Habitat Related Documents

• Habitat Delineation and Assessment Work Plan
  – August 2003
  – Part of the RD AOC
  – Outlines methods and contains SOPs for habitat delineation and assessment activities

• Habitat Delineation Report
  – Submitted June 2005 – under review
  – Provides maps that depict habitat types in the 40 mile project area

• Phase 1 Habitat Assessment Report
  – Approved by EPA November 2005
  – Describes methods and results for the habitat-specific assessments completed in 2003 and 2004
Habitat Related Documents (cont’d)

- Supplemental Habitat Assessment Report (SHAWP)
  - Approved by EPA November 2005
  - Provides maps depicting the general locations for all habitat assessment sampling stations
    - Target Stations (within areas to be dredged)
    - Reference Stations (outside of areas to be dredged)
  - Contains SOPs for collecting additional habitat data and habitat suitability index (fish and wildlife models) data
Classification of Hudson River Habitat

- Unconsolidated River Bottom (UCB)
  - Sand, gravel, cobble, or muddy areas with no vegetation

- Aquatic Vegetation Beds
  - Plants that grow entirely underwater (submerged aquatic vegetation, or SAV)
  - Floating aquatic vegetation

- Shoreline (SHO) – terrestrial habitat along edge of river
  - Natural shoreline has vegetation
  - Maintained shoreline has mowed lawns, bulkheads, or large stone (riprap)

- Riverine Fringing Wetlands (WET)
  - Generally in shallow water transitional area from shoreline to deeper water
Components of Hudson River Habitat Field Program

- Habitat Delineation
  - Mapping the habitats - survey of the entire 40-mile project area using aerial photographs
  - On-water surveys of project area (ground-truthing)

- Habitat Assessment
  - Composition of habitats - collected samples from each habitat type to document site-specific physical and biological conditions
  - Sampling Stations Selected to:
    - Characterize habitat strata identified from habitat delineation
    - Include an equal number of target (dredge) and reference (non-dredge) stations
    - Be allocated along river sections in rough proportion to the relative areas of the habitat to be dredged
Sampling Stations

- Phase 1 area sampling complete, some Phase 2 areas also assessed. Totals assessed to date (2003 to 2005):
  - UCB – 46 stations; 414 samples
  - SAV – 26 stations; more than 234 samples
  - SHO – 50 stations; 150 samples
  - WET – 6 stations; more than 54 samples
- Additional sampling in Phase 2 areas scheduled for 2006
  - 54 UCB; 26 SAV; 18 SHO; 10 WET
Goal of Habitat Assessment

- For each habitat type, collect information on physical and biological variables related to ecological functions within reference areas and within areas affected by dredging.

- Use information to develop the basis of design for habitat replacement and reconstruction in Phase 1 areas.

- Compare post-remediation conditions to range of reference conditions.
Functional Capacity Indices (FCIs)

• Series of habitat-specific variables identified to represent physical, hydrologic, and biological characteristics of a site that reflect its ability to perform important ecological functions

• General methodology developed by US Army Corps of Engineers (Hydrogeomorphic Assessments)
  – Site-specific models developed for Hudson River
FCI Variables

• **Unconsolidated River Bottom**
  - substrate, cover, percent fines and TOC

• **Aquatic Vegetation Beds**
  - shoot biomass, shoot density, plant species composition (% native), % cover, TOC, water depth, percent fines, nutrient availability [K, NH₄, PO₄]

• **Shoreline**
  - bank stability, bank vegetation protection, downfall, riparian edge cover

• **Riverine Fringing Wetlands**
  - slope, stem density, stem length, stem thickness, wetland edge, plant species composition, % nuisance species, aboveground biomass, contiguous with other habitats
Habitat Assessment Sampling

- Aquatic Vegetation Sampling
  (wild celery)

- Riverine Fringing Wetland Sampling
  (burreed)
## Habitat Assessment - Specific Measurement Parameters

<table>
<thead>
<tr>
<th>Unconsolidated River Bottom</th>
<th>Aquatic Vegetation Beds</th>
<th>Natural Shoreline</th>
<th>Riverine Fringing Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substrate type;</td>
<td>Total organic carbon;</td>
<td>Downfall;</td>
<td>stem density;</td>
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<tr>
<td>epifaunal substrate and</td>
<td>shoot density;</td>
<td>bank vegetation</td>
<td>stem length;</td>
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<tr>
<td>cover;</td>
<td>percent cover;</td>
<td>protection;</td>
<td>stem thickness;</td>
</tr>
<tr>
<td>total organic carbon;</td>
<td>shoot biomass;</td>
<td>bank stability;</td>
<td>soil properties;</td>
</tr>
<tr>
<td>water quality;</td>
<td>plant species composition</td>
<td>slope;</td>
<td>percent cover;</td>
</tr>
<tr>
<td>percent fines;</td>
<td>(including percent</td>
<td>substrate</td>
<td>shoot biomass;</td>
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<tr>
<td>embeddedness; and</td>
<td>nuisance species);</td>
<td>components;</td>
<td>plant species composition</td>
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<tr>
<td>downfall</td>
<td>sediment nutrient</td>
<td>riparian edge</td>
<td>(including percent</td>
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<tr>
<td></td>
<td>availability;</td>
<td>cover;</td>
<td>nuisance species);</td>
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<td></td>
<td>light availability;</td>
<td>and</td>
<td>slope;</td>
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<td>water quality;</td>
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<td>percent fines;</td>
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<td>area;</td>
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<td>and Downfall</td>
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<td>wetland edge</td>
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<td>area of buffer; and</td>
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<td>percent contiguous with</td>
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<td></td>
<td></td>
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<td>other habitats.</td>
</tr>
</tbody>
</table>
Habitat-Specific FCI Models

- Unconsolidated river bottom (UCB)
  - Potential to support benthic macroinvertebrates
  - Potential to support fish populations

- Aquatic vegetation bed (SAV)
  - Support phytophilous and benthic macroinvertebrate populations
  - Provide habitat for fish populations
  - Stabilization of substrate
  - Nutrient cycling
Habitat-Specific FCI Models (continued)

- Shoreline
  - Shoreline stability
  - Shade and cover
  - Wildlife habitat (habitat suitability)

- Riverine fringing wetlands
  - Surface-water exchange
  - Energy dissipation
  - Nutrient and organic cycling
  - Maintain character plant community
  - Wildlife habitat (habitat suitability)
### Relating Measured Parameters to Habitat Functions (FCIs) - Aquatic Vegetation Beds

<table>
<thead>
<tr>
<th>Function (FCI Code)</th>
<th>Measured Variable (Units)</th>
<th>Variable Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support PMI/BMI Populations (FCISAVMACROS)</td>
<td>Shoot biomass (g/m²)</td>
<td>VSAVBIO</td>
</tr>
<tr>
<td></td>
<td>Shoot density (number/m²)</td>
<td>VSAVDENSE</td>
</tr>
<tr>
<td></td>
<td>Plant species composition (% native)</td>
<td>VSAVSPP</td>
</tr>
<tr>
<td></td>
<td>TOC (percent)</td>
<td>VSAVTOC</td>
</tr>
<tr>
<td></td>
<td>Water depth (cm)</td>
<td>VSAVDEPTH</td>
</tr>
<tr>
<td>Provide Habitat for Fish Populations (FCISAVFISH)</td>
<td>Shoot biomass (g/m²)</td>
<td>VSAVBIO</td>
</tr>
<tr>
<td></td>
<td>Shoot density (number/m²)</td>
<td>VSAVDENSE</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td>VSAVTOC</td>
</tr>
<tr>
<td></td>
<td>Water depth (cm)</td>
<td>VSAVDEPTH</td>
</tr>
<tr>
<td></td>
<td>Percent cover (percent)</td>
<td>VSAVCOVER</td>
</tr>
<tr>
<td>Stabilization of Substrate (FCISAVSTAB)</td>
<td>Shoot density (g/m²)</td>
<td>VSAVDENSE</td>
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<tr>
<td></td>
<td>Percent fines (percent)</td>
<td>VFINES</td>
</tr>
<tr>
<td></td>
<td>Percent cover (percent)</td>
<td>VSAVCOVER</td>
</tr>
<tr>
<td>Nutrient Cycling (FCISAVNUTS)</td>
<td>Shoot biomass (g/m²)</td>
<td>VSAVBIO</td>
</tr>
<tr>
<td></td>
<td>TOC (mg/kg)</td>
<td>VSAVTOC</td>
</tr>
<tr>
<td></td>
<td>Sediment nutrient availability (mg/kg)</td>
<td>VSNN</td>
</tr>
</tbody>
</table>
Transforming Field Data into FCIs

- Data transformed into unitless subindices ranging from 0.0 to 1.0 for integration into FCI models
- For most variables, the highest measured value is set at 1.0
- All stations collected to date are used as “reference stations” since they represent current, pre-dredging conditions
Example: Aquatic Vegetation Bed

- **FCI_{SAVMACROS}**: Ability to support phytophilous and benthic macroinvertebrates

- Five variables averaged
  - (Shoot biomass (g/m²) \(V_{SAVBIO}\))
  - Shoot density (number/m²) \(V_{SAVDENSE}\)
  - Plant species composition (% native) \(V_{SAVSPP}\)
  - TOC (percent) \(V_{SAVTOS}\)
  - Water depth (cm) \(V_{SAVDEPTH}\)

\[
\left(\frac{V_{SAVBIO} + V_{SAVTOS} + V_{SAVDENSE} + V_{SAVSPP} + V_{SAVDEPTH}}{5}\right)
\]
Success Criteria

- Habitat-specific criteria will be developed based on range of conditions found in reference areas.
- Range defines “bounds of expectations” for habitat replacement and reconstruction.
- Developed for conditions within specific habitats.
Additional Measures

- Approach employed to determine success will be presented in the Adaptive Management Plan (anticipated submittal March 2006)
- Habitat Suitability Indices will be used as a secondary measure for evaluating success
# HSI Fish and Wildlife Species

- Belted kingfisher
- Great blue heron
- Wood duck
- Muskrat
- Mink
- Snapping turtle
- Yellow perch
- Largemouth bass
- Smallmouth bass
- Common shiner
- Bluegill
Additional Data Collection and Needs

- Spot-checking and reassessment
- Assessments in remaining Phase 2 areas
- Assessments in off-site reference areas: off-site reference stations for each of the four habitats will be selected in the Upstream Upper Hudson and/or Lower Mohawk River
- Validation of FCI models using site-specific data
  - Functional data assessment (e.g., fish and wildlife observations)
  - Existing data
  - On-going data collections (from other sampling programs)
Upcoming Habitat Assessment Field Work

• Complete habitat assessments at remaining Phase 2 areas and off-site reference areas
  – June-September 2006

• Conduct habitat reassessments at a subset of Phase 1 areas to determine year-to-year variability
  – June – September 2006
Components of Habitat Program

• Habitat Delineation
  – Document the extent of habitat types in the 40 mile project area
    • Unconsolidated River Bottom
    • Aquatic Vegetation Beds
    • Shoreline (Riparian)
    • Riverine Fringing Wetlands

• Habitat Assessment
  – Quantify habitat-specific parameters to be used to develop replacement and reconstruction designs
  – Quantify habitat function for use in determining success of habitat replacement reconstruction
Components of Habitat Program, (cont’d)

• Habitat Replacement and Reconstruction Designs
  – Habitat-specific designs to replace or reconstruct those areas removed by dredging
  – Designs must be integrated with residuals standards

• Adaptive Management
  – Corrective actions if needed to meet goals of program