



Introduction to Wetland Delineation & Regulation

MN BOARD OF WATER AND SOIL RESOURCES



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Class Purpose

The purpose of the MWPCP Introduction to Wetland Delineation and Regulation Course is to teach the fundamental subjects of wetland delineation and regulation in Minnesota. The course takes a field-based, multi-disciplinary approach to wetland science and resource management for private and public sector professionals.

Subjects covered include a comprehensive study of the 3-parameter (hydrology, vegetation, soil) approach to wetland delineation, along with their indicators and tests; wetland classification systems; wetland functions; restoration and monitoring; and wetland regulatory programs in MN with an emphasis on the basic administration of the Wetland Conservation Act including Local Government Unit duties, Technical Evaluation Panel procedures, decision types, application procedures, wetland banking, and enforcement procedures.

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MWPCP CORE CURRICULUM

- 1) **Wetland Conservation Act (WCA)**- MN Rule Chapter 8420 and underlying Statutes, Agency Guidance
- 2) **Purpose**- Not wet, increase quantity, quality & biological diversity, avoid, minimize, replace
- 3) **Scope**- What WCA Regulates & does NOT regulate
- 4) **Other Regulatory Programs**- Section 404 of the Clean Water Act, MN Public Waters Program, MNCS, Invasives
- 5) **Local Government Unit (LGU)**- Determining the LGU & LGU Duties
- 6) **Technical Evaluation Panel (TEP)**- TEP members, procedures, meetings, recommendations, and findings of fact.
- 7) **Critical Definitions**- Important WCA and delineation manual definitions
- 8) **Wetland Classification Systems**- Circular 39, Cowardin, Eggers & Reed, Hydrogeomorphic method
- 9) **Wetland Ecology & Functional Assessment**- Understanding wetland functions and values, biotic/abiotic method
- 10) **Wetland Delineation**- ISACE 1987 Manual and Regional Supplements & guidance documents
 - a) **Vegetation**- Plant ID, plant communities, definition of a hydrophyte, National Wetland Plant List, plant indicator status, determining hydrophytic vegetation, problematic vegetation
 - b) **Soil**- Definition of hydric soil, key physical properties, textural divisions, Web Soil Survey, Field Indicators of Hydric Soils
 - c) **Hydrology**- Hydrology technical standard, hydrology indicators, antecedent precipitation, ortho aerial imagery review
- 11) **Application Procedures**- General WCA application requirements, determining a complete application, file management
- 12) **Noticing Requirements**- Notice of Application, Notice of Decision, timelines
- 13) **Boundary and Type Applications**- Required report components, site review
- 14) **No-Loss Criteria**- Activities with no permanent loss or impact to wetlands
- 15) **Exemption Standards**- Impacts to wetlands that do not require replacement
- 16) **Replacement plans**- Purpose & requirement, application requirements, approval conditions, special considerations, sequencing, replacement standards
- 17) **Wetland Banking**- Purpose, bank types, actions eligible for credit, establishing a wetland bank, restoration construction methods, certification and deposit of credits, replacement for public road projects, monitoring and corrective actions, withdrawals and transfers
- 18) **Enforcement & Appeals**- Enforcement procedures, Agency Roles in violations, restoration methods, voluntary restorations, appeal process



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Basic Agenda

Monday

- 3 Parameters, Delineation Methods, Wetland Function & Classification Systems, Hydrology Indicators, Critical Definitions, Data Sheet Field Exercise

Tuesday

- Quiz 1, Antecedent Precipitation, Offsite Resources and Hydrology Methods, Soil Concepts, Hydric Soil Indicators, Web Soil Survey, Soil Texture Lab, Soil profile description field exercise

Wednesday

- Quiz 2, Intro to Regulatory Programs, WCA Basic Decision Types, LGU Duties, Technical Evaluation Panel, WCA Application Procedures, Wetland Vegetation, Vegetation Field Plots Exercise

Thursday

- Quiz 3, Small Group delineation Field Exercise, Submitting Delineations, Replacement Plans, Wetland Banks, Monitoring

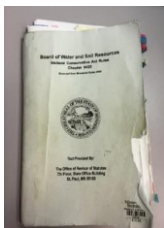
Friday

- WCA Enforcement, Altered Hydrology and Wetland Restoration, Functional Assessments Methods, Course Summary & Summary Quiz

- MWPCP Professional Exams

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Science first, then apply policy

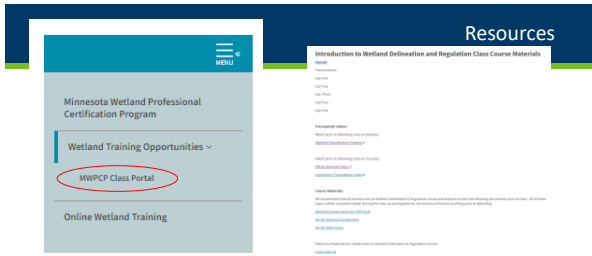


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Resources

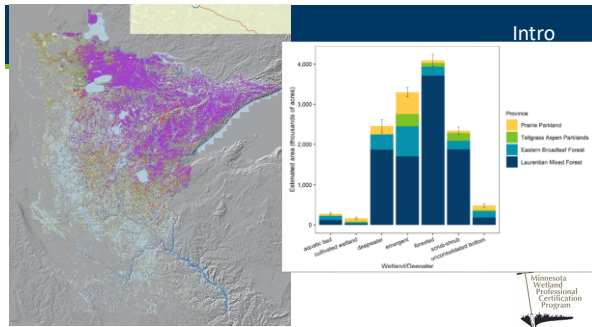
• <https://bwsr.state.mn.us/wetland-training-opportunities>

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MWPCP Class Portal

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Pop Quiz

According to the 2019 Minnesota update of the National Wetland Inventory, how many acres of wetlands are in MN?

- A) 6.3 million acres
- B) 10.5 million acres
- C) 12.2 million acres**
- D) 24.4 million acres



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What is a Wetland?

Definition: Those areas 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.



Hydrology + Vegetation + Soil = Wetland

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3 Parameters of a Wetland

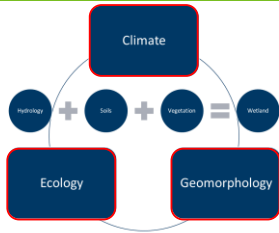
- 3 Parameters of a wetland
 - Hydrology- frequency and duration of movement of water through a landscape
 - Soil- organic and mineral surfaces which often exhibit characteristics that it has been in saturated conditions
 - Vegetation- plant community and prevalence of species that have made adaptations to live in saturated conditions



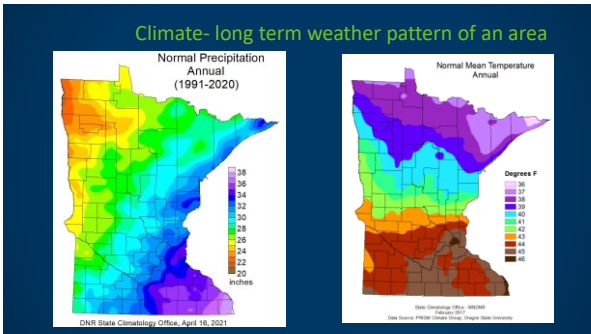
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Factors

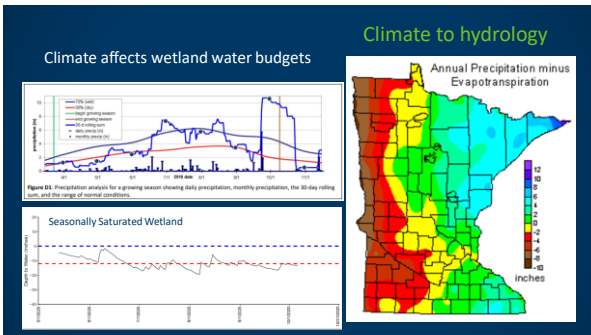
- Overarching factors that determine much of the condition of an area
- Examples:
 - Climate determines antecedent precipitation
 - Ecology determines dominate plant communities
 - Geomorphology determines landscapes and soil parent material



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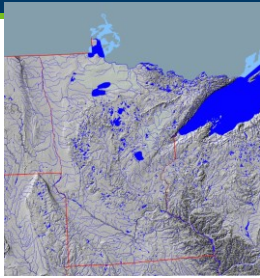
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Geomorphology

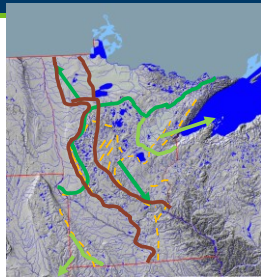
Study of physical features on the surface of the earth and their relation to its geologic structures.



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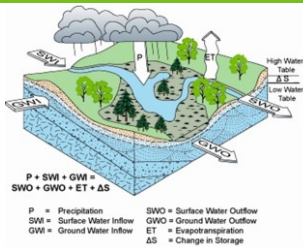
Watersheds and Ecologic Sections

Glacial landforms define MN topography
Major Watersheds align with:
Ecologic provinces
Along with climate



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Hydrology



- Inputs
 - Precipitation
 - Surface water inflow
 - Groundwater inflow
- Outputs
 - Surface water outflow
 - Groundwater outflow
 - Evapotranspiration

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Wetland Hydrology

1987 Corps Manual: "The sum total of wetness characteristics in areas that are inundated or have saturated soils for a sufficient duration to support hydrophytic vegetation."

Regional Supplements: "Wetland hydrology indicators are used in combination with hydric soil and hydrophytic vegetation to determine whether an area is wetland under the Corps manual."



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Hydrology Technical Standard

...inundated or saturated by surface or ground water at a frequency and duration"

Technical standard if hydrology indicators not observed:

- 14 or more consecutive days of flooding or ponding;
- Water table 12 in. or less below soil surface;



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Hydrology Indicators



Evidence that there is continuing hydrology and confirms that an episode of inundation/saturation occurred recently.



Wetland hydrology indicators are divided into two categories:

- **Primary** – provide stand-alone evidence of a current or recent hydrologic event; and
- **Secondary** – provide evidence of recent hydrology when supported by one or more other hydrology indicators.

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Soil

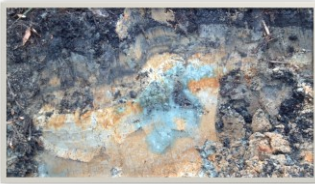
"...sufficient to support, and that under normal circumstances do support, a prevalence of **vegetation** typically adapted to life in **saturated soil conditions**"



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Hydric Soil

• A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding **long enough** during the **growing season** to develop anaerobic conditions in the **upper part**.



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Hydric Soil Indicators

Based on key physical properties: color & texture

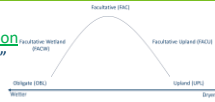
And the depth & thickness where they are found



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Vegetation

"...sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions"



Wetland Indicator Status	Definition
Obligate Wetland (OBL)	Almost always occur in wetlands
Facultative Wetland (FACW)	Usually occur in wetlands, but may occur in non-wetlands
Facultative (FAC)	Occur in wetlands and non-wetlands
Facultative Upland (FACU)	Usually occur in non-wetlands, but may in occur in wetlands
Obligate Upland (UPL)	Almost never occur in wetlands

<https://nwrpl.sec.usace.army.mil/>

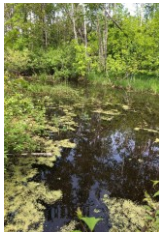
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Hydrophytes



Adaptations to saturated environment:

- morphological (multiple trunks, floating leaves)
- physiological (metabolic pathways)
- reproductive (floating seedlings)



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Dominance Tests



Methods to determine dominance of hydrophytic vegetation:

- Rapid test
- Dominance test (50/20)
- Prevalence Index
- Morphologic adaptations



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Rapid Test Example



Hydrophytic Vegetation?

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Quiz

- What are the three parameters that define a wetland?



Hydrology + Vegetation + Soil = Wetland

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Basic Overview of Wetland Delineation



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3-Parameter/ Indicator Approach

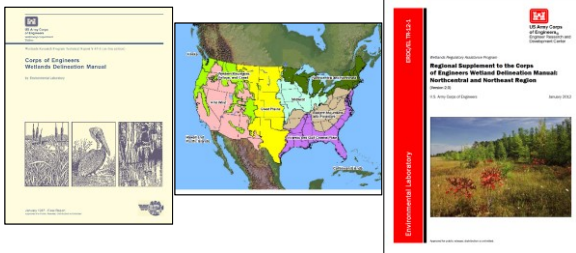
- 1. **Soils** –Longest term evidence, Historic conditions, may not reflect current condition.
- 2. **Hydrology** –Current condition, shortest term evidence but heavily influenced by recent climate conditions
- 3. **Vegetation** – Somewhere between



The 87 Manual requires 3 parameters because no one source typically gives the answer in all situations

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87 Manual and Regional Supplements



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Wetland Delineation Types

- Routine** – Qualitative Data
- Indicator based (veg, soil, hydro)
 - Representative sample points
 - Estimate and interpret data
 - 3-Types of delineations



- Comprehensive** – Quantitative Data
- Systematic sampling
 - Precise measurements



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Wetland Delineation Types

ROUTINE

Level 1 - Onsite Inspection Unnecessary

Level 2 - Onsite Inspection Necessary

Level 3 - Combination of Levels 1 and 2



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Wetland Delineation Types

Routine Level 1

Use when exact wetland boundary not necessary

Proposed Shed



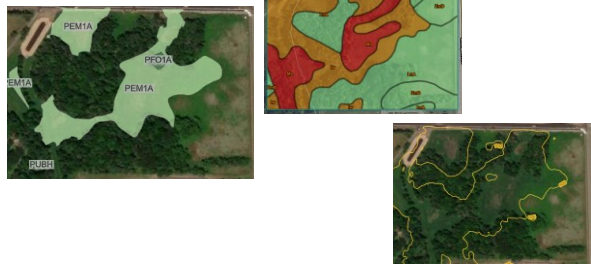
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Routine Level 1



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Routine Level 1



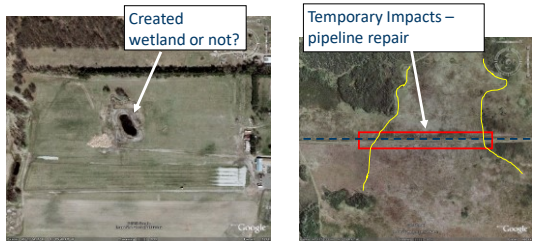
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Routine Level 1



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Routine Level 1 Examples



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Wetland Delineation Types

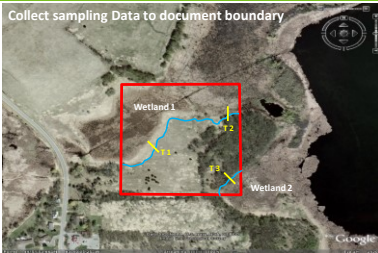
Routine Level 2

- Use when an accurate boundary is critical
- Need a formal boundary approval
- Most used and focus of class



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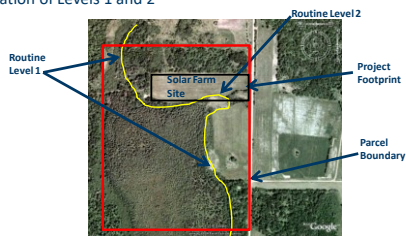
Routine 2



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Routine Level 3

Combination of Levels 1 and 2



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Routine Level 3



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Wetland Delineation Types

Comprehensive Delineation Method

- Complex, requiring rigorous documentation and coordination
- Quantitative Measurements of:
 - Hydrology
 - Vegetation
 - Soils
- Combine with other methods

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Comprehensive Delineation



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Routine Level 2 Process

- **Field Visit and Data Collection**
- Use preliminary map to make a plan
- Recon site and make informal observations and samples
- Make notes about general characteristics
 - Plant Communities
 - Topographic changes-Landscape position
 - Changes in soils
 - Precipitation conditions (wet, normal or dry)
 - Data collection/data sheets
- Delineate Wetland Boundary



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Field Equipment



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Sample Points

1. Top section of data sheet
 - > Documents sample location and landscape setting
 - > Site conditions Wet-Dry
2. Vegetation
 - > ID species to determine if plant community is hydrophytic
 - > Record comments on changes in vegetation
3. Soil
 - > Describe soil and determine if it is hydric
 - > Record comments on changes in soil



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Sample Points

- 4. Topography
 - Record changes in topography
 - Abrupt
 - Gradual
 - Geomorphic position
- 5. Other notable remarks and observations
 - Basis for delineation line (sharp topo/veg break)
 - Hydrology inputs and outputs



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It's all about the documentation!

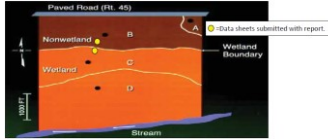
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It's all about the documentation!

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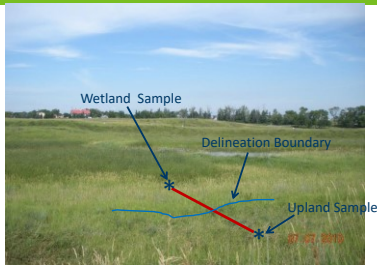
Sampling Location Should Be Representative

- Representative of soil changes (from upland to wetland)
- Representative of vegetation changes
- Representative of hydrology indicator changes
- Representative of landscape changes



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Routine Level 2 Sampling Transects



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Sample location is important!

Good data collection cannot compensate for poor sampling location choices.

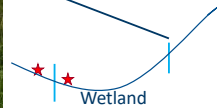


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Sampling Location

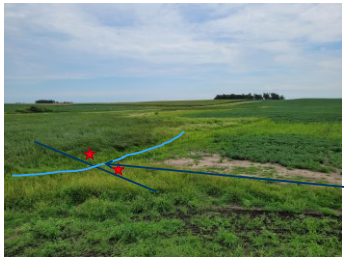


Steep vs flat topo



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Sampling Location



Agricultural Field



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Sampling Location



Road Rights-of-way

- Wetland boundary follows road slope toe.
- Try to select sample points parallel to roadway.

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Sampling Location



Representative of majority of upland plan community.



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Sampling Location



Multiple plant communities or difficult sites.

- How many wetlands?
- How many wetland/upland plant communities?
- Land use: pastureland, forest, disturbance?

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Make a Plan:

- Examining your offsite mapping before heading to the field.
- Do an initial site reconnaissance before settling on a sampling location.
- In tough areas, do "preliminary" sampling to help determine where you should do your "official" representative sampling (i.e. full data sheets).

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Guidance

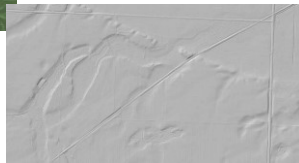
[BWSR Wetland Delineation page](#)

Wetland Delineation



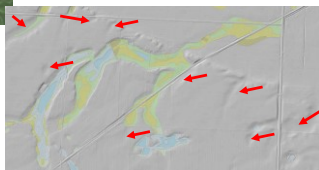
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Level One Delineation Exercise

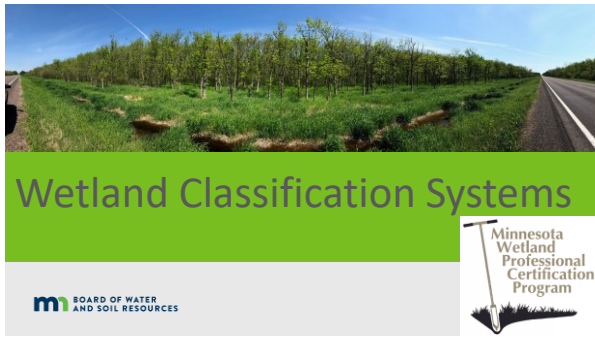


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Level One Delineation Exercise



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Wetland Classification Systems in MN

- Circular 39
- Cowardin et al.
- Eggers & Reed
- Hydrogeomorphic Method

 The presentation content includes a map of Minnesota on the left showing wetland distribution. In the center, there are two photographs: "Deep Marsh" and "Fresh Wet Meadow". To the right of these photos is a grid of diagrams illustrating hydrogeomorphic wetland types, with labels for "Type 1" through "Type 8".

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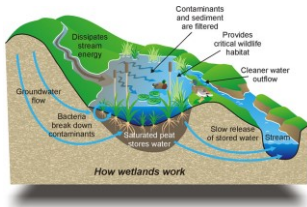
Wetland Classification Systems

 The presentation content shows two photographs of wetland types. The top photo is labeled "Type 4, Deep Marsh, PEM1F, Depression" and shows a deep, open water area. The bottom photo is labeled "Type 2, Fresh Wet Meadow, PEM1B, Depression" and shows a grassy wetland area.

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Wetland Functions

- Act as a natural "filter" to maintain water quality
- Facilitates infiltration recharging groundwater
- Stabilize base flow
- Decreases fluid velocity during high flow events which decreases turbidity
- Storm water retention (i.e. storage)
- Provides habitat
- Shoreline protection



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Values

More than a billion people make a living from wetlands across the world.

- Fishing
- Eco-tourism
- Farming
- Drinking water



Source: www.worldwildlife.org
Photos: www.ramsar.org

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Values

Hunting, Fishing, Bird watching, photography



Mud Duck Boats

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Values

Recreation, Aesthetics, Education



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Values

Food Production

Wild Rice



Cranberries

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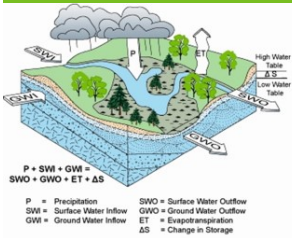
Hydrogeomorphic Method

Established classes based on geomorphic, hydrology and hydraulic functions of palustrine wetlands.

Classification Name	Definition
Lacustrine	Wetland occurs within a topographic depression that has a closed elevation contour that allows the accumulation of surface water and is restricted to the margin of a depressional lake basin.
Riverine	Wetland occurs on a nearly level landform and lies along and is influenced by flooding from a stream, river or flow-through ditch.
Slope	Wetland occurs on a slope (generally >2%) with groundwater discharge as its primary source of hydrology.
Mineral Flat	Wetland occurs on a nearly level landform, is not significantly influenced by flooding from a stream, river or flow-through ditch and has predominately mineral soils.
Organic Flat	Wetland occurs on a nearly level landform, is not significantly influenced by flooding from a stream, river or flow-through ditch and has predominately organic soils.
Depression	Wetland occurs within a topographic depression that has a closed elevation contour that allows the accumulation of surface water and is not associated with the margin of a depressional lake basin.

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Hydrology



- Inputs
 - Precipitation
 - Surface water inflow
 - Groundwater inflow
- Outputs
 - Surface water outflow
 - Groundwater outflow
 - Evapotranspiration

$P + SWI + GWI = SWO + GWO + ET + \Delta S$
 $P = \text{Precipitation}$ $SWO = \text{Surface Water Outflow}$
 $SWI = \text{Surface Water Inflow}$ $GWO = \text{Ground Water Outflow}$
 $GWI = \text{Ground Water Inflow}$ $ET = \text{Evapotranspiration}$
 $\Delta S = \text{Change in Storage}$

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Hydraulics- how water moves

- Uni-directional
- Bi-directional
 - Estuarine and lacustrine fringe

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HGM Classes

- RIVERINE
- DEPRESSIONAL
- SLOPE
- MINERAL SOIL FLATS
- ORGANIC SOIL FLATS
- LACUSTRINE FRINGE
- ESTUARINE FRINGE*

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Functions

Groundwater Recharge



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Surface Water - Extensive Flat

Mineral Soil Flats

- Landscape position- relic lake bottoms and floodplains, intergrades to multiple other classes (sloped, riverine, lacustrine)
- Hydraulics- vertical groundwater fluctuations
- Water source- precipitation, no groundwater interaction
- Outputs- evapotranspiration, saturated "seepage" flow

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Functions

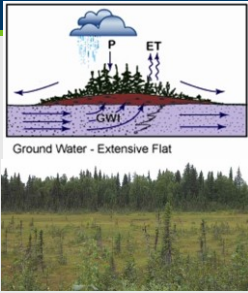
Habitat

- Many insects, reptiles and amphibians rely on wetlands to complete their life cycle.
- Some mammals are semi-aquatic: beavers, muskrat, mink, otters.
- Many birds feed and nest in wetlands.
- Fish rely on wetlands for breeding, feeding and shelter.



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Organic Soil Flats



- Landscape position- summit (interfluvial broad "plateau" between drainage systems, depressions filled with organics, vertical accretion of organics)
- Hydraulics- precipitation, unidirectional groundwater
- Water source- precipitation, groundwater
- Outputs- saturated overland seepage, evapotranspiration

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Functions

Carbon Storage

Although wetlands only account for 5-8% of earth's terrestrial landscape they may provide carbon sinks of about 300 to 700 billion tons of carbon. Peatland wetlands make up the majority of carbon sinks.



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Riverine

- Landscape position- floodplains and riparian corridors, often intergrade to sloped or depressional
- Hydraulics- unidirectional, surface overbank flow, groundwater, interflow (both surface and ground) from adjacent uplands
- Water source- precipitation, groundwater
- Outputs- overland surface flow (perennial flow not required), evapotranspiration



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Functions

Floodwater Retention

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Lacustrine Fringe

- Landscape position- adjacent to lakes, toe slope, often intergrade to sloped
- Hydraulics- bidirectional (inflow from adjacent uplands and lake)
- Water source- precipitation, groundwater
- Outputs- return flow to lake, saturated surface seepage, evapotranspiration

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Estuarine Fringe

- Landscape position- along coasts and estuaries, often intergrade into riverine
- Hydraulics- bidirectional (tidal flow)
- Water source- surface via frequent tidal flooding, precipitation
- Outputs- tidal exchange, saturated overland flow, evapotranspiration

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Functions

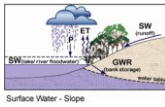
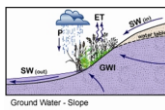
Water Quality



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Sloped

- Landscape position- linear or convex, predominately found at foot and toe slope, can be found on back slope and shoulder slope, often intergrades to other classes (mineral flat, riverine, depression)
- Hydraulics- unidirectional
- Water source- groundwater, surface runoff, precipitation



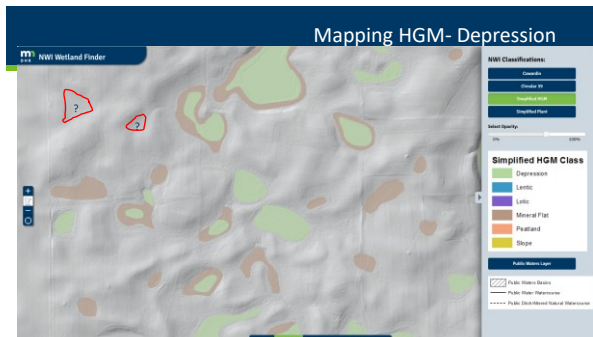
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Functions

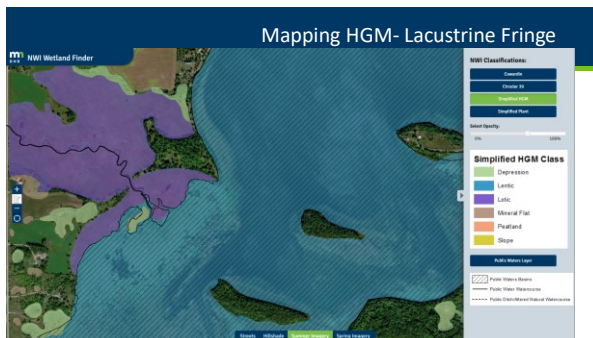
Sediment Trap



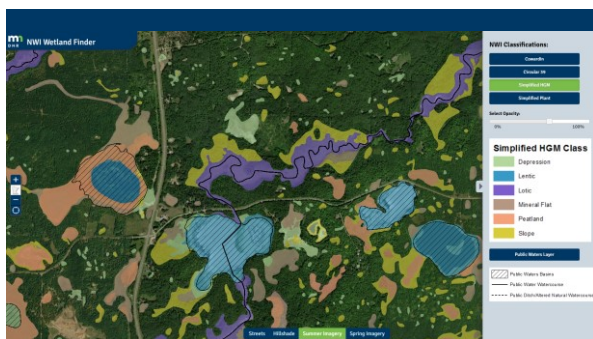
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Circular 39

Developed in 1956 for wildlife habitat (waterfowl).

Previously used in Minnesota Wetland Conservation Act

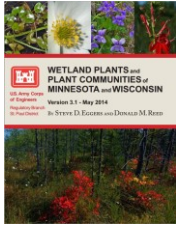
Based on hydrology and vegetation and applies landscape position.

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Eggers & Reed Classification System

Primarily based on plant communities, but includes "typical" associated hydrologic regimes

- Shallow, Open Water
- Deep Marsh
- Shallow Marsh
- Sedge Meadow
- Fresh (Wet) Meadow
- Wet/Wet-Mesic Prairie
- Calcareous Fen
- Open Bog/Coniferous Bog
- Shrub-Carr/Alder Thicket
- Hardwood Swamp/Coniferous Swamp
- Floodplain Forest
- Seasonally Flooded Basin

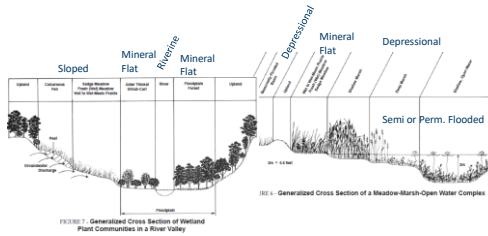


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Circular 39	Eggers & Reed
1	Seasonally Flooded Basins
1	Floodplain Forests
2	Sedge Meadows
2	Fresh (wet) Meadows
2	Wet to Wet-Mesic Prairies
2	Calcareous Fens
3	Shallow Marsh
4	Deep Marsh
5	Shallow, Open Water
6	Shrub-Carr
6	Alder Thicket
7	Hardwood Swamp
7	Coniferous Swamp
8	Open Bog
8	Coniferous Bog

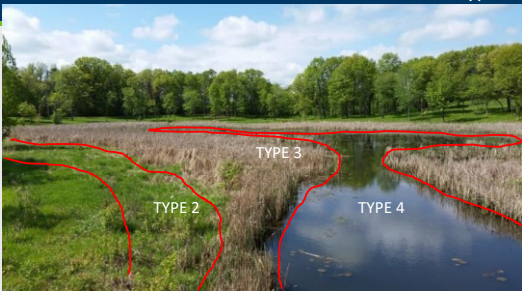
111

Eggers & Reed & WCA



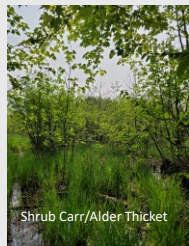
112

Circular 39 types?

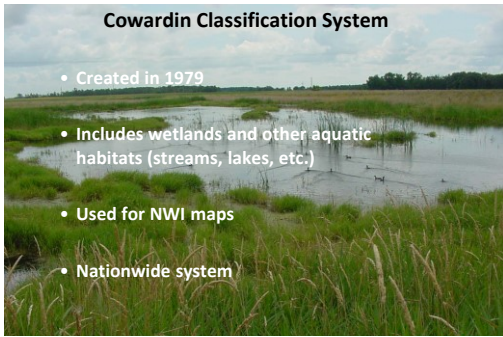


113

Eggers & Reed?



114



115

Cowardin System

Hierarchy uses symbols to describe System, Class, plant community, hydrology and modifiers

Examples of common symbols:

Systems:
P = Palustrine, L= Lacustrine, R = Riverine

Palustrine Classes:
EM = Emergent, SS = Scrub shrub, FO = Forested

Plant Community:
EM: Persistent=1, Non persistent=2
SS & FO: Broad-leaved deciduous=1, Needle-leave deciduous= 2, Broad-leaved evergreen=3, Needle-leaved evergreen=4

Water regime modifiers:
A = Temporarily Flooded, B= Seasonally Saturated, C = Seasonally flooded, D= Continuously Saturated, F=semi-permanently flooded, G=Intermittently Exposed, H=permanently flooded

Special Modifiers:
b = Beaver, d = Partially Drained/Ditched, f = Farmed, x = Excavated

116

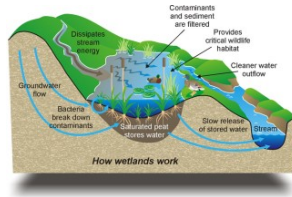
Cowardin System - NWI



117

Wetland Functions and Values

- Functions- natural processes
 - Water quality, flood retention, habitat, groundwater recharge, carbon storage
- Values- provide monetary or social welfare benefit
 - Wild rice, recreation, education, aesthetics, fishing



121

Hydrology Indicators

122

Wetland Hydrology

1987 Corps Manual: "The sum total of wetness characteristics in areas that are inundated or have saturated soils for a sufficient duration to support hydrophytic vegetation."

Regional Supplements: "Wetland hydrology indicators are used in combination with hydric soil and hydrophytic vegetation to determine whether an area is wetland under the Corps manual."



123

Hydrology Technical Standard

...“inundated or saturated by surface or ground water at a frequency and duration”

Technical standard if hydrology indicators not observed:

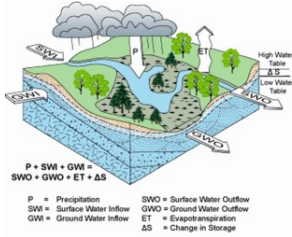
- 14 or more consecutive days of flooding or ponding;
- Water table 12 in. or less below soil surface;



124

Hydrology

Wetlands gain and lose water constantly through a variety of pathways.

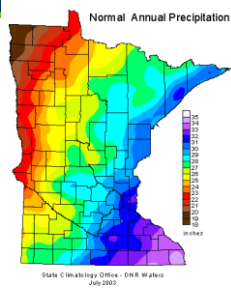
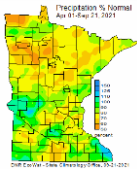


- Inputs
 - Precipitation
 - Surface water inflow
 - Groundwater inflow
- Outputs
 - Surface water outflow
 - Groundwater outflow
 - Evapotranspiration

125

Precipitation

- Average Annual precipitation varies significantly from one side of the state to the other
- A difference of 14 inches from Houston to Kittson



126

Hydrology Indicators

Evidence that there is continuing hydrology and confirms that an episode of inundation/saturation occurred recently.

Wetland hydrology indicators are divided into two categories:

Primary – provide stand-alone evidence of a current or recent hydrologic event; and

Secondary – provide evidence of recent hydrology when supported by one or more other hydrology indicators.



127

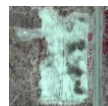
Hydrology Indicator Groups



Group A – direct observation of water



Group B – evidence of flooding/ponding



Group C – evidence of current or recent saturation.



Group D – *Landscape and veg. characteristics that indicate contemporary wetland conditions.*

128

Land Resource Regions

Regions dictate which indicators are used and how they are used



129

Flipbook



Pocket Guide to Field Indicators of Hydric Soils and Wetland Hydrology in Minnesota

2025 (Version 2)

B15. Marl Deposits: Presence of marl (calcium carbonate precipitated from standing or flowing water through the action of algae or diatoms) as a tan or whitish deposit on the soil surface.
Primary Indicator.
 North Central/North East Supplement (LRR K) only



B16. Moss Trim Lines: The presence (on trees or other upright objects) of an abrupt trim line below which water-intolerant mosses have been killed by prolonged inundation in a seasonally inundated area.
Secondary Indicator. Does not include lichen trim lines or trim lines caused by ice scour or abrasion, indicated by bark or tissue damage.
 North Central/North East Supplement (LRR K) only



130

Group A Indicators

Direct observation of water



131

A1: Surface water

Category: Primary

Direct, visual observation of surface water during a site visit.



Field Observations:

Surface Water Present? Yes No Depth (inches): _____

Water Table Present? Yes No Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes No Depth (inches): _____

132

A2: High water table

Category: Primary

Water table 12 in. (30 cm) or less below the surface in a soil pit, auger hole, or shallow monitoring well.

Water table at 9" below surface



Field Observations:		
Surface Water Present?	Yes ___ No ___	Depth (inches):
Water Table Present?	Yes ___ No ___	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ___ No ___	Depth (inches):

133

A3: Saturation

Category: Primary

Visual observation of saturated soil conditions 12 in. or less from the soil surface as indicated by water **glistening** on the surfaces and broken interior faces of soil samples.

- Glistening observed at 8" in a loamy clay soil
- Water table at 12"



Field Observations:		
Surface Water Present?	Yes ___ No ___	Depth (inches):
Water Table Present?	Yes ___ No ___	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ___ No ___	Depth (inches):

*Must include water table observation.

134

Group B Indicators

Evidence of ponding or flooding – past or present



135

B1: Water Marks

Category: Primary

Water marks are discolorations or stains on the bark of woody vegetation, rocks, bridge supports, buildings, fences, or other fixed objects as a result of inundation.



136

B2: Sediment Deposits

Category: Primary

Sediment deposits are thin layers or coatings of fine-grained mineral material or organic matter remaining on tree bark, plant stems or leaves, rocks, and other objects after surface water recedes

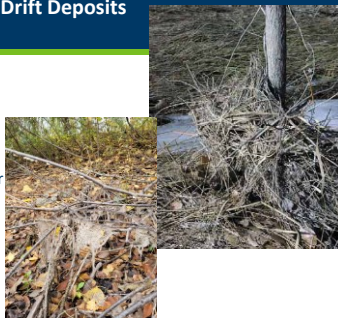


137

B3: Drift Deposits

Category: Primary

Drift deposits consist of rafted debris that has been deposited on the ground surface or entangled in vegetation or other fixed objects.

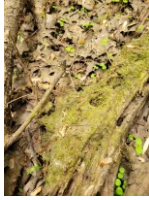


138

B4: Algal mat or crust

Category: Primary

This indicator consists of a mat or dried crust of algae, perhaps mixed with other detritus, left on or near the soil surface after dewatering.



139

B5: Iron deposits

Category: Primary

General Description: This indicator consists of a thin orange or yellow crust or gel of oxidized iron on the soil surface or on objects near the surface.



140

B6: Surface soil cracks

Category: Secondary

Water destroys the soil structure which facilitates the cracking. Surface soil cracks consist of shallow cracks that form when fine-grained mineral or organic sediments dry and shrink



141

B7: Inundation on aerial imagery

Category: Primary

One or more* recent aerial photographs or satellite images that show the site to be inundated during the growing season.



* Use Off-site Guidance Methods.

142

B8: Sparsely vegetated concave surface

Category: Primary. (Secondary in LRR F)

On concave land surfaces, the ground surface is either unvegetated or sparsely vegetated due to long-duration ponding during the growing season.

Sparsely vegetated concave surfaces should contrast with vegetated slopes and convex surfaces in the same area. Less than 5% ground cover.

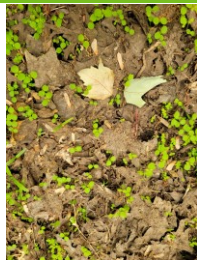
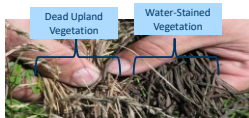


143

B9: Water-stained leaves

Category: Primary

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



144

B10: Drainage patterns

Category: Secondary

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



145

B15: Marl deposits

Category: Primary

Presence of marl on the soil surface.

Found mainly in calcareous fens, seeps, or white cedar swamps in areas underlain by limestone bedrock.



146

B16: Moss Trim Lines

Category: Secondary

Moss trim lines on trees or other upright objects in seasonally inundated areas.

Formed when water-intolerant mosses growing on tree trunks and other upright objects are killed by prolonged inundation.



147

Group C Indicators

Evidence of soil saturation – past or present

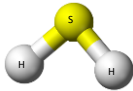


148

C1: Hydrogen sulfide odor

Category: Primary

A hydrogen sulfide (rotten egg) odor within 12 in. of the soil surface.



149

C2: Dry season water table

Category: Secondary

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.

Dry Season Dates per Region:

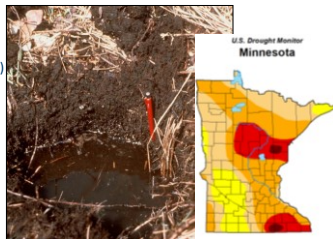
Great Plains (F): July 1

Midwest (M): July 15

NC/NE (K): August 1



Reference: Corps of Engineers Drought Newsletter



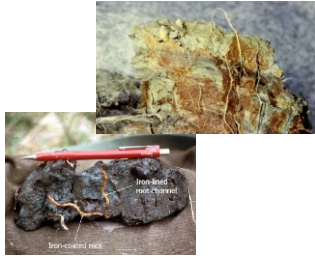
150

C3: Oxidized rhizospheres along living roots

Category: Primary.

Secondary indicator in LRR F (GP) where soils are in tilled or plowed.

Presence of a layer containing iron-oxide coatings or plaques on the surfaces of living roots and/or iron-oxide coatings or linings on soil pores immediately surrounding living roots within 12 inches of the soil surface.



Secondary

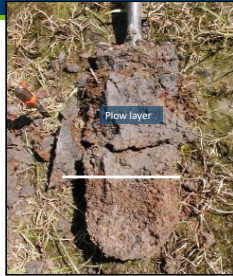
151

C6: Recent iron reduction in tilled soils

Category: Primary

Redox concentrations as pore linings or soft masses in the tilled surface layer of soils cultivated within the last two years.

Must be within the plow layer



152

C8: Crayfish burrows

Category: Secondary

General Description: Presence of crayfish burrows, as indicated by openings in soft ground up to 2 in. (5 cm) in diameter, often surrounded by chimney-like mounds of excavated mud.



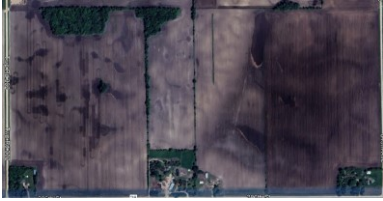
Secondary

153

C9: Saturation visible on aerial imagery

Category: Secondary

One or more* recent aerial photographs or satellite images indicate soil saturation. Saturated soil signatures must correspond to field-verified hydric soils, depressions or drainage patterns, differential crop management, or other evidence of a seasonal high water table.



* Use Off-site Guidance Methods.

154

Group D Indicators

Landscape and vegetation characteristics that indicate contemporary wet conditions



155

D1: Stunted or stressed plants

Category: Secondary

This indicator is 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 non-wetland situations.



This indicator is applicable to natural plant communities as well as agricultural crops and other introduced or planted vegetation. For this indicator to be present, a majority of individuals in the stand must be stunted or stressed.

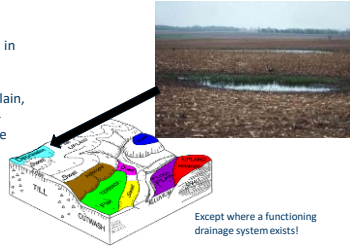


156

D2: Geomorphic position

Category: Secondary

This indicator is present if the area in question is located in a localized depression, linear drainageway, 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.

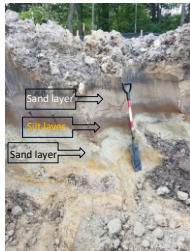
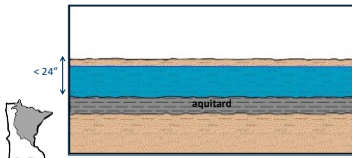


157

D3: Shallow Aquitard

Category: Secondary

Presence of an aquitard within 24 in. of the soil surface that is potentially capable of perching water within 12 in. of the surface.



158

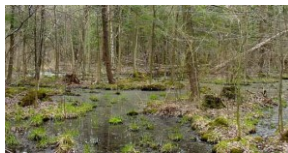
D4: Microtopographic relief

Category: Secondary

Microtopographic features that occur in areas of seasonal inundation or shallow water tables:

- Hummocks
- Tussocks
- Flark-and-strang topography

• Microhighs < 36 in. above the base soil level



159

Hydrology Indicators?



163

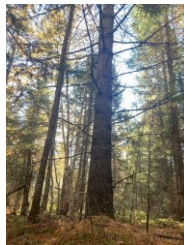
Critical Definitions for Wetland Delineation



164

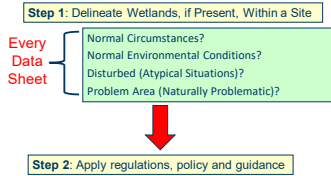
Critical Definitions

- Wetlands
- Deepwater Aquatic Habitat
- Semipermanently and permanently flooded
- Growing Season
- Disturbed (Atypical Situations)
- Naturally Problematic (Problem Areas)
- Normal Environmental Conditions
- Normal Circumstances



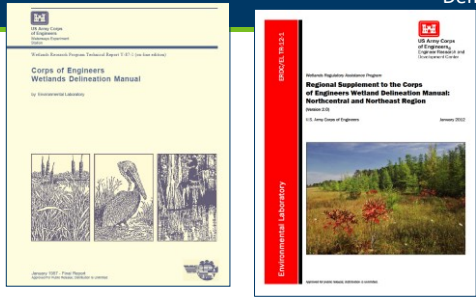
165

Two-Step Process



166

Definitions



167

Chapter 5- Difficult Wetland Situations

- Atypical situations
 - Agricultural Land (NE/NC, Midwest)
 - Silviculture (NC/NE)
- Problem areas
 - Problematic vegetation
 - Problematic soil
 - Seasonal hydrology
- Procedural problems
 - Wetland/non-wetland mosaics



168

What is a Wetland?

“Wetlands are sometimes wet areas where people meet to argue.”

Greg Larson

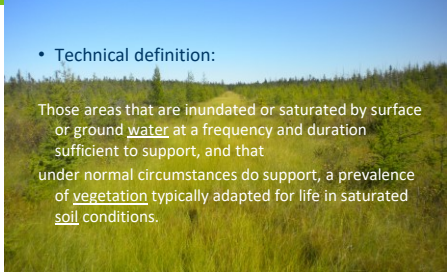


169

What is a Wetland?

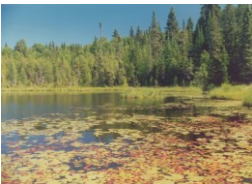
• Technical definition:

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 for life in saturated soil conditions.



170

Deepwater Habitat



Deepwater aquatic habitats are areas that are permanently inundated at mean annual water depths >8.2 ft or permanently inundated areas less than or equal to 8.2 ft that do not support rooted-emergent or woody plant species

They have the follow diagnostic characteristics:

- 1) vegetation- no rooted-emergent or woody plant species are present in these permanently inundated areas
- 2) Soil- the substrate technically is not defined as a soil if the mean water depth is >8.2 ft or if it will not support rooted emergent or woody plants

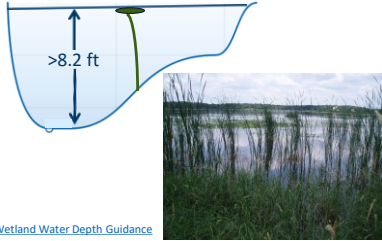
171

Limits of wetland (depth)- Deepwater Habitat

Important Considerations for Wetlands

- Must be capable of supporting rooted, emergent vegetation.
- Must have soil.

If the water is too deep or fast flowing, cannot support rooted vegetation and soil cannot form (unconsolidated bottom).



Wetland Water Depth Guidance

172

Permanently and Semipermanently flooded areas

- 2009 Rule language:
- Subp. 51. **Permanently and semipermanently flooded area of a type 3, 4, or 5 wetland.** "Permanently and semipermanently flooded area of a ~~type 3, 4, or 5~~ wetland" means the portion of a ~~type 2, 4, or 5~~ wetland below the level where the water has been maintained for a sufficient period of time to leave evidence upon the landscape, commonly the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial.



173

Permanently and Semipermanently flooded areas- Circular 39 & Eggers & Reed

	Eggers & Reed
1	Seasonally Flooded Basins
1	Floodplain Forests
2	Sedge Meadows
2	Fresh (wet) Meadows
2	Wet to Wet-Mesic Prairies
2	Calcareous Fens
3	Shallow Marsh
4	Deep Marsh
5	Shallow, Open Water
6	Shrub-Carr
6	Alder Thicket
7	Hardwood Swamp
7	Coniferous Swamp
8	Open Bog
8	Coniferous Bog

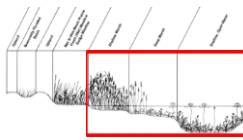


FIGURE 1 - Generalized Cross Section of a Meadow-Marsh-Open Water Complex

174

Why do we care about Growing Season?

Growing season dates are needed to:

- Evaluate and interpret certain wetland hydrology indicators
- Analyze recorded data to determine if wetland hydrology criterion is met



178

Indicators of Start of the Growing Season

1. Soil temperature at 12 inches is 41° F. or higher

Use a compost thermometer for each site

[Research & Outreach Centers | College of Food, Agricultural and Natural Resource Sciences \(umn.edu\)](#)

<https://www.mda.state.mn.us/protecting/soilprotection/soiltemp>



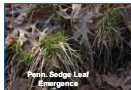
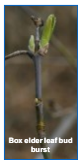
2. "Green-up" indicator



179

"Green-Up" Indicator for Start of Growing Season

Two or more species of non-evergreen plants show active growth in a wetland or surrounding area with similar elevation and aspect



180

Start of Growing Season



Two species of non-evergreen plants with new, green, aerial leaf/stem growth or flowering

April 13, 2026, site visit in St. Francis, Anoka Co.

Meets the "green-up" indicator for the start of the growing season



April 23, 2026, site visit in Brainerd, Crow Wing Co.

181

End of Growing Season

- woody deciduous species lose their leaves and/or
- the last herbaceous plants cease flowering and their leaves die back




182

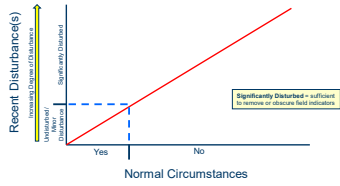
Normal Circumstance

- Those areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that **under normal circumstances** do support, a prevalence of vegetation typically adapted for life in saturated soil conditions

HISTORY: In early years of implementing the Section 404 regulatory program, wetland identification was based on vegetation – there were no delineation manuals/3-parameter approach. Cases arose where wetland vegetation was removed (plowed under, burned off, herbicided, etc.) in an attempt to evade wetland regulations. Corps/EPA then adopted the approach of determining whether the area in question **would support dominance** by wetland vegetation **under normal circumstances**.

183

Relationship of Normal Circumstances and Recent Disturbance(s)



187

Not Normal Circumstances



188

Normal Circumstances - Hydrology



Example A: Ditch legally constructed in 1950s and maintained since = ditch is established as **Normal Circumstances**. Partially drained is the normal circumstance for hydrology.

Example B: Ditch constructed last year; unauthorized side casting of fill materials in wetlands = **NOT Normal Circumstances**

189

Normal Circumstances



Authorized wetland fill meets the "extent and relative permanence test" - establishes a new Normal Circumstance

3. Physical alteration(s) is legally established, maintained and represents the long-term condition of the site; OR is a newly-authorized physical alteration (e.g., a permitted fill, new concrete dam).....Normal Circumstances

190

Normal Circumstances - Vegetation

Removal of natural vegetation and replacement with a planted crop = NOT Normal Circumstances

IGNORE the planted crop for purposes of the hydrophytic vegetation determination



When natural vegetation has been removed, focus on soils and hydrology. If a site has wetland hydrology and hydric soils, it would support dominance by hydrophytes under normal circumstances.

191

Normal Circumstances - Vegetation



Sample Point - vegetation not disturbed to the extent that dominant species cannot be accurately identified

Light grazing of a sedge meadow - minor disturbance of natural vegetation = Normal Circumstances
Example of an unimproved pasture = no interseeding, planting, etc.

192

Problem Areas (Naturally Problematic)



- ▶ One or more parameters are absent due to normal seasonal or annual variability, or permanently due to the nature of the soils or plant species
 - Seasonal wetlands
 - Prairie potholes
 - Red clay parent materials
 - FACU-dominated wetlands
 - Inter-dunal swales

199

Problem Areas

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: _____ City/County: _____ State: _____ Sampling Date: _____
 Applicant/Owner: _____ State: _____ Sampling Point: _____
 Investigator(s): _____ Section, Township, Range: _____
 Landform (Mileage, terrace, etc.): _____ Local relief (concave, convex, none): _____
 Slope (%): _____ Lat: _____ Long: _____ Datum: _____
 Soil Map Unit Name: _____ MVI identification: _____
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (if no, explain in Remarks.)
 Are Vegetation, Soil, or Hydrology significantly disturbed? Yes _____ No _____
 Are Vegetation, Soil, or Hydrology naturally problematic? (if needed, explain any answers in Remarks.)

200

Seasonal Wetlands



201

Problem Areas

Wetlands dominated by non-hydrophytic species like white pine, a Facultative Upland (FACU) species



202

Problem Areas and Normal Circumstances

• EXAMPLE: Vernal pools are naturally dry outside of the first few weeks of the growing season
= Normal Circumstances



203

Problem Areas and Normal Circumstances

Project/Site _____	City/County _____	Sampling Date _____
Applicant/Owner _____	Section, Township, Range _____	State _____
Investigator(s) _____	Local relief (concave, convex, none) _____	Sampling Point _____
Landform (hill/slope, terrace, etc.) _____	Slope (%) _____	Disturb _____
Soil Map Unit Name _____	Lat. _____	Long. _____
Soil Moist: Hydrologic conditions on the site typical for the time of year? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (If no, explain in Remarks.)	Are Vegetation _____	Soil _____ or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)
Are Vegetation _____	Soil _____ or Hydrology _____	naturally problematic? (If needed, explain any answers in Remarks.)



Prairie pothole wetland in a drought year

204

Normal Circumstances?



205

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Northcentral and Northeast Region <small>See ERDC/EL TR-12-1; the proponent agency is CECV-CC-R</small>		<small>OMB Control #: 0710-0024, Exp. 11/30/2024</small> <small>Requirement Control Symbol EXEMPT:</small> <small>(Authority: 48 CFR 15, paragraph 4.2a)</small>
Project/Site: _____	City/County _____	State _____
Applicant/Owner: _____	Investigator(s): _____	Section, Township, Range: _____
Landform (hedge, terrace, etc.): _____	Local relief (concave, convex, none): _____	Slope %: _____
Subregion (LRR or MLRA): _____	Lat: _____	Long: _____
Soil Map Unit Name: _____	Datum: _____	
Soil NWI classification: _____		
Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)		
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____		
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)		
SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.		
Hydrophytic Vegetation Present? Yes _____ No <input checked="" type="checkbox"/>	Hylic Soil Present? Yes _____ No <input checked="" type="checkbox"/>	Wetland Hydrology Present? Yes _____ No <input checked="" type="checkbox"/>
		Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Remarks: (Explain alternative procedures here or in a separate report.)		

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