Lower Passaic River
Sediment Removal Project

VI International Seminar on Remediation and Redevelopment of Contaminated Sites – October 27-28, 2008
Presented by Eugene Peck, PG, LEED-AP, ARCADIS, USA
Regional View

Passaic River
Lower Passaic River Sediment Removal Project

Presentation Outline

• Project Background
• Agreement with the US Environmental Protection Agency (USEPA)
• Existing Conditions
• Anticipated Scopes of Work
• Projected Schedule
Site Background

- Originally a tidal marsh
- **Mid-1940’s to 1977**: production of DDT and phenoxy herbicides
- **1983**: USEPA site samples showed high dioxin levels and site control was given to the State of New Jersey Department of Environmental Protection (NJDEP)
- **2002**: Upland site remediated by a cap, retaining floodwall and groundwater treatment
- **June 23, 2008**: USEPA signed Administrative Order on Consent (AOC) signed
- Overall goal to reduce inventory of dioxins in Passaic River by removing highest concentrations of 2,3,7,8-TCDD
AOC Requirements

- **Remove 153,600 m³** of Passaic River sediment adjacent to OU-1 (i.e. upland portion) of the Diamond Alkali Superfund Site

- Work to be conducted in two phases
  - **Phase I:** 30,600 m³ to be sent for treatment/disposal
  - **Phase II:** 123,000 m³ to be disposed in new Confined Disposal Facility (CDF)
Other Important AOC Requirements

- Removal depth of 3.7 meters below sediment surface (Phase I and Phase II)
- In-River work to be conducted within sheet pile enclosure (Phase I and Phase II)
- 30-month schedule (Phase I)
  - Subject to extension based upon certain occurrences
## Regulatory Process

- USEPA defines project as a Non-Time-Critical Removal Action (NTCRA)
- Engineering Evaluation /Cost Analysis
  - Feasibility Study
  - Risk Assessment
  - Cost Analysis
  - Public Review
- Removal Design
- Construction
- Identical but separate process for each phase
Removal Areas

**PHASE I**
- (1 hectare)

**PHASE II**
- (2.5 hectares)
- (1.2 hectares)

Legend:
- Orange: Phase I Work Area
- Yellow: Phase II Work Area
- Property Boundary

Graphic Scale:
- 0 500 1,000 Feet

Arcadis
Existing Conditions

• Characteristics of removal area and vicinity
  – Highly industrial
  – Active navigation channel
  – Numerous shoreline structures
  – Debris likely
• Generally fine-grained, highly organic sediment
• Tidal Velocities ~ 0.9 meter per second
• Tidal Fluctuations ~ 1.9 meters
Existing Conditions Phase I
Contaminant Concentrations

• 2,3,7,8-TCDD average: 0.244 ppm (5.3 ppm max.)

• Mercury average: 7.78 ppm (20.9 ppm max.)

• Total PCBs average: 1,370 ppb, (1,550 ppb max.)
Phase I Technology Classes

- Containment and shoreline stabilization
- Sediment removal
- Sediment processing
- Water treatment and discharge
- Off-site transport of sediment
- Off-site sediment treatment and disposal
- Backfilling
Containment and Shoreline Stabilization
Process Options

- Sheet pile enclosure
  - Remove in the dry
  - Remove in the wet
Sediment Removal
Process Options: Mechanical

- Clamshell
- Mechanical Excavator
Sediment Removal
Process Options: Hydraulic

• Horizontal Auger
• Cutterhead
Sediment Removal
Process Options: Other

- High Solids Pump
- Removal within a caisson
Sediment Processing
Process Options: Solids Separation

- Grizzly
- Hydrocyclone

http://www.pollutionengineering.com/Articles/Cases/ok/5183d7de8f88010VgnVCM100000f932a8cd0
http://www.pollutionengineering.com/Articles/Casebook/5183d7de8f88010VgnVCM100000f932a8cd0
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Sediment Processing
Process Options: Sediment Dewatering

- Geotextile Tubes
- Mechanical
- Gravity
Sediment Processing
Additional Process Options

- Oversize and Debris Handling

- ¾ Inch Material
- + ¾ Inch Material
- Coarse Material Stock Piles
Water Treatment and Discharge
Process Options

- Discharge to Public Water Treatment Facility (via sewer system)
- On-Site treatment / Discharge to Passaic
  - Sand Filter
  - Granular Activated Carbon
Off-Site Transport of Sediment
Process Options

• Transport of sealed water tight containers
  – Truck
  – Rail
  – Barge
Off-Site Sediment Treatment and Disposal Process Options

- Corrective Action Management Unit
- Landfill
- Incineration + Landfill

NOTE:
Any combination of modes of transport could be used.
Sediment Processing
Process Options: Segregation

- **In-situ**
  - Some sediments sent directly to incinerator (high cost)

- **Ex-Situ**
  - Sediments not sent directly to incinerator are further analyzed
  - If treatment required, sent to incinerator; otherwise sent to landfill (low cost)

- Contaminant and volume reduction additives
Backfilling
Process Options

• Use Conventional Placement equipment
• Look to ultimately restore surface

• Must consider:
  – Sediment geotechnical and hydrogeological properties
  – River hydrodynamics
  – Habitat restoration
  – Phase II Activities and schedule
Example
Removal Alternative Schematic

Transport

Disposal

NOTE: Any combination of modes of transport could be used.
Identification of Removal Action
Alternatives
Four Alternatives Were Developed

- **Alternative A**
  - Hydraulic removal with geotextile tube sediment processing

- **Alternative B**
  - Hydraulic removal with mechanical sediment processing

- **Alternative C**
  - Mechanical removal with mechanical sediment processing

- **Alternative D**
  - High-solids pump removal with mechanical processing
Anticipated Timeline

- **Oct. 2008**
  - Phase I EE/CA submitted to USEPA

- **Phase I Action Memo issued by USEPA (Anticipated)**

- **Phase I Design (Anticipated)**

- **Sept. 2008**
  - Phase I EE/CA Work Plan Finalized

- **USEPA review and Public comment on Phase I EE/CA (Anticipated)**

- **Phase II EE/CA Work Plan submitted to EPA (Anticipated)**

- **2009**

- **2010**

- **2011**

- **Phase I Work (Anticipated)**
General Scope of Phase II Removal Action

Per 2008 AOC:

- Remove 123,000 m³ of sediment from Phase II Work Area
- Remove sediment to 3.7 m below sediment surface
- Work to be contained by a sheet pile enclosure
- Sediment to be sent to a Confined Disposal Facility
- Phase II will undergo duplicate process as Phase I
- Will overlap Phase I

• CDF will have to be sited/designed
Regional View

Newark Bay
Confined Disposal Facility
Process Options

Nearshore Confined Disposal

CDF Capping

Dredging and CDF Filling
Confined Disposal Facility
Process Options
Imagine the result
## Lower Passaic River Sediment Removal Project
### Phase I Technology Screening

<table>
<thead>
<tr>
<th><strong>Containment and Shoreline Stability</strong></th>
<th><strong>Sediment Removal</strong></th>
<th><strong>Sediment Processing</strong></th>
<th><strong>Water Treatment and Discharge</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel sheet pile wall</td>
<td>Mechanical</td>
<td>Solids separation</td>
<td>Discharge to public sewer system</td>
</tr>
<tr>
<td>Removal in the wet</td>
<td>Hydraulic</td>
<td>Grizzly</td>
<td>On-site treatment/ Discharge to Passaic</td>
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<tr>
<td>Removal in the dry</td>
<td>High solids pump</td>
<td>Hydrocyclone</td>
<td>Sand Filter</td>
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<td></td>
<td>Caisson dredging</td>
<td></td>
<td>Granular Activated Carbon</td>
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<td></td>
<td></td>
<td>Sediment dewatering</td>
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<tr>
<td></td>
<td></td>
<td>Geotextile Tubes</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Mechanical</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gravity</td>
<td></td>
</tr>
</tbody>
</table>

Anticipated debris: timber piles, woody debris, metal objects

Water Treatment and Discharge:
- Discharge to public sewer system
- On-site treatment/ Discharge to Passaic
  - Sand Filter
  - Granular Activated Carbon

Processing:
- Solids separation
- Grizzly
- Hydrocyclone

Sediment dewatering:
- Geotextile Tubes
- Mechanical
- Gravity

Mechanical:
- Steel sheet pile wall
- Removal in the wet
- Removal in the dry

Hydraulic:
- High solids pump
- Caisson dredging

Sediment dewatering:
- Geotextile Tubes
- Mechanical
- Gravity
# Lower Passaic River Sediment Removal Project
## Phase I Technology Screening

<table>
<thead>
<tr>
<th>Off-site Transport of Sediment</th>
<th>Sediment Treatment and Disposal</th>
<th>Backfilling</th>
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<tbody>
<tr>
<td>Truck transport</td>
<td>Contaminant Reduction Technologies</td>
<td><strong>Must consider:</strong></td>
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<tr>
<td>Rail transport</td>
<td>Corrective action management units</td>
<td>Sediment geotechnical and hydrogeological properties</td>
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<tr>
<td>Barge transport</td>
<td>Landfills (Subtitle C)</td>
<td>River hydrodynamics</td>
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<td></td>
<td>Incineration + landfills (Subtitle C/D)</td>
<td>Habitat restoration</td>
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<td>Phase II Activities and schedule</td>
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</tbody>
</table>

**Backfilling**

- Must consider:
  - Sediment geotechnical and hydrogeological properties
  - River hydrodynamics
  - Habitat restoration
  - Phase II Activities and schedule

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*ARCADIS*
Technology Screening
Specialty Technologies
Potentially Applicable to All Alternatives

• Caisson dredge
  – Involves sediment removal and backfilling within a caisson.
  – Specialty dredge for near bulkheads.

• Contaminant Reduction Technologies
  – Reduce contamination prior to transport off site
## Summary of Technology Screening

<table>
<thead>
<tr>
<th>Technology Screening Group</th>
<th>Process Options</th>
<th>Alternatives</th>
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<tbody>
<tr>
<td>Containment and Shoreline Stability</td>
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<td>Off Site Transport of Sediment</td>
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<td>barge</td>
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<td>incineration and disposal in Subtitle C and D landfills</td>
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<tr>
<td>Backfilling</td>
<td>backfilling</td>
<td>X X X</td>
</tr>
</tbody>
</table>
Phase I Removal Action Objectives

- **Remove most concentrated 2,3,7,8-TCDD sediment** as well as other hazardous substances, to minimize the possibility of migration due to extreme weather events.
- **Prevent resuspension of sediment** to the extent practicable during removal operations.
- **Prevent potential for spillage or leakage** to the extent practicable during transport to the disposal facility.
- **Restore habitat**
Technical Challenges of Phase I Work Area