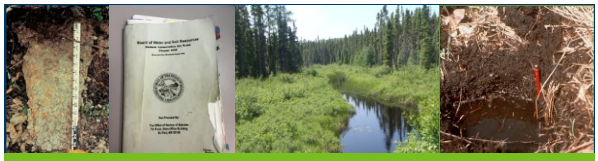
Day One



Introduction to Wetland Delineation & Regulation

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1

Land Recognition

Boozhoo!

We recognize the land on which we live, learn and work is the traditional, ancestral and contemporary lands of Indigenous peoples. The land on which the Northland Arboretum is located is part of ceded territory of a broader area of Great Lakes Ojibwe homeland.

Miigwech,

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2

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.

3

MWPCP CORE CURRICULUM

1) **Wetland Conservation Act (WCA)**- MN Rule Chapter 8420 and underlying Statutes, Agency Guidance
2) **Purpose**- No net loss; 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, NRCS Swampbuster
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, assessment methods
10) **Wetland Delineation**- USACE 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, offsite 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, Wetland Function & Classification Systems, Hydrology Indicators, Delineation Methods & 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

5

Resources

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

6

Resources

[MWPCP Class Portal]

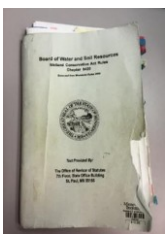
7

Important Resources for TEP members

- National Wetland Inventory
- Web Soil Survey
- County GIS/Land Explorer
- Google Earth
- Enviro Atlas
- MN Conservation Explorer

8

Science first, then apply policy



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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

10



Three Parameters of a Wetland

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Learning Objectives

- **Wetland Definitions**
- Define "wetland"
- Recognize the three parameters that are required to define a wetland
- Understand which factors influence the landscape to produce wetlands
- Introduce you to the indicator approach

12

What is a Wetland?

"Wetlands are sometimes wet areas where people meet to argue."

Greg Larson

13

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

14

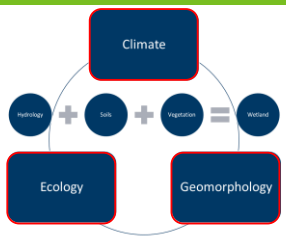
3 Parameters of a Wetland

- 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

15

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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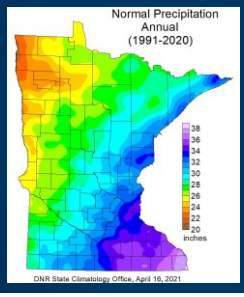
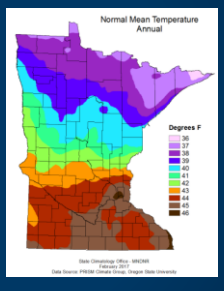
Climate- long term weather pattern of an area





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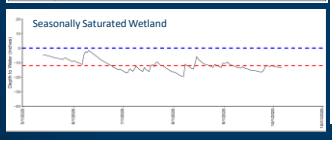
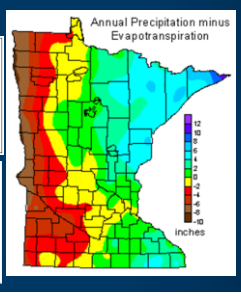
Climate affects wetland water budgets



Climate to hydrology



18

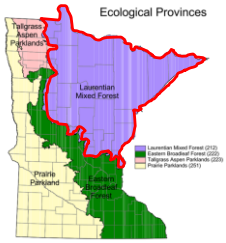
Geomorphology

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

19

Laurentian Mixed Forest Province

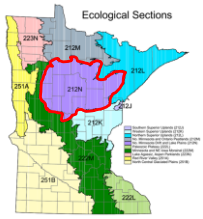
- Covers MN, WI, MI, southern Ontario and parts of New England
- In MN covers 23 million acres
- Mixed conifer and hardwood forests
- Varys from thin glacial deposits over bedrock, deep glacial till, thick peatlands
- Precipitation increases SW-NE
- Temperature decreases SW-NE
- Vegetation changes accordingly



20

Northern MN Drift and Lake Plains Section

- Complex surficial geology formed by multiple glacial advances
- Moraines, outwash plains, lake plains, drumlin fields
- Headwaters of the Mississippi River
- Glacial lakes Upham and Aitkin found in east
- Vegetation distribution varies with landforms:
  - Historically jack and red pine fire dependent forests
  - Sugar maple, basswood, aspen, red oak along moraines
  - Peatland black spruce and black ash swamps



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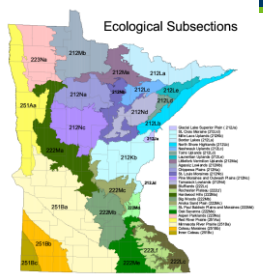
Ecological Subsections

- 26 Subsections in MN
- Defined by glacial deposition, bedrock, climate, topography and plant- esp. trees



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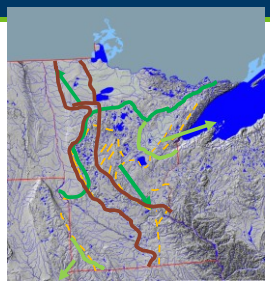
Watersheds and Ecologic Sections

Glacial landforms define MN topography

Major Watersheds align with:

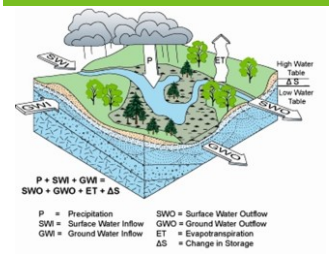
Ecologic provinces

Along with climate



23

Hydrology



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

24

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.*"

25

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;

26

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.

27

Soil

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



28

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**.

29

Hydric Soil Indicators

Based on key physical properties: color & texture

And the depth & thickness where they are found


30

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
Faculative Wetland (FACW)	Usually occur in wetlands, but may occur in non-wetlands
Faculative (FAC)	Occur in wetlands and non-wetlands
Faculative Upland (FACU)	Usually occur in non-wetlands, but may in occur in wetlands
Obligate Upland (UPL)	Almost never occur in wetlands

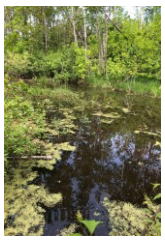
https://nwpl.sec.usace.army.mil/

31

Hydrophytes

Adaptations to saturated environment:

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

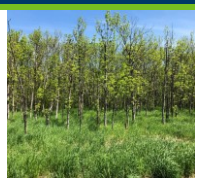


32

Dominance Tests

Methods to determine dominance of hydrophytic vegetation:

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



33

Rapid Test Example

Hydrophytic Vegetation?

34

Quiz

- What are the three parameters that define a wetland?

Hydrology + Vegetation + Soil = Wetland

35

Wetland Functions

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Learning Objectives

Wetland Functions

- Describe the ecological functions performed by wetlands and the environmental, social, and economic values they provide to the State of Minnesota.
- Differentiate between wetland functions and values
- Explain how wetland functions contribute to water quality, flood attenuation, groundwater recharge and discharge, wildlife habitat, biodiversity, carbon storage, and other ecosystem services.

37

Wetland Functions & Values

Wetland Functions: in scientific assessments means natural processes

Wetland Value: wetland goods and services providing monetary or social welfare benefit.

38

Functional Groups

Hydrologic focuses on three specific functions: *Surface Water Attenuation, Surface Water Supply,* and *Ground Water Recharge*. Wetlands play an important role in the hydrologic cycle – influencing and controlling surface water flows in watersheds in ways that often are an interface between surface and groundwater.

Water Quality focuses on the ability of a wetland to improve water quality of downstream resources and is comprised of five specific functions: *Nitrate Removal, Phosphorus Retention, Sediment and General Pollutant Retention, Shoreline Stabilization,* and *Thermoregulation*. The water quality of a wetland is accounted for in other functions, specifically the ecological function related to fish and wildlife habitat. Wetland water quality influences wetland condition which drives ecological functioning.

Ecological focuses on fish and wildlife habitat of endemic species. Specific functions include *Native Plant Habitat, Wildlife Habitat, and Fish Habitat*. This group also emphasizes the natural, ecological functioning of a wetland in its landscape.

Climate relates to the physical attributes and biochemical processes of wetlands that mitigate the effects of excess atmospheric carbon and methane gas. The specific function evaluated is *Carbon Sequestration*. Wetlands accumulate carbon through internal (e.g., vegetation growth) and external (e.g., runoff) processes, and store much of that accumulated carbon in anoxic sediment over decadal and longer timescales, thereby decreasing atmospheric CO_2 concentrations as well as avoiding loss of terrestrial carbon as CO_2.

Anthropogenic function represents the attributes of wetlands that affect direct human uses, including commercial production of goods, recreation, education and research. Specific anthropogenic functions are *Historic or Cultural Uses, Scientific or Educational Importance, Commercial Uses, Recreational Uses, and Scenic Beauty.*

Functional Group	Specific Function
Hydrology	Surface Water Attenuation
	Surface Water Supply
	Groundwater Recharge
Water Quality	Nitrate Removal
	Phosphorus Retention
	Sediment and Pollutant Retention
	Shoreline Stabilization
	Thermoregulation
Ecological	Native Plant Habitat
	Wildlife Habitat
	Fish Habitat
Climate	Carbon Sequestration
Anthropogenic	Historic or Cultural Uses
	Scientific or Educational Importance
	Recreational Uses
	Scenic Beauty
	Commercial Uses

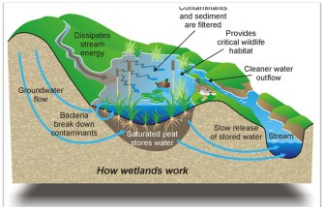
39

Description of Functions in each Group- Hydrology

Focuses on ability to affect the movement and distribution of water on the landscape- including interface between surface and groundwater

- Surface water attenuation
  - Ability to store surface water
- Surface water supply
  - Ability to supply water downstream
- Groundwater recharge
  - Ability to recharge groundwater

Hydrologic focuses on three specific functions: *Surface Water Attenuation, Surface Water Supply,* and *Ground Water Recharge*. Wetlands play an important role in the hydrologic cycle – influencing and controlling surface water flows in watersheds in ways that often are an interface between surface and groundwater.



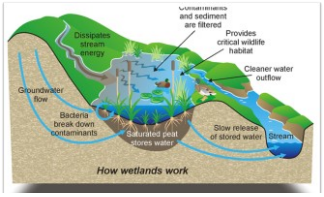
40

Description of Functions in each Group- Water Quality

Focuses on ability of wetland to improve water quality of downstream resources

- Nitrate Removal
- Phosphorous retention
- Sediment and pollutant retention
- Shoreline stabilization
- Thermoregulation

Water Quality focuses on the ability of a wetland to improve water quality of downstream resources and is comprised of five specific functions: *Nitrate Removal, Phosphorus Retention, Sediment and General Pollutant Retention, Shoreline Stabilization,* and *Thermoregulation*. The water quality of a wetland is accounted for in other functions, specifically the ecological function related to fish and wildlife habitat. Wetland water quality influences wetland condition which drives ecological functioning.



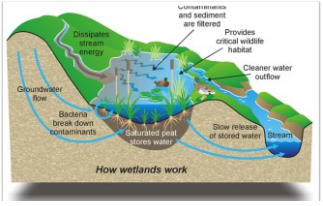
41

Description of Functions in each Group- Ecological

Focuses on the ability to affect natural relationships of organisms in wetland and surronding landscape

- Native plant habitat
- Wildlife habitat
- Fish habitat

Ecological focuses on fish and wildlife habitat of endemic species. Specific functions include *Native Plant Habitat, Wildlife Habitat,* and *Fish Habitat*. This group also emphasizes the natural, ecological functioning of a wetland in its landscape.



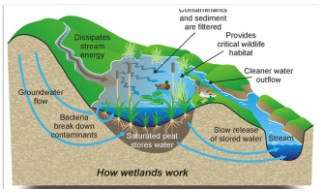
42

Description of Functions in each Group- Climate

Focuses on ability to mitgate the negative effects of excess atmospheric carbon and methane gas

- Water regime
- Catchment Characteristics
- Soils
- Vegetation

Climate relates to the physical attributes and biochemical processes of wetlands that mitigate the effects of excess atmospheric carbon and methane gas. The specific function evaluated is Carbon Sequestration. Wetlands accumulate carbon through internal (e.g., vegetation growth) and external (e.g., runoff) processes, and store much of that accumulated carbon in anoxic sediment over decadal and longer timescales, thereby decreasing atmospheric CO_2 concentrations as well as avoiding loss of terrestrial carbon as CO_2.



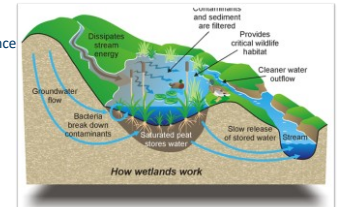
43

Description of Functions in each Group-Anthropogenic

Focuses on ability to provide various types of direct human uses

- Historic or cultural uses
- Scientific or education importance
- Commercial uses
- Recreational uses
- Scenic beauty

Anthropogenic function represents the attributes of wetlands that affect direct human uses, including commercial production of goods, recreation, education and research. Specific anthropogenic functions are *Historic or Cultural Uses, Scientific or Educational Importance, Commercial Uses, Recreational Uses, and Scenic Beauty*.



44

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

45

Values

Hunting, Fishing, Bird watching, photography

www.nps.org

Mud Duck Boats

46

Values

Recreation, Aesthetics, Education

47

Values

Food Production

Wild Rice

Cranberries

48

Wetland Classification Systems

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Learning Objectives

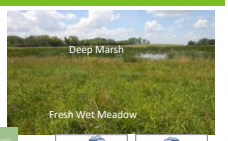
Wetland Classification systems

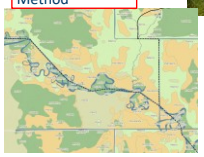
- Describe the purpose and characteristics of the principal wetland classification systems used in Minnesota: Circular 39, Cowardin, Eggers & Reed, and Hydrogeomorphic (HGM).
- Determine which classification systems are appropriate for specific regulatory, ecological, and resource management applications.

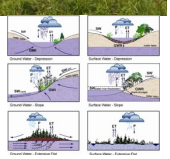
50

Wetland Classification Systems in MN

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







51

Why Classify Wetlands?

- To establish a consistent organizational structure for:
  - Understanding functions
  - Inventory/mapping
  - Scientific study and tracking
  - Regulation

Most systems use

- Vegetation (emergent or forested?)
- Hydrology (standing water or saturation?)
- Water depth (6 inches or 3 feet?)

Some use

- hydrologic source (surface or groundwater fed)
- geomorphic position (position on the landscape).

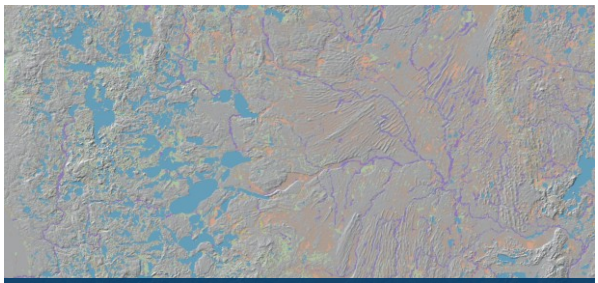
52

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.

53

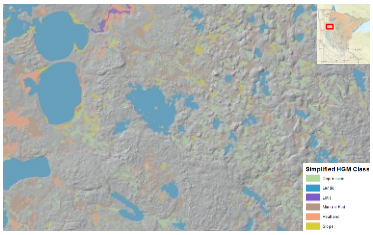


3 Parameters of HGM= Hydrology, Geomorphology, Hydraulics

54

Parameters of HGM

- Geomorphology
  - Where and how a wetland is situated on the landscape
- Hydrology
  - How water enters and leaves the landscape
- Hydraulics
  - How water moves through the landscape



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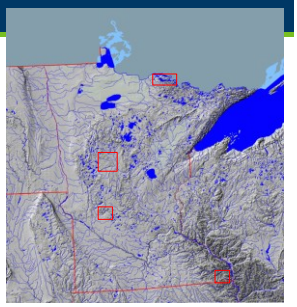
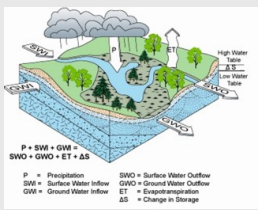
Glaciers left different HGM classes of wetlands in MN

- Kettle depressions
  - Depression and lacustrine fringe
- Glacial lakes
  - Organic and mineral flat
- Surficial shape of landscape
  - Mineral flat and sloped
- Fluvial-Lacustrine systems following glacial outwash
  - Riverine, mineral flat, sloped, organic flat

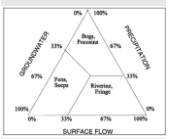


56

Wetland Hydrology

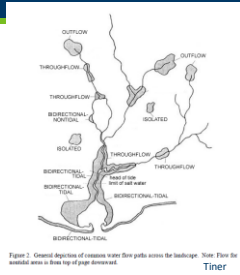


- Inputs
  - Precipitation
  - Surface water inflow
  - Groundwater inflow
- Outputs
  - Surface water outflow
  - Groundwater outflow
  - Evapotranspiration

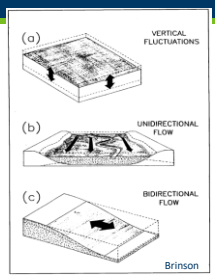


57

Wetland Hydraulics



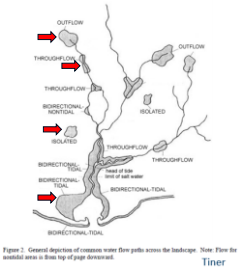
Tiner



Brinson

58

Water Flow Paths & Landscape Position of Wetland



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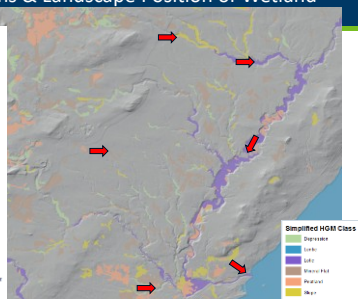


59

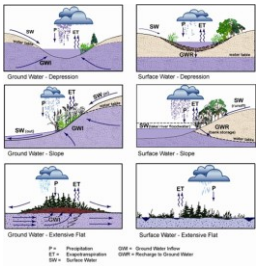
HGM Classes

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

60

HGM Subclasses

- Influenced by:
  - Groundwater input
  - Surface water input
  - Hydrology Outputs
    - Surface
    - Ground



61

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

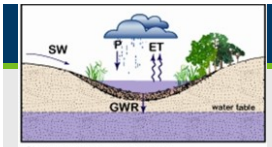
62

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

63

Depressional- surface

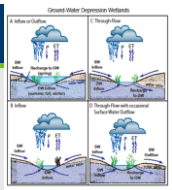


Surface Water - Depression

- Landscape position- concave, foot slope/toe slope, closed contours
- Hydraulics- unidirectional
- Water source- surface flow and precipitation, seasonal
- Outputs- Evapotranspiration, groundwater recharge

64

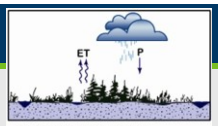
Depressional- groundwater



- Landscape position- concave, foot and toe slopes, closed contours
- Hydraulics- unidirectional
- Water source- groundwater and precipitation, *seasonal*
- Outputs- Evapotranspiration, groundwater recharge, intermittent overland flow

65

Mineral Soil Flats

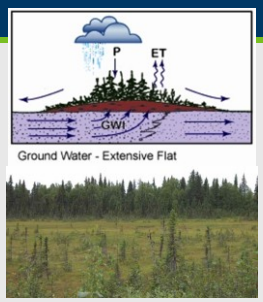


Surface Water - Extensive Flat

- 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

66

Organic Soil Flats



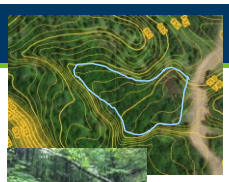
Ground Water - Extensive Flat

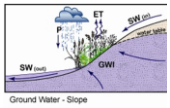
- Landscape position- summit (interfluves- broad "plateau" between drainage systems, depressions filled with organics, vertical accretion of organics
- Hydraulics- precipitation, unidirectional groundwater
- Water source- precipitation, groundwater
- Outputs- saturated overland seepage, evapotranspiration

67

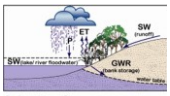
Sloped

- 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 Outputs-





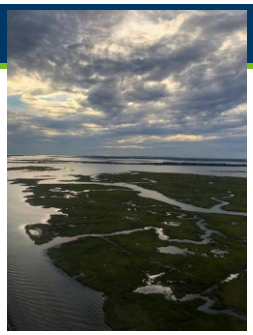
Ground Water - Slope



Surface Water - Slope

68

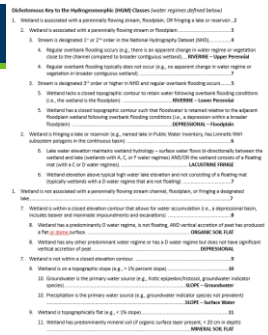
Estuarine Fringe



- 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

69

HGM



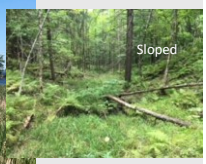
Dichotomous Key to the Hydrogeomorphic (HGM) Classes *(water regimes defined below)*

1. Wetland is associated with a perennially flowing stream, floodplain, OR fringing a lake or reservoir...2
2. Wetland is associated with a perennially flowing stream or floodplain.....3
3. Stream is designated 1st or 2nd order in the National Hydrography Dataset (NHD).....4
4. Regular overbank flooding occurs (e.g., there is an apparent change in water regime or vegetation close to the channel compared to broader contiguous wetland).... **RIVERINE – Upper Perennial**
4. Regular overbank flooding typically does not occur (e.g., no apparent change in water regime or vegetation in broader contiguous wetland).....7
3. Stream is designated 3rd order or higher in NHD and regular overbank flooding occurs.....5
5. Wetland lacks a closed topographic contour to retain water following overbank flooding conditions (i.e., the wetland is the floodplain) ..... **RIVERINE – Lower Perennial**
5. Wetland has a closed topographic contour such that floodwater is retained relative to the adjacent floodplain wetland following overbank flooding conditions (i.e., a depression within a broader floodplain) ..... **DEPRESSIONAL – Floodplain**
2. Wetland is fringing a lake or reservoir (e.g., named lake in Public Water Inventory, has Limnetic NWI subsystem polygons in the continuous basin).....6
6. Lake water elevation maintains wetland hydrology – surface water flows bi-directionally between the wetland and lake (wetlands with A, C, or F water regimes) AND/OR the wetland consists of a floating mat (with a C or D water regimes)..... **LACUSTRINE FRINGE**
6. Wetland elevation above typical high water lake elevation and not consisting of a floating mat (typically wetlands with a D water regime that are not floating).....7
1. Wetland is not associated with a perennially flowing stream channel, floodplain, or fringing a designated lake.....7
7. Wetland is within a closed elevation contour that allows for water accumulation (i.e., a depressional basin, includes beaver and manmade impoundments and excavations).....8
8. Wetland has a predominantly D water regime, is not floating, AND vertical accretion of peat has produced a flat or dome surface..... **ORGANIC SOIL FLAT**
8. Wetland has any other predominant water regime or has a D water regime but does not have significant vertical accretion of peat..... **DEPRESSIONAL**
7. Wetland is not within a closed elevation contour.....9
9. Wetland is on a topographic slope (e.g., > 1% percent slope).....10
10. Groundwater is the primary water source (e.g., histic epipedon/histosol, groundwater indicator species)..... **SLOPE – Groundwater**
10. Precipitation is the primary water source (e.g., groundwater indicator species not prevalent) ..... **SLOPE – Surface Water**
9. Wetland is topographically flat (e.g., < 1% slope).....11
11. Wetland has predominantly mineral soil (if organic surface layer present, < 20 cm in depth) ..... **MINERAL SOIL FLAT**

HGM Classification System for Minnesota

70

HGM?



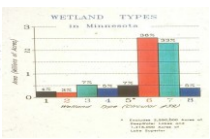
71

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.

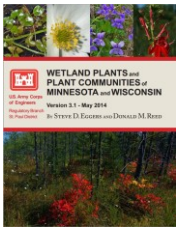


72

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**

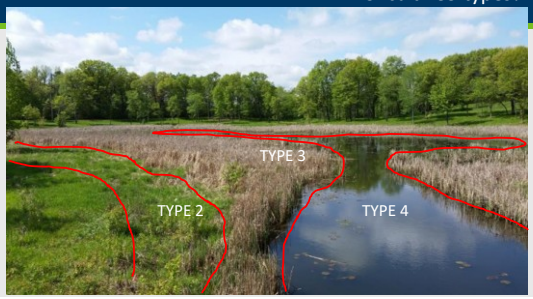


73

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

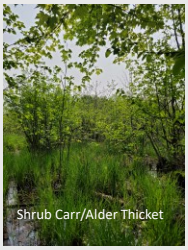
74

Circular 39 types?



75

Eggers & Reed?



76

Cowardin Classification System

- Created in 1979
- Includes wetlands and other aquatic habitats (streams, lakes, etc.)
- Used for NWI maps
- Nationwide system

77

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

78

Cowardin System - NWI

79

Wetland Classification Systems in Minnesota

Circular 39
- Based on hydrology and vegetation

Cowardin
- Based on hierarchy system, class, veg, water regime, special modifiers

Eggers & Reed
- Based on plant communities & "typical" associated hydrologic regimes

Hydrogeomorphic Method
- Based on landscape position, water source, hydraulics


Type 3, PEM1F, shallow marsh, DEPRESSION-surface

80

Hydrology Indicators

Minnesota Wetland Professional Certification Program

81

Learning Objectives

- **Wetland Hydrology Indicators**
- Explan the definition of wetland hydrology and the primary inputs and output of hyrology on a site
- Explain the technical standard for wetland hydrology used in federal wetland delineation.
- Identify and interpret primary and secondary indicators of wetland hydrology.
- Differentiate among the major groups of hydrology indicators, including direct observations, flooding and ponding evidence, soil saturation indicators, and landscape and vegetation indicators.

82

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.*"

83

Hydrology Technical Standard

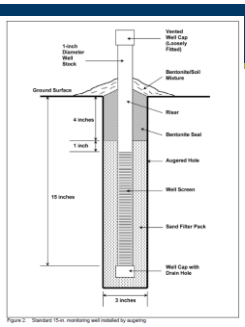
…"inundated or saturated by surface or ground water at a frequency and duration"

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;

84

Monitoring wells



Monitoring wells

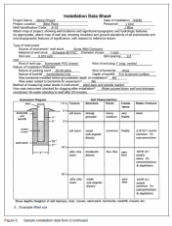
- Screen, Riser, Sand Pack, Bentonite seal

https://bwsr.state.mn.us/hydrology-antecedent-precipitation

85

Installation Log

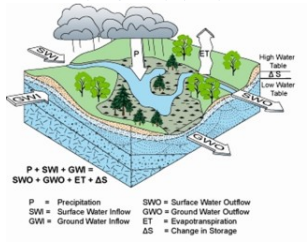
Sample Data Sheet



86

Hydrology

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

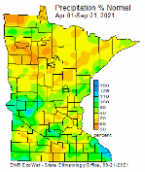


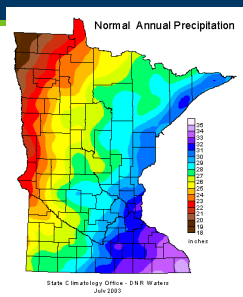
- Inputs
  - Precipitation
  - Surface water inflow
  - Groundwater inflow
- Outputs
  - Surface water outflow
  - Groundwater outflow
  - Evapotranspiration

87

Precipitation

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





88

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:

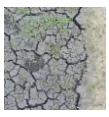
Primary – provide stand-alone evidence of a current or recent hydrologic event; and

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

89

Hydrology Indicator Groups

Group A – direct observation of *water*



Group B – evidence of *flooding/ponding*

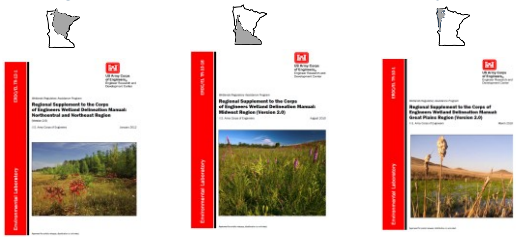
Group C – evidence of *current or recent saturation*.

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

90

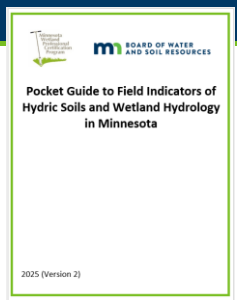
Land Resource Regions

Regions dictate which indicators are used and how they are used



91

Flipbook



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

92

Group A Indicators

Direct observation of *water*

93

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):

94

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.

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):

95

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.

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.

96

Group B Indicators

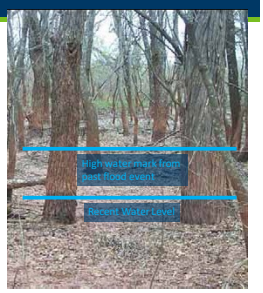
Evidence of ponding or flooding – past or present

97

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.



98

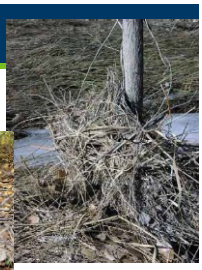
B2: Sediment Deposits

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

99

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.

100

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.

101

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.

102

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

103

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.

104

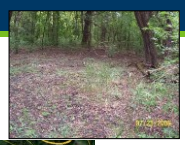
B8: Sparsely vegetated concave surface

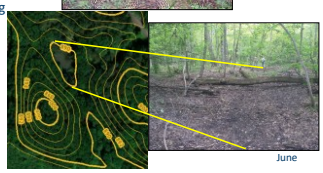
Category: Primary. (Secondary in LRR F)

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.

Secondary





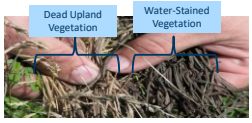
June

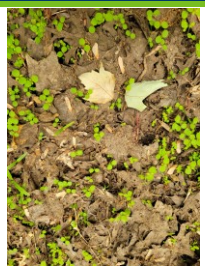
105

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.





106

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

107

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.

108

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.

109

Group C Indicators

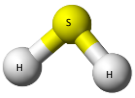
Evidence of soil saturation – past or present

110

C1: Hydrogen sulfide odor

Category: Primary

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



111

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*.

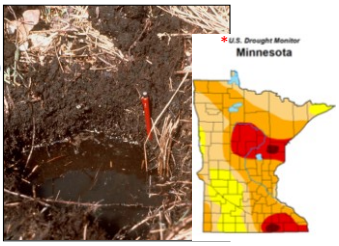
Dry Season Dates per Region:

Great Plains (F): July 1

Midwest (M): July 15

NC/NE)K): August 1

Reference: Corps of Engineers Drought Newsletter



112

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

113

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

114

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.

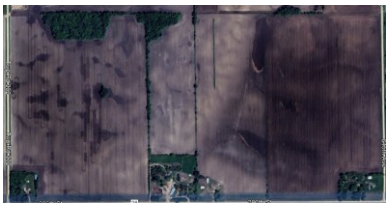
Secondary

115

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.

116

Group D Indicators

Landscape and vegetation characteristics that indicate contemporary wet conditions

117

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.

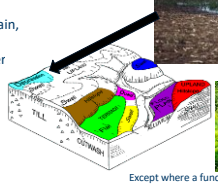
This indicator is applicable to natural plant communities as well as agricultural crops and other introduced or planted vegetation. For this indicator to be present, a majority of individuals in the stand must be stunted or stressed.

118

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.



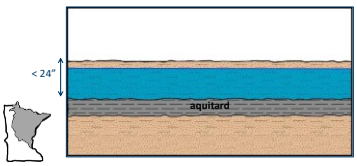
Except where a functioning drainage system exists!

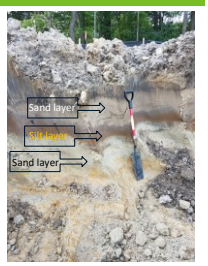
119

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.





120

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

121

D5: FAC – neutral test

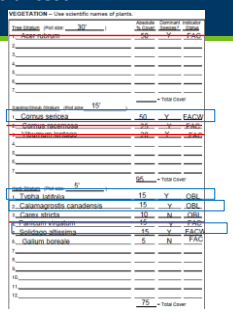
Category: Secondary

The plant community passes the FAC-neutral test:

1. Compile list of dominant plant species across all strata
2. Drop any with FAC
3. >50 % of remaining dominant species are FACW and/or OBL

If it's an equal number of each, then use non-dominant

*This indicator uses the longer-term nature of plants



Does this pass?
Yes, 100% remaining dominant species are FACW or OBL

122

Hydrology Indicators

Take home message

- Wetland hydrology is dynamic
- Indicators prove current or recent evidence of hydrology
- Proof = minimum of 1 Primary or 2 Secondary
- Lack of indicator(s) does not confirm absence of wetland hydrology! CH 5 (Difficult Wetland Situations) is a "must read"

123

Hydrology Indicators?

124

Basic Overview of Wetland Delineation

125

Learning Objectives

Wetland Delineation Methods & Critical Definitions

- Apply the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual and applicable Regional Supplements to identify wetlands and delineate wetland boundaries.
- Differentiate among routine and comprehensive wetland delineation methods and determine the appropriate level of delineation for a proposed project in accordance with Minnesota guidance.
- Explain the definition of a wetland and the concept of "normal circumstances" used in wetland delineation.
- Recognize atypical conditions, problem areas, and difficult wetland situations, and apply appropriate technical procedures to complete defensible wetland delineations.

126

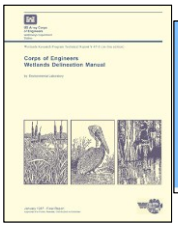
3-Parameter/ Indicator Approach

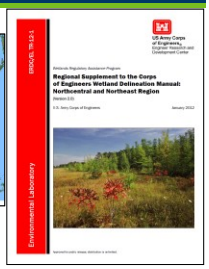
1. **Soils** –Longest term evidence, Historic conditions, may not reflect current condition.
2. **Hydrology** –Current condition, shortest term evidence but heavily influenced by recent climate conditions
3. **Vegetation** – Somewhere between

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

127

87 Manual and Regional Supplements





128

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

129

Wetland Delineation Types

ROUTINE

Level 1 - Onsite Inspection Unnecessary

Level 2 - Onsite Inspection Necessary

Level 3 - Combination of Levels 1 and 2

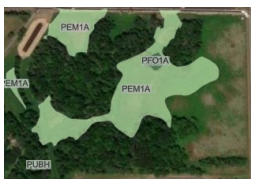
130

Routine Level 1

Use when exact wetland boundary **not necessary**

131

Routine Level 1

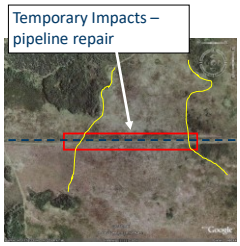


132

Routine Level 1

133

Routine Level 1 Examples



134

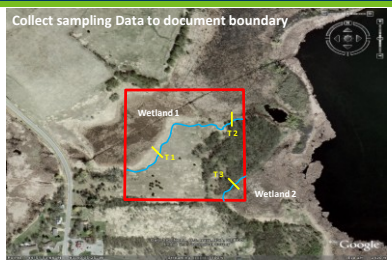
Wetland Delineation Types

Routine Level 2

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

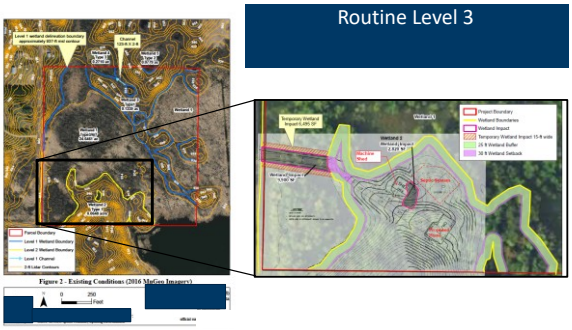
135

Routine 2



136

Routine Level 3



137

Wetland Delineation Types

Comprehensive Delineation Method

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

138

Comprehensive Delineation

139

Guidance

Delineation Method	Review of offsite mapping resources	Site Visit	Sampling Approach	Complete Field Data Forms	Field Staking of Wetland Boundaries
Routine Level 1	Yes	Sometimes	Offsite	No	No
Routine Level 2	Yes	Yes	Onsite, qualitative	Yes	Yes
Comprehensive	Yes	Yes	Onsite, quantitative	Yes	Yes

WCA Application Type Examples	*Commonly Used* Delineation Method
Temporary impact under No-Loss	Routine Level 1
Banking application: pre-application scoping	Routine Level 1
Banking application: full application	Routine Level 2
Road Program Wetland Impact Documentation—Road project through a large continuous wetland	Routine Level 1
Road Program Wetland Impact Documentation—Scattered wetlands within construction corridor	Routine Level 2
Replacement plan	Routine Level 2
Enforcement actions	Routine Level 2 or Comprehensive
Wetland boundary approval (no project application)	Routine Level 2
Agricultural exemption determination (8420.0420, Subpart 2A)	Routine Level 1

140

140

Routine Level 2 Process

1. Research data sources
   - Know site before visit
   - Saves time and effort
2. Field visit and data collection
   - Data collection
   - Preponderance of evidence
3. Delineate wetland boundary
   - Document indicators of wetland/non-wetland decision
   - Only after multiple informal observations

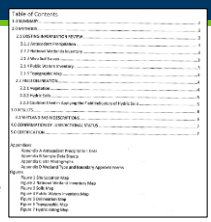


Table of Contents

141

Offsite Resources = Data Sources

- Aerial Photos (current and historic)
- Soil map (Web Soil Survey)
- Topography\LiDAR
- NWI Map (MN DNR)
- DNR Public Waters Map

142

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

143

Field Equipment

144

Sample Points

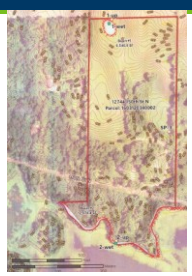
1. Top section of data sheet
   - Documents sample location and landscape setting
   - Site conditions Wet-Dry
2. Vegetation
   - ID species to determine if plant community is hydrophytic
   - Record comments on changes in vegetation
3. Soil
   - Describe soil and determine if it is hydric
   - Record comments on changes in soil
4. Hydrology
   - Observe primary and secondary indicators
   - Record water table, saturation or inundation

145

Sample Points

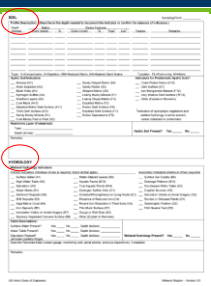
4. Topography
   - Record changes in topography
     - Abrupt
     - Gradual
     - Geomorphic position

5. Other notable remarks and observations
   - Basis for delineation line (sharp topo/veg break)
   - Hydrology inputs and outputs



146

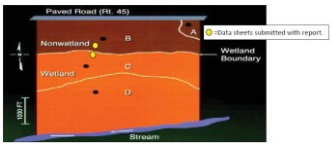
It's all about the documentation!



147

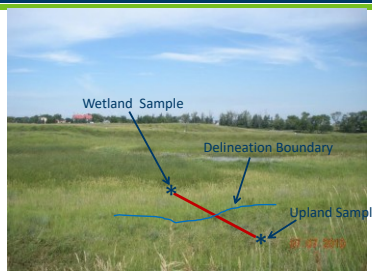
Sampling Location Should Be Representative

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



148

Routine Level 2 Sampling Transects



149

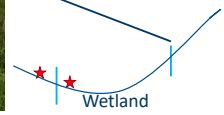
Sample location is important!

Good data collection cannot compensate for poor sampling location choices.

150

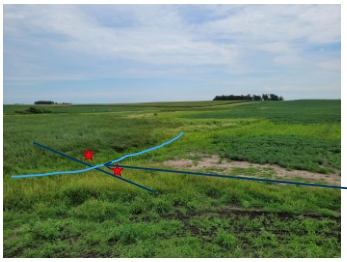
Sampling Location

Steep vs flat topo



151

Sampling Location



Agricultural Field

152

Sampling Location

Road Rights-of-way

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

153

Sampling Location

Representative of majority of upland plant community.

154

Sampling Location

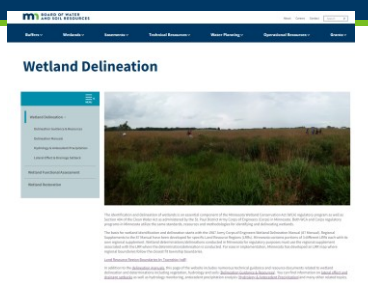
Multiple plant communities or difficult sites.

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

155

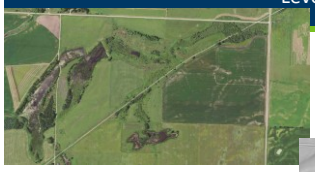
Guidance

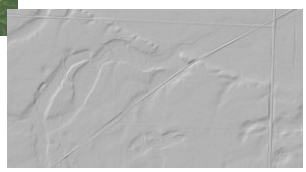
BWSR Wetland Delineation page



156

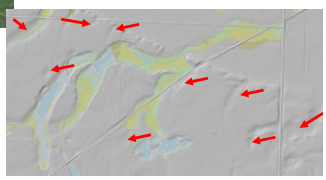
Level One Delineation Exercise





157

Level One Delineation Exercise



158

Critical Definitions for Wetland Delineation

159

Critical Definitions

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

160

Two-Step Process

Step 1: Delineate Wetlands, if Present, Within a Site

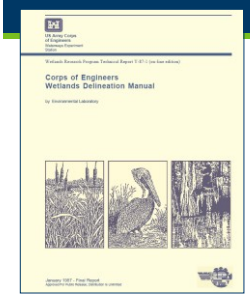
Every Data Sheet

- Normal Circumstances?
- Normal Environmental Conditions?
- Disturbed (Atypical Situations)?
- Problem Area (Naturally Problematic)?

Step 2: Apply regulations, policy and guidance

161

Definitions



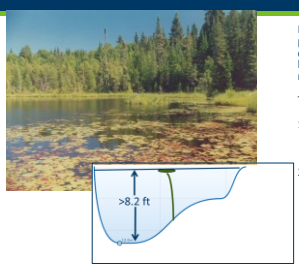
162

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

163

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

Wetland Water Depth Guidance

164

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 3, 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.

165

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

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

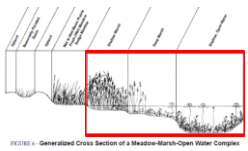


FIGURE 6 - Generalized Cross Section of a Meadow-Marsh-Open Water Complex

166

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
- BWSR – WCA Topic of the Week: Growing Season and Wetland Delineations

167

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 for delineations early in the year (April)

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

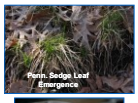
https://www.mda.state.mn.us/protecting/soilprotection/soiltemp

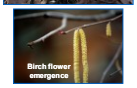
2. **"Green-up" indicator**

168

"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.





169

Start of Growing Season

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

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

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

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

170

End of Growing Season

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

171

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.

172

Normal Circumstances

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: _____ City/County: _____ Sampling Date: _____

Applicant/Owner: _____ State: _____ Sampling Point: _____

Investigator(s): _____ Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____

Slope (%): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ 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 _____

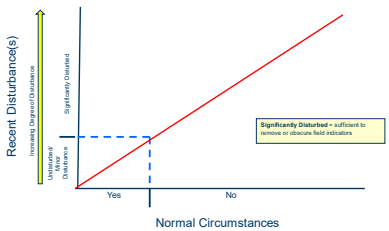
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

If "Yes", data collection is based on current conditions.

If "No", data collection is based on conditions that would exist in absence of recent disturbance(s).

173

Relationship of Normal Circumstances and Recent Disturbance(s)



174

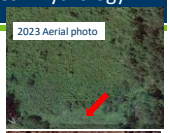
Not Normal Circumstances

Recent, unauthorized fill that buried natural vegetation and native soils, and altered hydrology

175

Normal Circumstances - Hydrology

Example A: Ditch legally (via permit) constructed or pre-1991 and maintained since = ditch is established as **Normal Circumstances**. Partially drained is the normal circumstance for hydrology.



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

176

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**

177

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.

178

Normal Circumstances - Vegetation

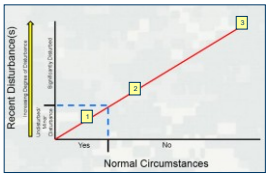
Light grazing of a sedge meadow – minor disturbance of natural vegetation = Normal Circumstances

Example of an unimproved pasture = no interseeding, planting, etc.

179

Normal Circumstances - Vegetation

What about moderate grazing sufficient to result in a shift of the plant community to species more tolerant of grazing ("increasers") at the expense of other plant species ("decreasers")(see Table 10 in Midwest Supplement for examples). Most cases: NOT Normal Circumstances. Follow Midwest Supplement guidance.



KEY:
1 Light Grazing – Sedge Meadow
2 Moderate Grazing
3 Overgrazed – Exposed Soils

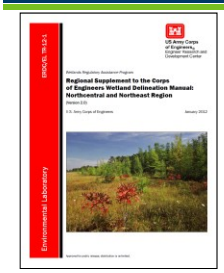
180

Normal Circumstances - Vegetation

Natural vegetation removed and replaced by manipulated/manicured vegetation (seeding, mowing, fertilizing, selective herbicide applications) = NOT Normal Circumstances

181

Disturbed (Atypical Situations)



- **One or more parameters altered or absent due to recent human activities or natural event**

Filling, artificial drainage, stream channelization, mechanized land clearing, levee construction, mowing, cropping, plowing, logging, change in river course, high-capacity groundwater well pumping, tree farms, etc.

182

Disturbed? Amount of Disturbance

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: _____ City/County: _____ Sampling Date: _____
Applicant/Owner: _____ State: _____ Sampling Point: _____
Investigator(s): _____ Section, Township, Range: _____
Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____
Slope (%): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ 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.)

Significantly Disturbed = sufficient to remove or obscure field indicators

183

Disturbed (Atypical)

184

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

185

Problem Areas

WETLAND DETERMINATION DATA FORM – Midwest Region

Project/Site: _____ City/County: _____ Sampling Date: _____

Applicant/Owner: _____ State: _____ Sampling Point: _____

Investigator(s): _____ Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____

Slope (%): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ 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.)

186

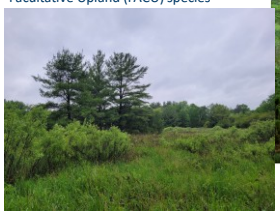
Problem Areas - Seasonal Wetlands

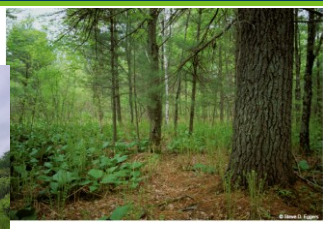
EXAMPLE: Vernal pools are naturally dry outside of the first few weeks of the growing season = **Normal Circumstances**

187

Problem Areas - vegetation

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

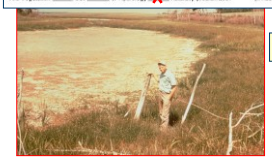




188

Problem Areas and Normal Circumstances

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



Prairie pothole wetland in a drought year

189

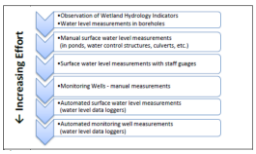
Normal Circumstances?

No:
One or more parameters removed/manipulated.

190

Learning Objectives

- **Top of Data Sheet & Hydrology Field Exercise**
- Apply the concepts and critical definitions of wetland delineation to complete the top of the data sheet
- Observe wetland hydrology indicators and complete data sheet
- Site location of borehole transect to document wetland hydrology
- Understand proper well installation methodology



191

Top of Data Sheet and Hydrology Field Exercise

- Work as group to complete offsite information
- Group demonstration on digging boreholes
- Group demonstration monitoring well installation
- Dig at least three boreholes along transect
- Complete remaining top of data sheet
- Observe and document hydrology indicators
- Document water table depths and interpret hydrology along transect
- Complete hydrology portion of data sheet

192

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Northcentral and Northeast Region
See ERDC/EL TR-12-1; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: _____ City/County: _____ Sampling Date: _____
Applicant/Owner: _____ State Sampling Point: _____
Investigator(s): _____ Section, Township, Range: _____
Landform (hillside, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope %: _____
Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ 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 X	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____ No X	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes ____ No X	

Remarks: (Explain alternative procedures here or in a separate report.)

193

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (inches): _____
Water Table Present? Yes ____ No ____ Depth (inches): _____
Saturation Present? Yes ____ No ____ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? Yes ____ No X

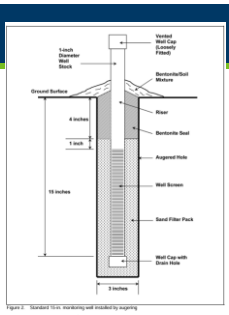
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

ENG FORM 6116-B, JUL 2018 — Northcentral and Northeast – Version 2.0

194

Monitoring well installation



https://bwsr.state.mn.us/hydrology-antecedent-precipitation

195