CHAPTER 7. HYDROLOGY

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CHAPTER 7. HYDROLOGY

Hydrology is the major defining characteristic of wetland ecosystems; affecting both soil development and vegetation composition, which in turn reflect ecological condition (Mitsch and Gosselink 2007). The following protocol is designed to characterize the hydrologic characteristics of the site being assessed. The types of data to be collected are:

- Identification of Water Sources
- Hydrology Indicators
- Hydrology Stressors, including measurements of ditches.

For detailed information on the rationale for the hydrology indicator, see "Ecological Indicators for the 2011 National Wetland Condition Assessment" (in prep.).

This chapter provides the details necessary to collect hydrology data by the Assessment Area and Buffer (AB) Team within the Assessment Area (AA). Prior to departure for the site the AB Team will review pertinent hydrology information concerning the site and ready the forms and equipment (See Section 7.5) needed for hydrology sampling. In locations under the influence of tides, stage of tide may affect access to the site and may make portions of the AA unsampleable or unsafe, particularly if the area is inundated by surface water 1m or more in depth. Refer to local tide tables and plan the visit so that maximum time is available to sample the site.

Collecting hydrologic data for the NWCA involves a number of tasks. These include: recording the weather on the day of sampling and for the previous week; documentation and ranking of hydrologic characteristics including surface water connectivity to the buffer; estimates of hydrologic fluctuations based on evidence of seasonal water levels, and documentation and ranking of hydrologic alterations or stressors. Additionally, indicators of hydrology including observation of current or recently saturated soils, and evidence of recent inundation will also be assessed and recorded.

To avoid impairing data collection for the Vegetation Indicator (Chapter 5), AB Team members will avoid stepping into areas that might be delineated as Vegetation Plots, by waiting until the Plots are marked before entering the AA. Assessment of hydrologic features occurring in Vegetation Plots must be done from plot peripheries to avoid trampling vegetation in the plots. The AB Team will survey the entire AA, as it fits into the overall survey schedule of the day’s activities to identify, rank, and record Hydrology Indicator data. Hydrologic indicators and stressors in the buffer zone surrounding the AA will be evaluated using the buffer protocol (Chapter 4). Additional hydrologic information will be collected as part of the soil (Chapter 6) and water quality (Chapter 8) protocols.

7.1 SAMPLING PROCEDURES

Protocols for the NWCA hydrology sampling are:

1) Identification and Ranking of Water Sources
2) Identification and Ranking of Hydrology Stressors
3) Ditch Measurements
4) Identification of Indicators of Hydrology.
Fill out the header information for Form H-1. Note the start time for collecting hydrology data in the Time of Sampling field using a 24-h clock. In the appropriate field, describe the weather for the day of sampling and the previous week, and indicate stage of tide, if applicable. Fill in the bubble at the beginning of each section to confirm that items not completed were absent rather than overlooked.

### 7.1.1 Water Sources

Water sources and outflows provide an indication of the seasonality and hydrograph of the wetland. Sources of water input may include surface water (e.g., direct rainfall, stream inlets, sheet flow, flooding) and groundwater. In estuarine environments, tidal surge or tidal channels may be a significant source of water inundation within the AA. Particularly in urban settings, surface water may originate from anthropogenic sources including pipes and ditches.

1) Walk the entire AA as necessary to identify the presence or suspected presence of various water sources influencing site hydrology including inlets and outlets.

   Use the aerial photos and topographic maps in the Site Packet to help identify potential inlets to investigate at ground level, especially for heavily vegetated sites.

2) Record each type of water source found within the AA as Present in the Water Sources - Natural section of Form H-1. If the water source is not listed, record the related data in the Other field and describe the source using a flagged comment.

   - Sources may include natural inlet streams/springs, tidal channels, ocean, lake, groundwater, precipitation and surface water runoff.

   - Some source indicators may require interpretation. Provide a best informed decision for your determination. Flag any decisions that require clarification to inform data interpretation.

3) Consider all natural types of water sources found, and rank the three most important. Give each a score from 1 to 3 with a value of 1 to the most important, ecosystem driving or influential type.

### 7.1.2 Hydrology Stressors Within the AA

Wetland hydrologic alterations include a number of human influenced changes in hydrologic complexity, duration and magnitude that will be recorded on Form H-1. The Buffer Protocol (Chapter 4) will document stressors found in the buffer zone adjacent to the AA that are influencing the hydrology of the AA.

1) Identify the presence of anthropogenic hydrology stressors within the AA in the Hydrologic Stressors section of Form H-1. The following list identifies a number of possible hydrologic disrupters that may be observed:

   a) Damming Features – Dikes/Berms/ Dams/ RR Beds/Roads- Record the presence of these flow impeding structures within the AA. Such structures may elevate or lower the natural water table of the AA.
b) **Shallow channels** – Record the presence of shallow channels (e.g., animal trampling, vehicle ruts) within the AA.

c) **Impervious surfaces** – Record the presence of any impervious surfaces found present within the AA. These surfaces (e.g., compacted soil roads, asphalt, concrete) hinder or block infiltration of water, thus changing the local water table level.

d) **Recent sedimentation** – Note and record if the AA is receiving freshly deposited sediment. Recently deposited sediment may be different in color (often lighter) than sediment deposited in the past, be a different particle size than the wetland substrate, and lack algae or vegetation growing on the deposit.

e) **Pumps** – Record the presence of any pumps within the AA used to divert water away from or into the wetland. Many types of pumps may be used for purposes including crop irrigation or household water supply.

f) **Field tiling** – If agricultural field tiling is apparent within the AA, mark present.

g) **Excavation/Dredging** – Record the presence of any dredging or other excavation activity noted in the AA.

h) **Pipes** – Record the presence of pipes that act to direct water into or out of the AA.

i) **Culverts** – Record the presence of culverts that act to direct water into or out of the AA.

j) **Other** – Record presence of other hydrology stressors identified. Describe the stressor in a flagged comment.

2) Review the stressors identified in the AA and rank the top three most influential hydrologic stressors (1-3, with 1 being most stress) to complete the Hydrology Stressors section of Form H-1.

### 7.1.3 Ditch Depth Within the AA

Ditches facilitate the movement of water from one location to another and generally lower the local groundwater table. However, depending upon topography, ditches may expedite the draining of a wetland or its flooding (by bringing in water that raises the water table).

1) Search for ditches within the AA.

   a) If one ditch is present, proceed to Step 2.

   b) If more than one ditch is present, identify the deepest ditch and proceed with Step 2.

   c) If there are no ditches in the AA, fill in the No Ditch Present bubble on Form H-1.
2) Measure the depth of the deepest ditch in three locations within the AA using a surveyor’s rod (also known as a stadia rod) and a ski pole or other graduated rod marked in centimeters following the steps below.

a) One AB team member places the surveyor’s rod across the ditch. For wider ditches, the rod may need to be held to keep it horizontal without bowing from its own weight.

b) The second AB team member holds a ski pole or other rod with graduations marked in centimeters vertically from the bottom of the ditch up to the surveyor’s rod.

   The intersection of the bottom of the horizontal surveyor’s rod on the vertical rod is the depth of ditch.

c) Record Depth 1 in centimeters on Form H-1.

d) Take two more measurements of ditch depth spaced fairly evenly within the AA.

e) Record Depth 2 and 3 on Form H-1.

f) Mark the depth measurement locations on the aerial photo from the Site Packet and/or the sketch map on the back of Form AA-1 that is being used to document the layout of the AA (Chapter 3).

7.1.4 U.S. Army Corps of Engineers Indicators of Hydrology

Indicators of hydrology may take many forms. The AB team should carefully look around the entire AA to note the presence of indicators and record their presence on the back of Form H-1. Reference card H-1 has pictures and/or descriptions of some U.S. Army Corps indicators (USACOE 2009) to help with identification.

1) Record the presence of surface water, saturated soils and other site condition evidence that suggests the presence of various wetland characteristics by filling in all applicable bubbles.

2) Record any evidence of recent inundation. Mark the bubbles for various residual marks from water (stains, drift lines or deposits, mineral deposits, etc.) and sediment (deposits, drainage patterns, crusts, etc.) and plant and animal presence or indicators.

3) Note any evidence of current or recent soil saturation. Mark bubbles for evidence including olfactory as well as visual indicators.

4) For all indicators, if further explanation is required, use a flagged comment to elaborate.

7.2 SAMPLE AND DATA HANDLING

There are no physical samples to process and track for the Hydrology Indicator. All data is recorded on Form H-1. See Chapter 2 for data form and records management protocols.
7.3 LITERATURE CITED


REFERENCE CARD

Reference Card H-1: NWCA Assessment Area Hydrology
Evidence of Recent Inundation

**Water marks** - Discolorations or stains on the bark of woody vegetation, rocks, bridge supports, buildings, fences, or other fixed objects as a result of inundation

**Sediment deposits (A)** - Thin layers or coatings of fine-grained mineral material (e.g., silt or clay) or organic matter (e.g., pollen), sometimes mixed with other detritus, remaining on tree bark, plant stems or leaves, rocks, and other objects after surface water recedes

**Drift deposits** - Rafted debris that has been deposited on the ground surface or entangled in vegetation or other fixed objects. Debris consists of remnants of vegetation (e.g., branches, stems, and leaves), manmade litter, or other waterborne materials

**Algal mat or crust (A)** - A mat or dried crust of algae, perhaps mixed with other detritus, left on or near the soil surface after dewatering

**Iron deposits (B)** - Thin orange or yellow crust or gel of oxidized iron on the soil surface or on objects near the surface

**Surface soil cracks (C)** - Shallow cracks that form when fine-grained mineral or organic sediments dry and shrink, often creating a network of cracks or small polygons

**Water-stained leaves (D)** - Water-stained leaves are fallen or recumbent dead leaves that have turned grayish or blackish in color due to inundation for long periods

**Drainage Patterns** - Consists of flow patterns visible on the soil surface or eroded into the soil, low vegetation bent over in the direction of flow, absence of leaf litter or small woody debris due to flowing water, and similar evidence that water flowed across the ground surface

**Salt crust (E)** - Hard or brittle deposits of salts formed on the ground surface due to the evaporation of saline surface water

**Aquatic invertebrate** - Presence of live individuals, diapausing insect eggs or crustacean cysts, or dead remains of aquatic fauna, such as, but not limited to, sponges, bivalves, aquatic snails, aquatic insects, ostracods, shrimp, other crustaceans, tadpoles, or fish, either on the soil surface or clinging to plants or other emergent objects

**Biotic crust (F)** - Ponding-remnant biological crusts, benthic micro-flora, and the dried remains of free-floating algae left on or near the soil surface after dewatering

**Sparsely vegetated concave surface** - Concave surfaces should contrast with vegetated slopes and convex surfaces in the same area

**Marl deposits (G)** - Crumbly mixture of clays, calcium and magnesium carbonates, on the soil surface

**Moss trim lines (H)** - Presence of lines of moss on trees (note arrow) or other upright objects in seasonally inundated areas

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### Observations of Surface Water or Saturated Soils and Other Site Condition Evidence

- **Stunted or stressed plants** - Present if individuals of the same species growing in the potential wetland are clearly of smaller stature, less vigorous, or stressed compared with individuals growing in nearby drier landscape situations.
- **Geomorphic position** – Present if the area in question is located in a localized depression, linear drainage-way, concave position within a floodplain, at the toe of a slope, on the low-elevation fringe of a pond or other water body, or in an area where groundwater discharges.
- **Microtopographic relief** – Presence of features that are found areas of seasonal inundation or shallow water tables, such as hummocks, flarks and strangs, tussocks, frost circles or pedestals, with micro-highs less than 90cm above the base soil level.
- **Shallow aquitard** - Occurs in and around the margins of depressions, such as temporary pools, and consists of the presence a low permeability layer within the soil profile that is potentially capable of perching water within 12 in. (30 cm) of the surface.
- **Surface water** – Observation of surface water (flooding or ponding during a site visit).
- **High water table** - Direct visual observation of the water table 30cm or less below the surface including perched water, through flow and discharging groundwater.
- **Saturation** – Observation of soaked soil conditions 30cm or less from the soil surface. Indicated by water glistening on the surfaces and broken interior faces of soil clods (See Chapter 6: Soils).

### Evidence of Current or Recent Soil Saturation

- **Hydrogen sulfide odor** - A rotten egg odor within 12 in. (30 cm) of the soil surface.
- **Dry season water table** - Visual observation of the water table between 12 and 24 in (30 and 60 cm) below the surface during the normal dry season or during a drier-than-normal year.
- **Surficial thin muck** - Consists of a layer of moist sticky mud and organic material 1 in (2.5 cm) or less thick on the soil surface.
- **Salt deposits** - Whitish or brownish deposits of salts that accumulate on the ground surface through the capillary action of groundwater.
- **Crayfish burrows (A)** - Presence of crayfish tunnel, as indicated by openings in soft ground up to 2 in (5 cm) in diameter, often surrounded by chimney-like mounds of excavated mud.
- **Fiddler crab burrows (B)** - Presence of fiddler crab burrows in mud or sand characterized by inorganic feeding pellets left near burrows after organic matter is removed.

7.5 EQUIPMENT LIST AND DATA FORM
HYDROLOGY EQUIPMENT CHECKLIST

___ Data Form and Reference Card
___ Pencils
___ Telescoping surveyor’s rod (also known as a stadia rod) (need one to measure ditch depth)
___ Ski pole or rod marked in 1cm and 10cm gradations
### Identify and Rank Water Sources / Stressors:

Rank the top 3 Water Sources (1 = most influential). Rank the top 3 Stressors (1 = most stress) by perceived influence on the Site/Assessment Area Hydrology.

#### Water Sources - Natural

- **Stream Inflow (creeks, rivers)**
- **Outflow**
- **Springs (seeps)**
- **Lake**
- **Precipitation (rain, snow)**
- **Groundwater**

#### Hydrologic Stressors

- **Damming Features**
- **Shallow Channels**
- **Impervious Surfaces**
- **Recent Sedimentation**
- **Field Tilling**
- **Pumps**

#### Depth of Deepest Ditch:

Measure cross sectional depth in 3 places if a ditch is present in the AA

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Flag codes: K = No measurement made, U = Suspect measurement, F1,F2, etc. = misc. flags assigned by each field crew. Explain all flags in comment section.
Site ID: NWCA11-  

Date: 01/21/2011

### USACOE - Hydrology Indicators
Fill in bubbles for all applicable indicators. (Reference Card H-1 provides details about each indicator. Not all indicators will be found in every wetland).

#### Observation of Surface Water or Saturated Soils and other Site Condition Evidence
- Stunted or Stressed Plants
- Surface Water
- High Water Table
- Geomorphic Position
- Soil Saturation
- Shallow Aquitard
- Microtopographic Relief

#### Evidence of Recent Inundation
- Water Marks
- Algal Mat or Crust
- Water-stained Leaves
- Aquatic Invertebrate
- Drainage Patterns
- Sediment Deposits
- Iron Deposits
- Sparsely Vegetated Concave Surfaces
- Drift Deposits
- Surface Soil Cracks
- Salt Crust
- Marl Deposits
- Sparsely Vegetated Concave Surfaces
- Moss Trim Lines

#### Evidence of Current or Recent Soil Saturation
- Hydrogen Sulfide Odor
- Dry Season Water Table
- Crayfish Burrows
- Fiddler Crab Burrows
- Salt Deposits
- Surficial Thin Muck

### Flag

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