Cooperative NRDA and Restoration at the Newport, DE Superfund Site.

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Presentation Agenda

- Site Background
- Remedial Decision & Injury Assessment
- Integrated Remedial/Restoration Actions
- On-site Restoration
- Cooperative NRDA
- Compensatory Restoration Project
Site Background

- Krebs ownership (1902-1929).
- DuPont pigments facility from 1929 to 1984.
- Site = uplands, wetlands, and manufacturing areas.
- Superfund regulatory activities began in the late 1980s.
- Record of decision signed by the USEPA in 1993.
- Remediation of soils and sediments from 1995 to 2002.
  - Improve remedy and incorporate restoration into the plans.
  - Coordinated effort among DuPont and agencies.
- Restoration monitoring continues into 2011
Remedial Decision and Injury Assessment: Wetlands & River

North Wetlands

South Wetlands

- **Green Zone** - Data < AET Value
- **Gray Zone** - Data > AET, Normalized Data < EPA Site-specific Criteria.
- **Red Zone** - Normalized data above EPA Site-specific Criteria.
**Risk Management:**
Final Remedial Approach & Record of Decision

2.7 ac Compared to < 1 ac in ROD
9,500 cy Compared to ~1,000 cy in ROD

<table>
<thead>
<tr>
<th>ppm</th>
<th>ROD(^1)</th>
<th>Final(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc</td>
<td>5,600</td>
<td>1,600</td>
</tr>
<tr>
<td>Lead</td>
<td>1,200</td>
<td>660</td>
</tr>
<tr>
<td>Cadmium</td>
<td>60</td>
<td>9.6</td>
</tr>
</tbody>
</table>
Integrated Remediation and Restoration - North Wetlands: Construction Phase

Good example of combining remediation and restoration to achieve greater risk reduction and improved habitat functions cost effectively. Illustrated the value of working with USEPA and Trustees in an open, cooperative forum.
Integrated Remediation and Restoration - North Wetlands: Post-Construction Restoration
North Wetlands - Restoration

Tidal and Non-Tidal Wetland Habitats,
High & Low Marsh, Tidal Open Water

9-Fold Gain in Plant Species Richness (Yr 5)
Fine Grained Sediment Accumulation &
Viable Algal Community (Yr 1)
83% Cover in Non-Tidal (Yr 5)
98.5% Cover in Tidal (Yr 5)
Loosestrife Observed (Yr 1)
Loss of 0.21 Acres of Wetlands
## Pre- and Post-Remediation and Restoration Metrics

### North Wetlands

<table>
<thead>
<tr>
<th>Function</th>
<th>Pre-Remediation (Base Condition)</th>
<th>ROD Required (Goal)</th>
<th>Post-Remediation/Restoration (Achieved 2002)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FCI</td>
<td>Area</td>
<td>FCU</td>
</tr>
<tr>
<td>Shoreline Erosion</td>
<td>0.25</td>
<td>0.34</td>
<td>0.09</td>
</tr>
<tr>
<td>Sediment Stabilization</td>
<td>0.70</td>
<td>2.70</td>
<td>1.89</td>
</tr>
<tr>
<td>Water Quality</td>
<td>0.56</td>
<td>2.70</td>
<td>1.51</td>
</tr>
<tr>
<td>Wildlife</td>
<td>0.21</td>
<td>2.70</td>
<td>0.57</td>
</tr>
<tr>
<td>Tidal Fish</td>
<td>0.30</td>
<td>2.00</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4.65</td>
<td></td>
<td>6.54</td>
</tr>
<tr>
<td><strong>Functional Ratio</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NWL EPW FCI Scores

- **Base Condition**
- **Goal**
- **Achieved**
Natural Resource Damage Assessment

Cooperative Natural Resource Damage Assessment
• Restoration Based Strategy
• Sharing of Data and Resources
• Accounting for On-site Restoration Beyond ROD

Injury Assessment
• Reasonably Conservative Injury Evaluation (RCIE) + Habitat Equivalency Analysis (HEA)
• Injury to Benthos – Reflective of Service Losses
• Focus Habitats – Pre-Post Wetlands, Open Water, Riparian, and Riverine

Injury Quantification
• Use of Predicted Probability of Toxicity Based on Site-specific Sediment Chemistry
• Logistic Regression P-Max Scores (Field et al, 2002)
• Predicted Mortality as Measure of Injury
• Total Area-weighted Average Loss Per Habitat
NRD – Restoration Project

- 40 Alternatives Evaluated
- Tidal Marsh Enhancement / Preservation Project Selected
NRD – Restoration Project
Damage Assessment and Restoration Plan / Environmental Assessment

RESTORATION CREDIT (Remedial Site):
115 DSAYs for Primary Restoration Beyond ROD Goals + 40%

TOTAL LOSS = 303 EqDSAYs + 43 Riparian habitat DSAYs = 346 DSAYs

RESTORATION GAIN

<table>
<thead>
<tr>
<th>Enhancement Area</th>
<th>Increase in Service Flow</th>
<th>Acres</th>
<th>DSAYs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riparian Enhancement</td>
<td>10%</td>
<td>6.7</td>
<td>22</td>
</tr>
<tr>
<td>Riparian Creation</td>
<td>100%</td>
<td>0.9</td>
<td>22</td>
</tr>
<tr>
<td>Phragmites dominated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>converted to Spartina marsh</td>
<td>35%</td>
<td>24.7</td>
<td>284</td>
</tr>
<tr>
<td>Enhancement of existing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spartina marsh</td>
<td>10%</td>
<td>6.6</td>
<td>21</td>
</tr>
<tr>
<td>Enhancement of Open water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>habitat (oxbow)</td>
<td>5%</td>
<td>9.0</td>
<td>4</td>
</tr>
</tbody>
</table>

TOTAL GAIN 353 DSAYs
Summary

COOPERATION = GREATER UPLIFT - Working in a cooperative assessment and restoration process can save time and money while leading to greater risk reduction and increased natural resource service flows.

CHALLENGES CAN BE OVERCOME - Not all of the process went smoothly – the assessment and restoration team had to overcome technical and other issues to stay on track.

FLEXIBILITY IS KEY - The ability of the Trustees to be flexible in the assessment and restoration scaling process proved to be a significant factor in the successful outcome.

INTEGRATE EFFORTS - In this case combining restoration with the remedial action (excavation) streamlined the overall effort and lead to risk reduction greater than that which would have been accomplished through the ROD.