residual Layer

Propwash Mixing Zone (40 cm)
Water Quality Monitoring

• Intensive water quality monitoring as part of comprehensive environmental monitoring program
  – Monitor turbidity
  – Assess total suspended solids from dredging
  – Confirm field results through laboratory analysis
Silt Curtain
Integrating Geotechnical and Structural Restrictions

• Work adjacent to existing structures
  – Requirements for dredging setback and offsets
Integrating Geotechnical and Structural Restrictions (cont.)

- Graving dock sill
Construction Tendering Challenges

• Limited pool of potentially qualified contractors
  – Develop qualification criteria
    • Contaminated sediment dredging greater than 40,000 m³
    • In-water slope armoring
    • Silt curtains and projects requiring Environmental Management Plans
    • Active marine site
    • Land transport and landfill disposal greater than 20,000 m³
  – Contracting strategy
    • Single Design-Bid-Build contract
    • Public tender
  – Balance cost competitiveness vs. risk
Key Construction Challenges

• Construction impacts on EGD operations
  – Operations takes precedence over construction
  – Booking schedule changes
  – Limited on-site staging area
  – DND facility coordination

• Contractor schedule changes
• Residual management cover placement after dredging is complete
Key Construction Challenges (cont.)

• Contractor experience with large-scale sediment remediation
  – Achieve tight design tolerances
  – Offload facility production rate
  – Diver-assisted hydraulic dredging
Key Construction Challenges (cont.)

- Remove maximum contamination practicable
  - Unanticipated subsurface conditions

Redesign of backfill pads

Debris encountered in hydraulic dredge area

Timber piles encountered in dredge prism

Hard material (debris) and glacial till encountered above design dredge elevation
Key Construction Challenges (cont.)

- Remove maximum contamination practicable
  - Missed inventory and residuals contingency dredging
Project Performance

- Work completed on schedule in March 2014
- Maximum contaminant removal – 145,600 m$^3$
- Confirmatory results
Project Performance (cont.)

• Post-cover mixed concentration
Lessons Learned

- Plan for dredge residuals with sequencing, BMPs, and contingency actions
- Select qualified contractor using criteria that balance cost-competitiveness and risk
- Incorporate risk-based contingency into project cost estimate
- On-site construction management staff
  - Reinforce objectives of the cleanup
  - Minimize impact to operations
  - Support adaptive management
Questions

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