

Biological Resources (Con't.)

- ◆ Aquatic Systems
- ◆ Wetlands
- ◆ Threatened & Endangered Species

Assessing Impacts to Aquatic Systems

- ◆ **Identify Source of Potential Impacts**
 - Changes in Water Quality
 - Change Hydrology (de-water/flood)
 - Placement of Fill
 - Shading
 - Changes in Aquatic Vegetation (invasive species)
- ◆ **Determine Study Area**
 - Generally areas of direct impact
- ◆ **Determine Existing Conditions**
 - Field Visit for Habitat
 - Species Likely to Occur
 - Fish Surveys (electroshocking/seines/traps)
 - Macroinvertebrates Surveys
 - HEP/HES
- ◆ **Identify Standard**
 - Usually none except for E & T species

Aquatic Systems (cont.)

- ◆ **Impact Prediction**
 - Direct Taking
 - Change in Hydrology
 - Shading
 - Water Quality Effects
 - HEP/HES
 - Invasive Species
- ◆ **Assess Significance of Impacts**
 - Percentage/Professional Judgment
 - Unique Characteristics/ Sensitive Species
 - Economic Value
- ◆ **Mitigation**
 - Avoid/Minimize Sensitive Areas
 - Enhance Habitat (HEP/HES)
 - Control Invasive Species

Habitat Evaluation System (HES)

- ◆ Assumes abundance of species is determined by presence of habitat.
- ◆ 2 Aquatic Systems (streams and lakes)
- ◆ 5 Terrestrial Systems
- ◆ Steps of HES
 - Derive Habitat Quality Index (HQI) scores
 - Derive Habitat Unit Values
 - Calculate Difference With and Without Project
 - Use to Determine Mitigation

Assessing Impacts to Wetlands

- ◆ **Identify Source of Potential Impacts**
 - Placement of Fill
 - Change Hydrology (de-water)
 - Shading
 - Toxic Substances
 - Spills
 - Mining
 - Non-indigenous Species
- ◆ **Determine Study Area**
 - Generally Areas of Direct Fill or Changes to Hydrology
- ◆ **Determine Existing Conditions**
 - Aerial Photographs
 - Field Visit
 - Wetland Delineation
 - Wetland Evaluation Technique (WET)
 - Hydrogeomorphic Approach (HGM)

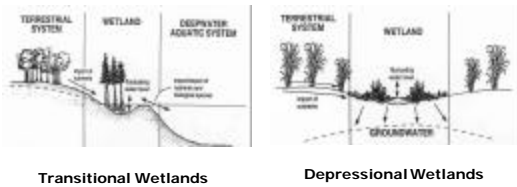
Wetlands (cont.)

- ◆ **Identify Standard**
 - Federal/State Permits
 - ◆ Nationwide
 - ◆ Individual
- ◆ **Impact Prediction**
 - Direct Taking
 - Change in Hydrology
 - Shading
 - WET/HGM
- ◆ **Assess Significance of Impacts**
 - Individual Permit
 - Percentage/Professional Judgment
 - Unique Characteristics/ Sensitive Species
- ◆ **Mitigation**
 - Avoid/Minimize Sensitive Areas
 - Compensate (WET/HGM)
 - Banking

Wetland Basics

- ◆ **Definition:** Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas. (US Army Corps of Engineers, 1977)

Wetlands Basics (cont.)



Transitional Wetlands

Depressional Wetlands

Wetland Functions

- ◆ **Abiotic Functions**
 - Flood Mitigation
 - Storm Abatement
 - Aquifer Recharge
 - Water Quality
 - ◆ Nutrient retention
 - ◆ Sediment trapping
 - Bank Stabilization
- ◆ **Biotic Functions**
 - Wildlife Habitat
 - Aquatic Habitat
 - Food Chain Support
- ◆ **Human Functions**
 - Active Recreation
 - Passive Recreation
 - Resource Harvest

Wetland Evaluation

- ◆ Wetland Evaluation Technique (WET)
 - 11 Functions
 - Evaluated on:
 - ◆ Social Significance
 - ◆ Effectiveness
 - ◆ Opportunity
- ◆ Hydrogeomorphic Analysis (HGM)
 - Wetland Group by:
 - ◆ Geomorphic setting
 - ◆ Water source
 - ◆ Hydrodynamics
 - Groups have different functions
 - Functional capacity models for region
 - Reference wetlands
 - Functional capacity units

HGM Wetland Classification

Table 1
Hydrogeomorphic Classes of Wetlands Showing Dominant Water Sources, Hydrodynamics, and Examples of Subclasses

| Hydrogeomorphic Class (geomorphic setting) | Water Source (dominant) | Hydrodynamics (dominant) | Examples of Regional Subclass | |
|--|--|-------------------------------|-----------------------------------|----------------------------|
| | | | Eastern USA | Western USA and Alaska |
| Riverine | Overbank flow from channel | Unidirectional and horizontal | Bottomland hardwood forests | Riparian forested wetlands |
| Depressional | Return flow from groundwater and interflow | Vertical | Prairie pothole marshes | California vernal pools |
| Slope | Return flow from groundwater | Unidirectional, horizontal | Fens | Avalanche chutes |
| Mineral soil flats | Precipitation | Vertical | Wet pine fitwoods | Large pleyas |
| Organic soil flats | Precipitation | Vertical | Peat bogs; portions of Everglades | Peat bogs |
| Estuarine fringe | Overbank flow from estuary | Bidirectional, horizontal | Chesapeake Bay marshes | San Francisco Bay |
| Lacustrine fringe | Overbank flow from lake | Bidirectional, horizontal | Great Lakes marshes | Fishhead Lake marshes |

HGM Computations

| Variables | Project Wetland | | | | | |
|------------------------|---------------------------|----------|------------------|----------|----------------|----------|
| | Bellevue National Wetland | | Bellevue Airport | | Julien Airport | |
| | Date | Subclass | Date | Subclass | Date | Subclass |
| Flow | -4.2 | 1.8 | 1.9 | 1.8 | 7 | 0.20 |
| Height | -0.5 | 1.2 | -1.8 | 1.9 | 7 | 0.20 |
| Water | 80 | 1.4 | 11 | 10.7 | 10 | 0.27 |
| Flow | 70 | 1.8 | 42 | 0.6 | 10 | 0.3 |
| Water | 15 | 1.8 | 28 | 1.0 | 8 | 0.2 |
| Flow | 25 | 1.9 | 23 | 1.0 | 8 | 0 |
| Flow | 4.5 | 1.9 | 1.1 | 0.2 | 2 | 0 |
| Wetland Capacity Index | | 0.0 | | 0.97 | | 0.21 |

(Definition: Deposition and retention of organic and inorganic particles contribute to the physical processes. Where net deposition occurs, the wetland is considered to be accreting. Deposition increases surface elevation and changes topographic complexity. Organic matter may also be retained for decomposition, nutrient recycling, and detrital food web support.)

$$FCU = \sqrt{\frac{1}{2} \left(\frac{Flow + Water}{Flow + Water} \right) \left(\frac{Water + Flow}{Water + Flow} \right)}$$

Flow = Frequency of hydrologic inundation for average condition (year) between flooding events. Water = Water table height to the wetland as a ratio of water volume to wetland volume. Wetland = Microtopographic complexity measured as the difference in elevation between the height of the low point of wetland basin and the maximum depth of the wetland. Flow = Wetland plant density measured as percent cover within the wetland assessment area. Water = Slope and wetting frequency measured as percent cover within the wetland assessment area. Flow = Tree density measured as the frequency (number of) tall trees within the wetland assessment area. Water = Volume of coarse woody debris (or "log") measured as diameter (width) of log and log length within the wetland assessment area.

HGM Output

Table 6
Example Data Sheet for Comparing Functional Capacity Indices (FCIs) with Permit-Based Operations (PBOs) for Wetland Assessments Area Under Proposed and Existing Conditions

FCIs and PBOs by WMA Under Proposed and Existing Conditions

WMA: _____
Project: _____
Wetland Assessment Area: _____
Address: _____

| Activity | Proposed | | | Existing | | |
|--|-----------|----------|-------|-----------|----------|-------|
| | Area (Ac) | Area (%) | Value | Area (Ac) | Area (%) | Value |
| Forest (Native/Non-Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Low-Tech Surface Water | 25 | 15 | 25 | 25 | 15 | 25 |
| High-Tech Surface Water | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native/Non-Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native/Non-Native) in Canyons | 25 | 15 | 25 | 25 | 15 | 25 |
| Forest (Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Forest (Native) and Canyons | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) and Canyons | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) and Canyons | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) and Canyons | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) and Canyons | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) and Canyons | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) and Canyons | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) and Canyons | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) and Canyons | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) | 25 | 15 | 25 | 25 | 15 | 25 |
| Wetland (Native) and Canyons | 25 | 15 | 25 | 25 | 15 | 25 |

Continued on p. 10

Assessing Impacts to Species of Concern (T&E, Rare)

◆ Identify Source of Potential Impacts

- Clearing and Grubbing
- Change Hydrology (de-water/flood)
- Toxic Substances
- Spills
- Placement of Fill
- Shading
- Noise
- Human Contact
- Non-Indigenous Species



◆ Determine Study Area

- Generally Areas of Direct

◆ Determine Existing Conditions

- Consultation with US Fish & Wildlife service
- Habitat for Species Likely to Occur
- Field Visit for Habitat
- Survey for Species

Species of Concern (cont.)

◆ Identify Standard

- Jeopardy

◆ Impact Prediction

- Biological Assessment
 - ◆ Direct Taking
 - ◆ Habitat Alternation
- Biological Opinion



◆ Assess Significance of Impacts

- Affect on Wildlife Species of Concern
 - ◆ No Jeopardy
 - ◆ Jeopardy



◆ Mitigation

- Avoid/Minimize Sensitive Areas
- Enhance Habitat
- Move Species

ESA Consultation Process

