Recent Updates in Wetland Delineation and Replication Standards

Considerations for Civil Engineers

BEALS AND THOMAS

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Agenda

- Brief History of Delineation Methods in Massachusetts
- Introduction to the **Massachusetts Handbook for Delineation of Bordering Vegetated Wetlands**, 2022/2023
- Introduction to the **Massachusetts Inland Wetland Replication Guidelines,** 2022/2023

Parallax - the effect whereby the position or direction of an object appears to differ when viewed from different positions, e.g. through the viewfinder and the lens of a camera.

Federal
US ACE 1987 Manual
Northeast Regional Supplement
NE Hydric Soil Technical Committee
Supreme Court Decisions

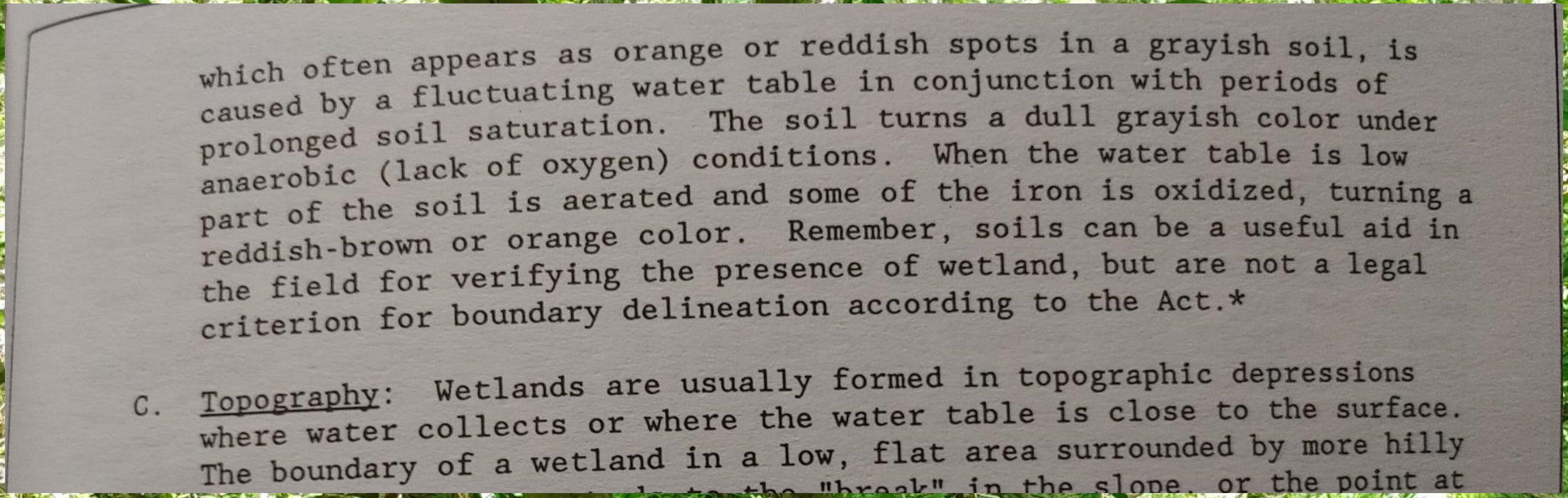
State
Delineating BVW Under the MA WPA
(2022/2023 Handbook)
310 CMR 10.55(2)

Local
Jurisdiction and/or Definitions of
Municipal Ordinance/Bylaw

Federal
WOTUS maybe?

State
BVW, Bank, MAHW, etc.

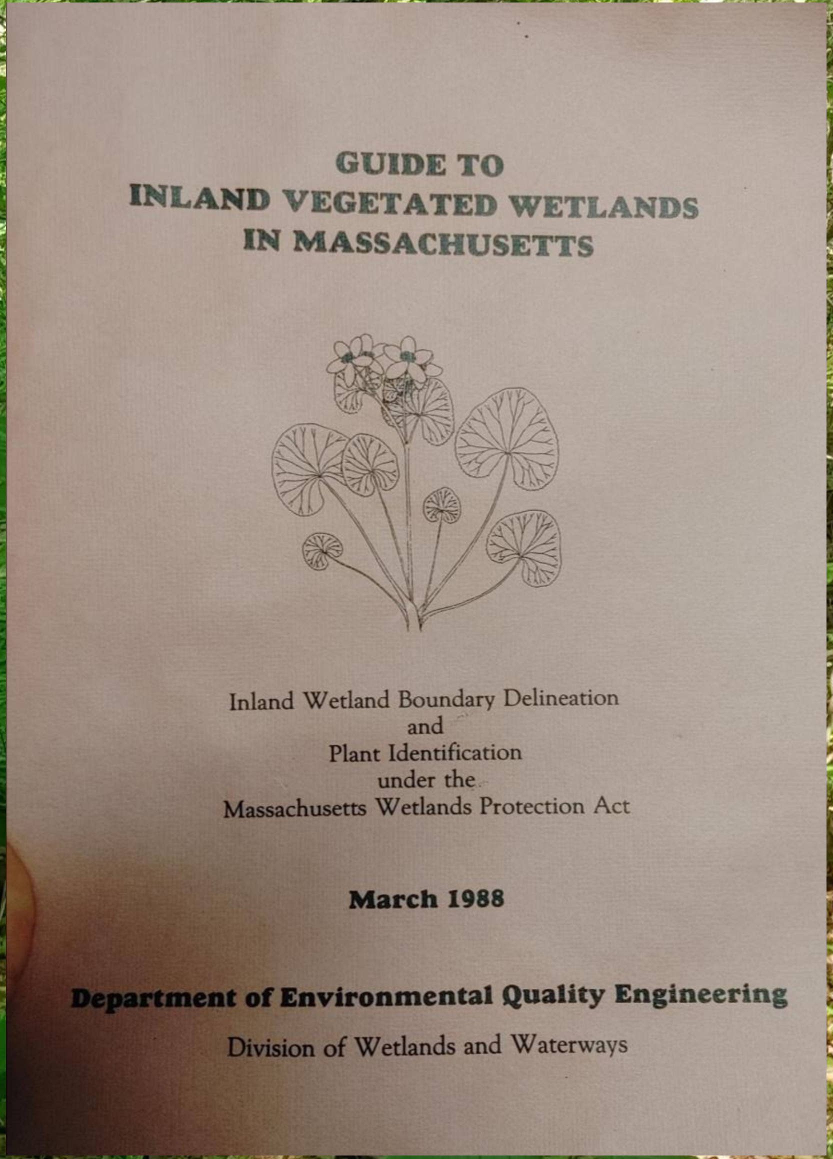
Local
IVWs & other municipal resource areas.

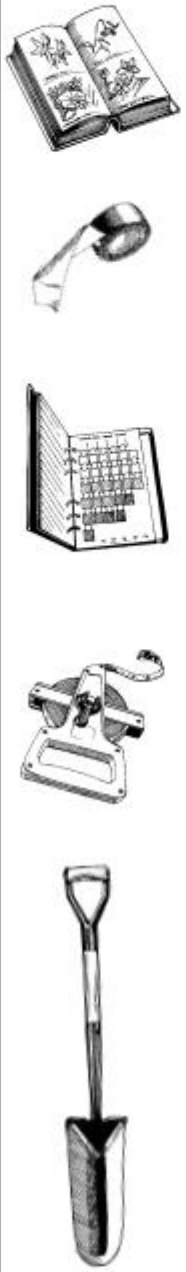


which often appears as orange or reddish spots in a grayish soil, is caused by a fluctuating water table in conjunction with periods of prolonged soil saturation. The soil turns a dull grayish color under anaerobic (lack of oxygen) conditions. When the water table is low part of the soil is aerated and some of the iron is oxidized, turning a reddish-brown or orange color. Remember, soils can be a useful aid in the field for verifying the presence of wetland, but are not a legal criterion for boundary delineation according to the Act.*

C. Topography: Wetlands are usually formed in topographic depressions where water collects or where the water table is close to the surface. The boundary of a wetland in a low, flat area surrounded by more hilly

1988 Delineation Manual

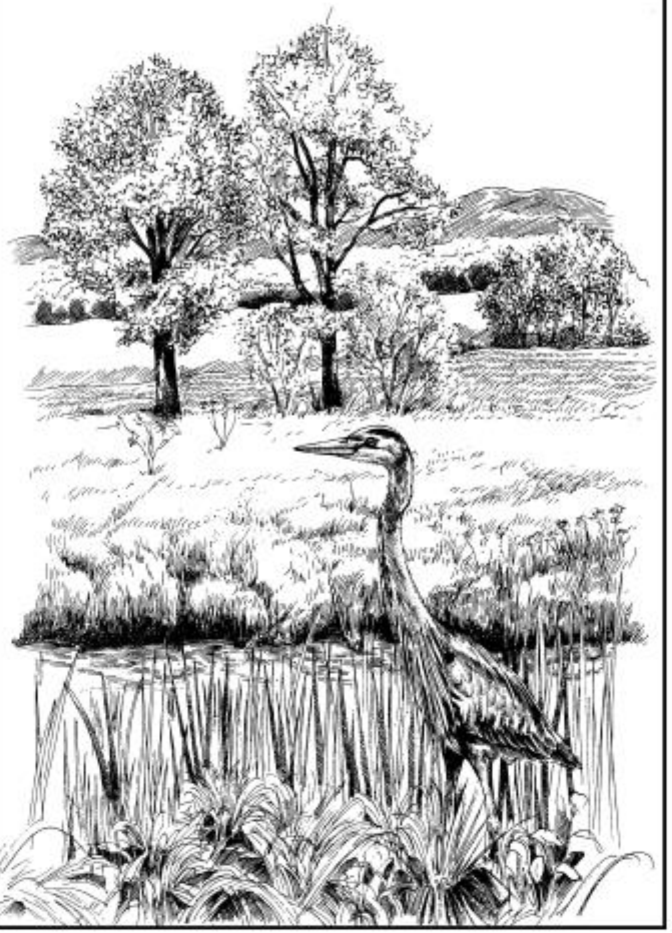




Delineating Bordering Vegetated Wetlands

Under the Massachusetts Wetlands Protection Act

MA Department of Environmental Protection
Division of Wetlands and Waterways



Delineating Bordering Vegetated Wetlands

Under the Massachusetts Wetlands Protection Act

A Handbook

March 1995

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Massachusetts Department of Environmental Protection
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Plant illustrations courtesy of Abigail Rorer, from *Freshwater Wetlands: A Guide to Common Indicator Plants of the Northeast* by D.W. Magee. 1981. University of Massachusetts Press, Amherst, MA and *Field Guide to Nontidal Wetland Identification* by Ralph Tiner, Jr. 1988. Maryland Department of Natural Resources, Annapolis, MD and USFWS.

DEP

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Division of Wetlands and Waterways
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Hydric Soil Indicators

Most hydric soils have a soil horizon with a chroma of 0, 1, or 2 below the A-horizon. These are referred to as low-chroma colors. (Reminder: the Munsell Soil Color Charts are used to determine soil colors.) Generally, when evaluating mineral soils for low-chroma colors or other evidence of saturation, look for indicators directly below the A-horizon and within the top 12 inches of the soil surface. In areas where the O-horizon is less than 8 inches thick, soil depths are measured from the bottom of the O-horizon. When the O-horizon is 8 inches or greater (for histosols and soils with histic epipedons), such depths are measured from the soil surface. The soil surface is the top of the mineral soil; or, for soils with an O-horizon, the soil surface is measured from the top of the O-horizon. Fresh leaf or needle fall that has not undergone observable decomposition (the litter layer) is excluded from soil and may be separately described.

The following is a list of some hydric soil indicators - any of which can be used to identify the presence of wetland hydrology:

- Histosols (organic soils). Histosols are soils with at least 16 inches of organic material measured from the soil surface.
- Histic epipedons. These are soils with 8 to 16 inches of organic material measured from the soil surface.
- Sulfidic material. A strong "rotten egg" smell generally is noticed immediately after the soil test hole is dug.
- Gleyed soils. Soils that are predominantly neutral gray, or occasionally greenish or bluish gray in color within 12 inches from the bottom of the O-horizon. (The Munsell Soil Color Charts have special pages for gleyed soils.)
- Soils with a matrix chroma of 0 or 1 and values of 4 or higher within 12 inches from the bottom of the O-horizon.
- Within 12 inches from the bottom of the O-horizon, soils with a chroma of 2 or less and values of 4 or higher in the matrix, and mottles with a chroma of 3 or higher.
- Within 12 inches from the bottom of the O-horizon, soils with a matrix chroma of 3 and values of 4 or higher, with 10 percent or more low-chroma mottles, as well as indicators of saturation (i.e., mottles, oxidized rhizospheres, concretions, nodules) within 6 inches of the soil surface.

1995 MassDEP Delineation Field Data Forms

Section II. Indicators of Hydrology

Hydric Soil Interpretation

1. Soil Survey

Is there a published soil survey for this site? Yes
title/date: Web Soil Survey
map number:
soil type mapped:
hydric soil inclusions:

Are field observations consistent with soil survey?

Remarks:

2. Soil Description

Horizon Depth Matrix Color Mottles Color

Remarks:

3. Other:

Conclusion: Is soil hydric?

Other Indicators of Hydrology: (check all that apply & describe)

☐ Site Inundated: ______________________________

☐ Depth to free water in observation hole: ______________

☐ Depth to soil saturation in observation hole: ____________

☐ Water marks: ______________________________

☐ Drift lines: ______________________________

☐ Sediment Deposits: ___________________________

☐ Drainage patterns in BVW: ______________________

☐ Oxidized rhizospheres: ________________________

☐ Water-stained leaves: _________________________

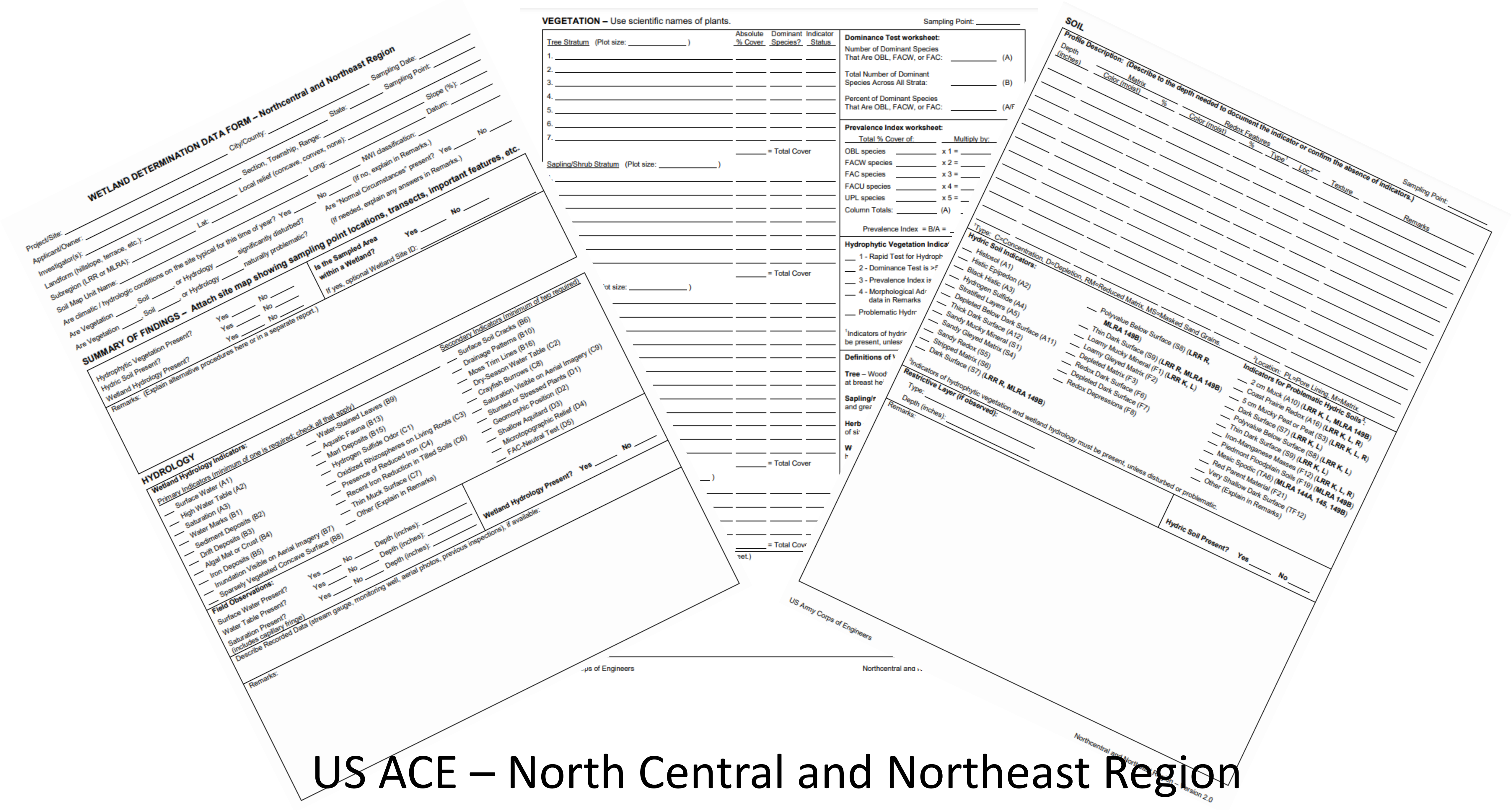
☐ Recorded Data (streams, lake, or tidal gauge; aerial photo; other):_____________________________________

☐ **Other:** ________________________________

Vegetation and Hydrology Conclusion

	Yes	No
Number of wetland indicator plants ≥ # of non-wetland indicator plants	____	_____
Wetland hydrology present:		
Hydric soil present	____	_____
Other indicators of hydrology present	____	_____
Sample location is in a BVW	_____	_____

Submit this form with the Request for Determination of Applicability or Notice of Intent.



WETLAND DETERMINATION DATA FORM – Northcentral and Northeast 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 (%):
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
Hydric Soil Present? Yes No
Wetland Hydrology Present? Yes No
Is the Sampled Area within a Wetland? Yes No
If yes, optional Wetland Site ID:
Remarks: (Explain alternative procedures here or in a separate report.)

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? (includes capillary fringe) Yes No Depth (inches):
Wetland Hydrology Present? Yes No
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
Remarks:

VEGETATION – Use scientific names of plants. Sampling Point:

Tree Stratum (Plot size:) Absolute % Cover / Dominant Species? / Indicator Status
1. 2. 3. 4. 5. 6. 7.
= Total Cover
Sapling/Shrub Stratum (Plot size:)
= Total Cover

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: (A)
Total Number of Dominant Species Across All Strata: (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: (A/B)

Prevalence Index worksheet:
Total % Cover of: Multiply by:
OBL species x 1 =
FACW species x 2 =
FAC species x 3 =
FACU species x 4 =
UPL species x 5 =
Column Totals: (A)
Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
1 - Rapid Test for Hydrophytic Vegetation
2 - Dominance Test is >50%
3 - Prevalence Index is ≤3.0
4 - Morphological Adaptations (Provide supporting data in Remarks)
Problematic Hydrophytic Vegetation

SOIL Sampling Point:

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)
Depth (inches) | Matrix: Color (moist) % | Redox Features: Color (moist) % Type Loc | Texture | Remarks

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:
Histosol (A1), Histic Epipedon (A2), Black Histic (A3), Hydrogen Sulfide (A4), Stratified Layers (A5), Depleted Below Dark Surface (A11), Thick Dark Surface (A12), Sandy Mucky Mineral (S1), Sandy Gleyed Matrix (S4), Sandy Redox (S5), Stripped Matrix (S6), Dark Surface (S7) (LRR R, MLRA 149B)
Polyvalue Below Surface (S8) (LRR R, MLRA 149B), Thin Dark Surface (S9) (LRR R, MLRA 149B), Loamy Mucky Mineral (F1) (LRR K, L), Loamy Gleyed Matrix (F2), Depleted Matrix (F3), Redox Dark Surface (F6), Depleted Dark Surface (F7), Redox Depressions (F8)

Indicators for Problematic Hydric Soils:
2 cm Muck (A10) (LRR K, L, MLRA 149B), Coast Prairie Redox (A16) (LRR K, L, R), 5 cm Mucky Peat or Peat (S3) (LRR K, L, R), Dark Surface (S7) (LRR K, L), Polyvalue Below Surface (S8) (LRR K, L), Thin Dark Surface (S9) (LRR K, L), Iron-Manganese Masses (F12) (LRR K, L, R), Piedmont Floodplain Soils (F19) (MLRA 149B), Mesic Spodic (TA6) (MLRA 144A, 145, 149B), Red Parent Material (F21), Very Shallow Dark Surface (TF12), Other (Explain in Remarks)

Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):
Hydric Soil Present? Yes No
Remarks:

US Army Corps of Engineers — Northcentral and Northeast Region – Version 2.0

US ACE – North Central and Northeast Region

USDA

United States
Department of
Agriculture

Natural Resources
Conservation
Service

In cooperation with
the National Technical
Committee for Hydric Soils

Field Indicators of Hydric Soils in the United States

A Guide for Identifying and Delineating Hydric Soils, Version 8.0, 2016

Figure 43.—The profile on the right is from a drained wetland adjacent to a ditch. The profile on the left is from an area not affected by the ditch. Both soils meet the requirements for indicators F3 (Depleted Matrix) and A11 (Depleted Below Dark Surface) and thus are hydric soils.

***Depleted matrix.** For loamy and clayey material (and sandy material in areas of indicators A11 and A12), a depleted matrix refers to the volume of a soil horizon or subhorizon in which the processes of reduction and translocation have removed or transformed iron, creating colors of low chroma and high value (fig. 44). A, E, and calcic horizons may have low chromas and high values and may therefore be mistaken for a depleted matrix; however, they are excluded from the concept of depleted matrix unless the soil has common or many distinct or prominent redox concentrations occurring as soft masses or pore linings. In some areas the depleted matrix may change color upon exposure to air (see Reduced matrix); this phenomenon is included in the concept of depleted matrix. The following combinations of value and chroma identify a depleted matrix:

1. Matrix value of 5 or more and chroma of 1 or less with or without redox concentrations occurring as soft masses and/or pore linings; or
2. Matrix value of 6 or more and chroma of 2 or less with or without redox concentrations occurring as soft masses and/or pore linings; or
3. Matrix value of 4 or 5 and chroma of 2 and 2 percent or more distinct or prominent redox concentrations occurring as soft masses and/or pore linings; or

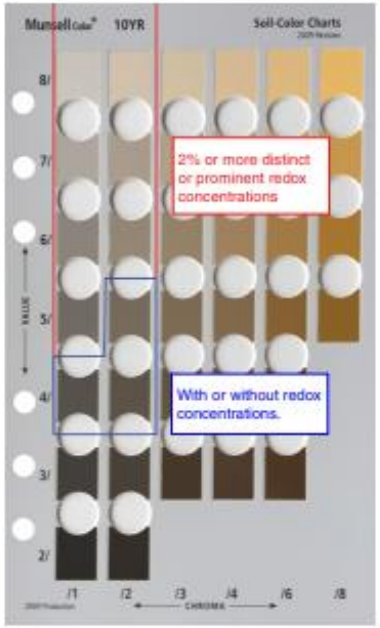
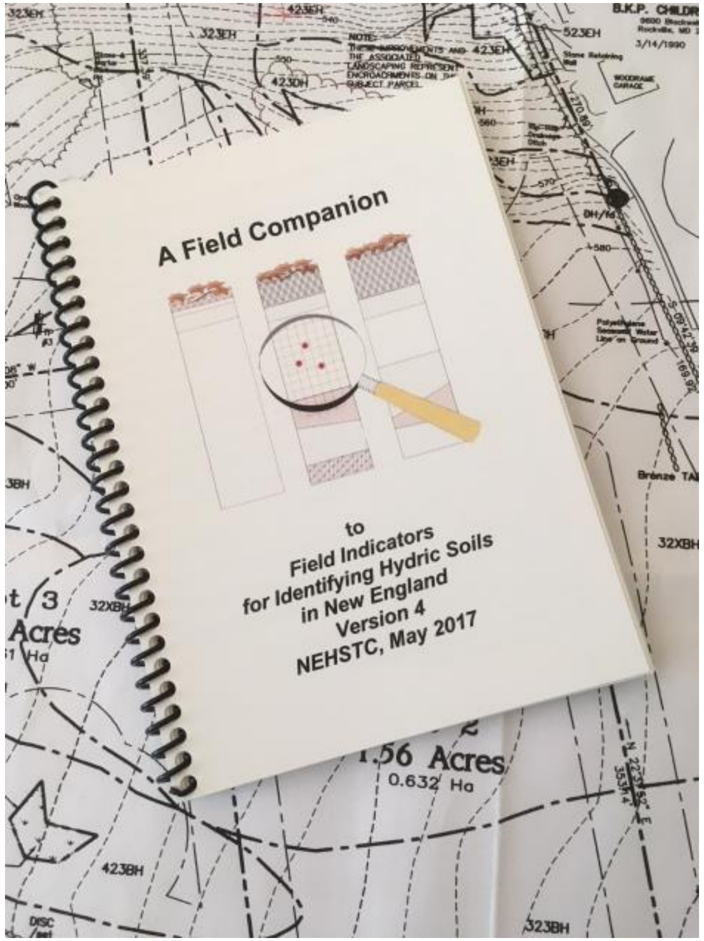


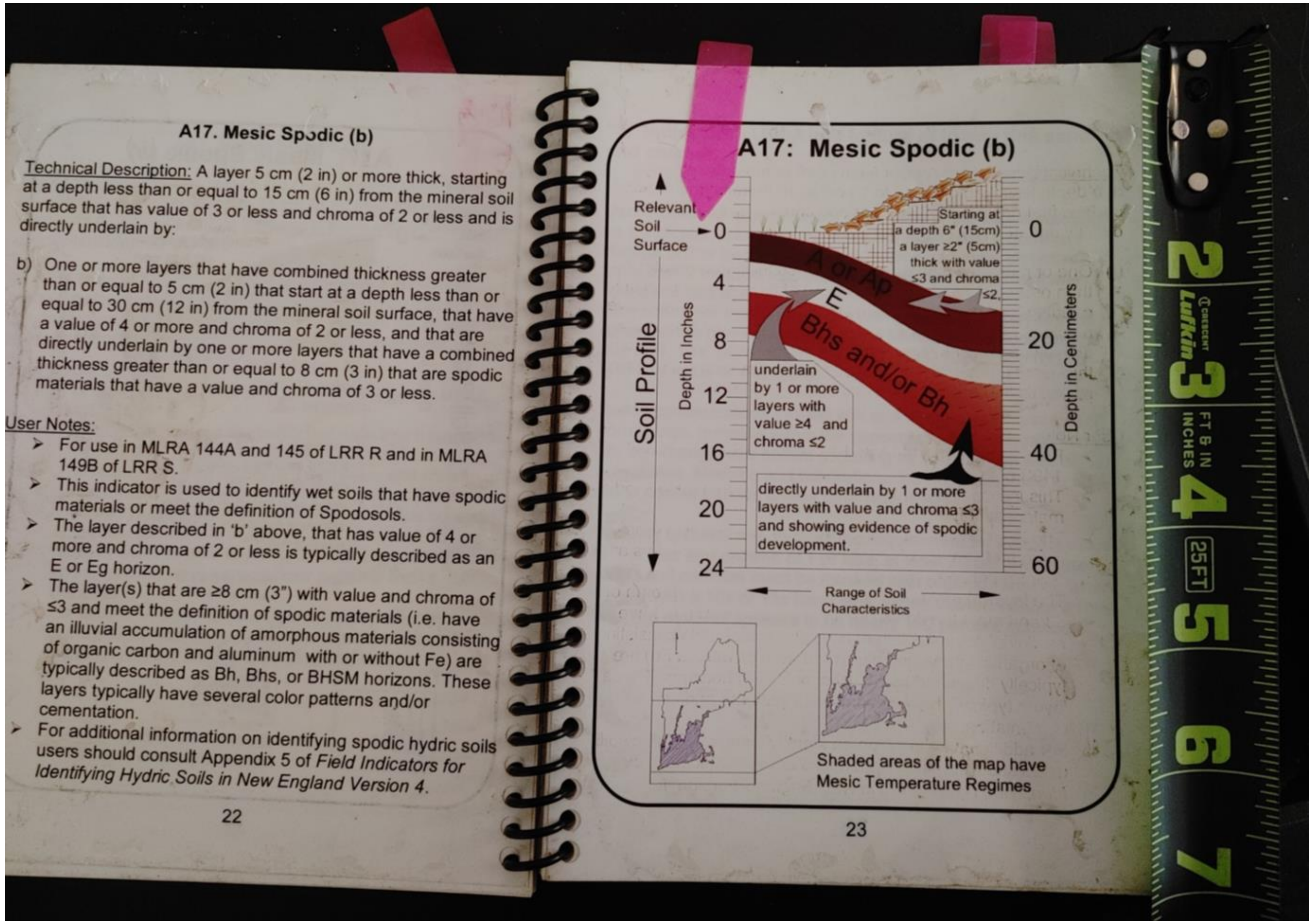
Figure 44.—Illustration of values and chromas that require 2 percent or more distinct or prominent redox concentrations and those that do not, for hue 10YR, to meet the definition of a depleted matrix. Due to inaccurate color reproduction, do not use this page to determine soil colors in the field. Background image from the Munsell Soil Color Charts reprinted courtesy of Munsell Color Services Lab, a part of X-Rite, Inc. (Xrite 2009).

4. Matrix value of 4 and chroma of 1 and 2 percent or more distinct or prominent redox concentrations occurring as soft masses and/or pore linings (fig. 45).

Diffuse boundary. Used to describe redoximorphic features that grade gradually from one color to another (fig. 46). The color grade is commonly more than 2 mm wide. "Clear" is used to describe boundary color gradations intermediate between sharp and diffuse.

The Field Companion to Field Indicators for Identifying Hydric Soils in New England





Massachusetts Handbook for Delineation of Bordering Vegetated Wetlands

Massachusetts Department of Environmental Protection
Bureau of Water Resources
Wetlands Program

Second Edition, September 2022

Scott D. Jackson and Deborah J. Henson, University of Massachusetts Amherst
David Hilgeman, Michael McHugh, and Lisa Rhodes, Massachusetts Department of Environmental Protection, Wetlands Program

UMassAmherst | Center for Agriculture, Food, and the Environment

MassDEP

This revision of the BVW Delineation Handbook replaces the former Handbook released in 1995. Note that MassDEP is proposing new regulations that will update the plant list used for BVW Delineation to the 2020 edition of USACE National Plant List, although the current regulations refer to the 1988 Plant List at 310 CMR 10.55(2). Although this updated guidance refers to the 2020 Plant List, projects under review prior to promulgation of the new regulations should be using the 1988 Plant List in accordance with the regulations. Note that the 2020 plant list does not include indicator status categories FAC+, FACW- or FACW+. Most of the plants classified in these categories in the 1988 plant list are listed as FAC or FACW in the 2020 plant list and are still considered wetland indicator plants.

Group II: Difficult to Analyze Hydric Soils

In this Handbook, difficult to analyze soils include both undisturbed soils and disturbed/altered soils that have morphological features that require evaluation by a wetland scientist well trained in soil science. In these soils, features of wetness do not match up with the hydric soil indicators discussed in the section above. In some situations, redox features are present but masked in some way, in other situations, redox features may be present, but soil morphology can be easily misinterpreted without appropriate training, leading to false positive determinations.

Each of the scenarios presented below represents recognized hydric soil indicators at the federal and regional levels, but these indicators should only be applied by trained wetland scientists. When faced with a boundary delineation that relies upon the presence/absence of any of these indicators, wetland scientists with training in soil science should be consulted.

Difficult Indicators for All Soils: Regardless of Texture

Indicator A5. Hydric Floodplain Soils/Stratified Layers. (Figure F.11). Active floodplain soils receive periodic inputs of sediment, which essentially reinitiate the time clock on soil horizon formation. This leads to stratified layers of sediment, which rarely contain well-developed redox features (as described for Group I hydric soil indicators).

To be a hydric floodplain soil, several stratified layers must occur starting within 6 in. of the soil surface; and at least one of the layers must have a value of 3 or less with a chroma of 1 or less; or it must have a significant accumulation of organic matter such that it is a muck, mucky peat, peat, or mucky modified mineral texture. The remaining layers must have chroma of 2 or less.

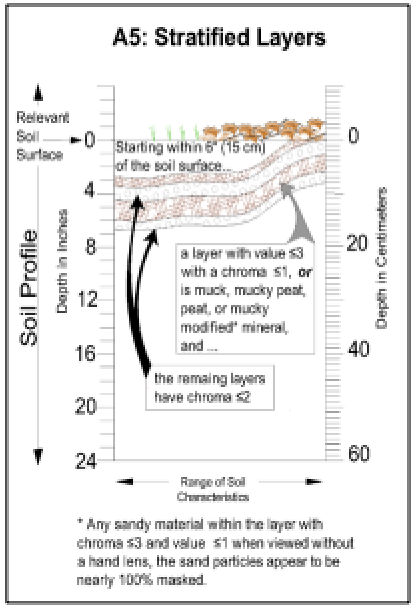


Figure F.11
Stratified Layers

<u>User Notes:</u>

- A stratified layer is a layer of soil that has been deposited (often by floodwaters) and has not formed in place gradually, over time due to natural pedogenic (soil forming) processes. Keep in mind that one layer of soil has to either have a value of 3 or less and a chroma of 1 or less or be composed of organic soil material.
- The stratified layers may have any soil texture.
- Individual strata are usually less than 1 in. thick. A hand lens (i.e., magnifying glass) is an excellent tool to aid in the identification of this indicator.

Sampling Point__________

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Location[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators (Check all that apply)		**Indicators for Problematic Hydric Soils**
☐ Histosol (A1)	☐ Polyvalue Below Surface (S8)	☐ 2 cm Muck (A10)
☐ Histic Epipedon (A2)	☐ Thin Dark Surface (S9)	☐ 5 cm Mucky Peat or Peat (S3)
☐ Black Histic (A3)	☐ Loamy Gleyed Matrix (F2)	☐ Iron-Manganese Masses (F12)
☐ Hydrogen Sulfide (A4)	☐ Depleted Matrix (F3)	☑ Mesic Spodic (A17)
☐ Stratified Layers (A5)	☐ Redox Dark Surface (F6)	☐ Red Parent Material (F21)
☐ Depleted Below Dark Surface (A11)	☐ Depleted Dark Surface (F7)	☐ Very Shallow Dark Surface (F22)
☐ Thick Dark Surface (A12)	☐ Redox Depressions (F8)	
☐ Sandy Mucky Mineral (S1)		
☐ Sandy Gleyed Matrix (S4)		
☐ Sandy Redox (S5)		☐ Other (Include Explanation in Remarks)
☐ Stripped Matrix (S6)		
☐ Dark Surface (S7)		

Restrictive Layer (if observed) Type: ______________________ Depth (inches): ____________________

Remarks:

Hydric Soils criterion met? **Yes** ☐ **No** ☐

Updates Considering Vegetation, Hydrology, and Soils

- Discourage the use of vegetation alone
- Reference to the 2020 Wetland Plant List (still not codified)
- Adopt the federal hierarchy for vegetation analysis and strata
- Deemphasize the use of circular plots in favor of strip transects
- Other indicators of hydrology included
- Consistency with federal hydric soil criteria regional supplements
- Discouraging winter delineations

Small Details, Meaningful Changes

- Vegetative strata used for delineation data plots have updated to match those of the US ACE 1987 Manual.

Trees are woody plants with a dbh of 5 inches or greater and a height of 20 feet or more. (See dark areas in illustration.)

MassDEP 1995

1. ***Tree stratum*** – Consists of woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.
2. ***Sapling/shrub stratum*** – Consists of woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.
3. ***Herb stratum*** – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants less than 3.28 ft tall.
4. ***Woody vines*** – Consists of all woody vines greater than 3.28 ft in height.

USACE 1987

When it Matters

Trees: woody plants with a DBH of 3 in. or greater regardless of height (2022).

Keep in Mind

- New Handbook applies to Bordering Vegetated Wetlands. Isolated Vegetated Wetlands (different than ILSF) are not covered in the Wetlands Protection Act.
- Municipal Bylaws and Ordinances may contain unique delineation standards.
- Budget appropriately for transect forms/data sheets.

MASSACHUSETTS
INLAND WETLAND REPLACEMENT GUIDELINES

Second Edition, September 2022

Massachusetts Department of Environmental Protection
Bureau of Water Resources
Wetlands Program

Scott Jackson | University of Massachusetts Amherst

Lisa Rhodes, David Hilgeman, Thomas Maguire and **Michael McHugh** | Massachusetts Department of Environmental Protection, Wetlands Program

UMassAmherst | Center for Agriculture, Food, and the Environment

MassDEP

Feasibility Assessment

- Getting suitable hydrology at the replacement site is critical for establishing an appropriate plant community, developing hydric soils, and supporting ecological functions necessary for successful mitigation.
- Recommends assigning the impacted/reference wetland to one of four *Novitski system classifications:*
    - *Surface water depression*
    - *Groundwater slope*
    - *Surface water slope*
    - *Surface water depression*

Table 2 | **Novitski Classification Examples and Relevant Hydrologic Information**

Novitski Classification	Definition	Water Feature Examples[12]	Assessment Techniques
Groundwater depression	Characterized by contact with the water table with minimal surface drainage away from the site.	Bogs, fens, interdunal wetlands, karst sinkhole wetlands	Section 2.2.2
Groundwater slope	Typically occur at the intersection of the slope and groundwater (i.e., toe of slope). They can be characterized as having a relatively flat slope and water surface elevation, with extremely slow-moving water draining away from the site.	Fens, sedge meadows, wet meadows, some shrub/forested wetlands	Section 2.2.2
Surface water slope	Located above the water table along the margins of lakes, streams, and other water bodies. Water drains readily as the stage of the adjacent water body falls. Can include capillary fringe-driven features.	Fringe wetlands that rely on water from an adjacent lake, pond, river or stream, floodplain forests, and tidal marshes	Section 2.2.3
Surface water depression	Occur where precipitation and overland flow (both sheet and channel) collect in a depression, generally without significant inputs from groundwater.	Vernal pools, river meander scars, beaver ponds, farm ponds	Section 2.2.4

Recommended Observation Techniques for Groundwater Slopes/Depressions

- Soil observation holes
- Soil observation pits (think formal test pit)
- Piezometers and shallow groundwater observation wells
- Recorded groundwater elevation data
- Observations of capillary fringe

Surface Water Assessment Techniques

- Staff gauges
- USGS stream gauges
- Observations of capillary fringe
- Water budget

Considerations

- If you know a wetland crossing or impact is proposed, plan to conduct your feasibility analysis early.
- Involve wetland staff in the design of BVW replication.
- Plan on monitoring not only on the success of vegetation, but also the hydrology of the replication area.

Open Discussion