USDA Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

Hydric Soils of Problematic Conditions and Altered Materials

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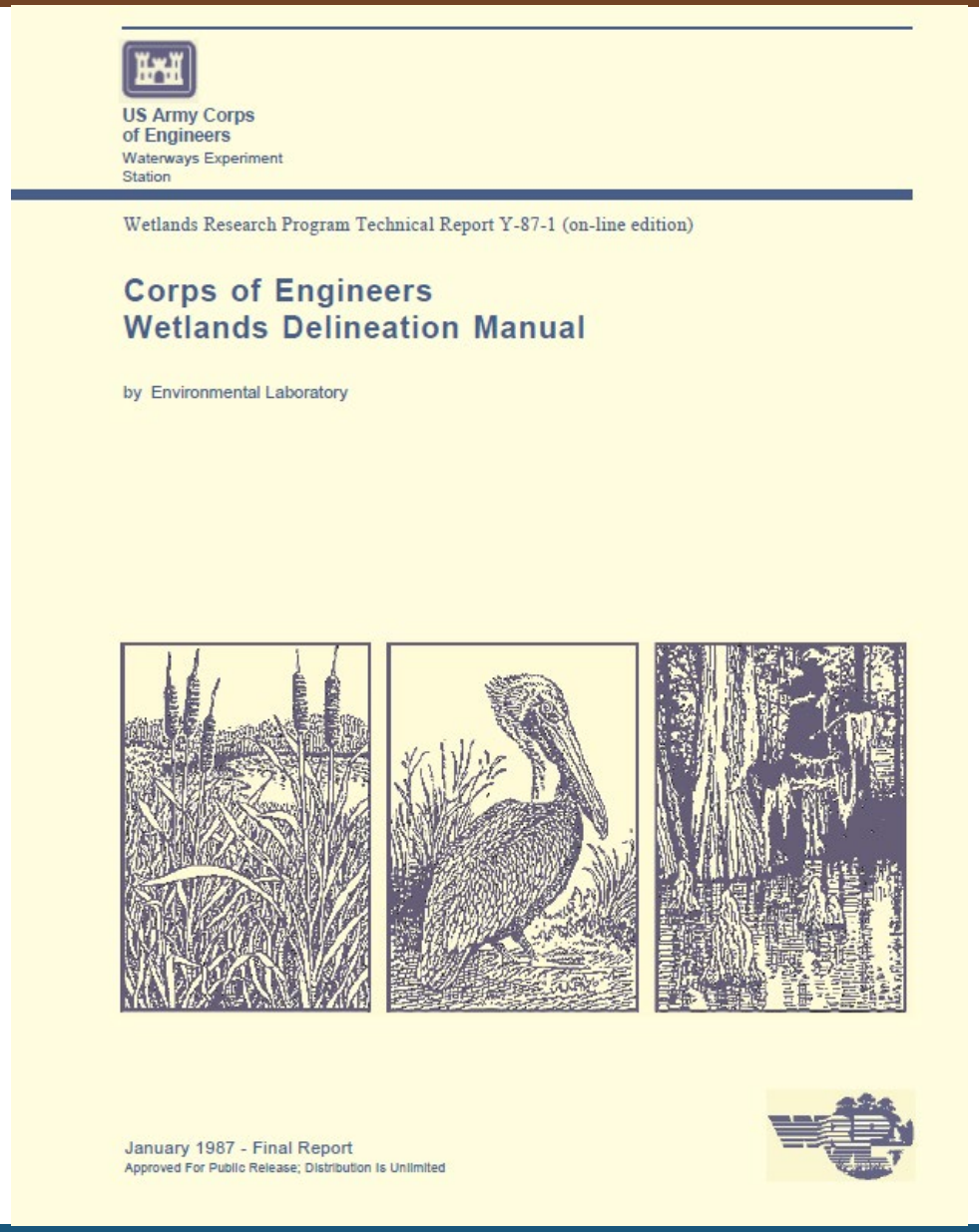
SOIL SCIENCE AND RESOURCE ASSESSMENT

USACE Wetlands Delineation Manual

“for the identification and delineation of wetlands”


US Army Corps
of Engineers
Waterways Experiment
Station

Wetlands Research Program Technical Report Y-87-1 (on-line edition)

Corps of Engineers
Wetlands Delineation Manual

by Environmental Laboratory

January 1987 - Final Report
Approved For Public Release; Distribution Is Unlimited

Organizing Experiences into Knowledge

Objectives

- Provide a directory of hydric problems and scenarios
- Reference current state-of-the-science
- Propose guidance and solutions to addressing problems
- Promote future research and direct funding

Table of Contents

A. Settings with Problematic Soils

Setting 3 – Fluvial and Flood Plain Sediments

Fluvial Soils

Challenges

- Replenished sediments - have insufficient exposure to redox processes to affect morphology.
- Lacking stagnant components - oxygenated and cold waters inhibit reduction, especially during high stream stage period.
- Barriers to vegetative foothold - lack of organic matter in soils.
- Alkalinity in water - evaporative discharge concentrates salts, inhibits redox.

Guidance

- F19 – Piedmont Floodplain Soils – approved for MLRA 148 and 149A in PA. (within 25cm, chroma < 4, and 20% redox).

Setting 4 – Seasonally Ponded Soils

Seasonally Ponded Soils

Perched or episaturated conditions in depressional features

Challenges

- Poor drainage recycles Fe back into soil profile.
- Vegetation dynamics may lead to low soil organic matter.
- Aggradation of upland sediments will bury depleted layer.

Guidance

- F8 – Redox Depressions – approved for use in PA (In closed depressions, 5cm thick layer starts within 10cm, 5% redox).

Setting 6 – Red Parent Materials

Red Parent Material

Deposits or residuum from red-bed geologies (Jurrasic, Triassic, Paleozoic) as dominant soil parent material.

Challenges

- Minerals resistant to iron depletion
- Problematic hydric areas are usually found near wetland edge.

Guidance

- F21 in PA for MLRAs: 127, 147, and 148. Within upper 25cm, 10cm thick layer, 7.5YR or redder hue, value/chroma (2<v/c<4), 10% redox.
- Note: Stratified deposits and other young layers will rarely meet F21.

Setting 8—Black Parent Materials

Soils where colors are black, most often from coal-derived deposits or alluvium.

Challenge

- Will not be able to see redox features.

Guidance

- Can often use dipyridyl die or test strips to identify reduced iron (must be actively reduced and have Fe in system).

Setting 14 – Discharge Areas for Iron-Enriched Groundwater

Discharge Areas

Soils occur in seepage areas, such as footslopes, toeslopes, and springs that discharge Fe-enriched groundwater. Cause soil chromas generally greater than 3.

Challenge

- Fail to meet indicators requiring lower chroma, such as those with depleted matrices.

Guidance

- Can often use dipyridyl die or test strips to identify reduced iron. (must be actively reduced)

Setting 16 – Very Shallow Mineral Soils

Shallow Soils

Mineral soils that may meet the color requirements but not the thickness requirements of one or more hydric soil indicators.

Challenge

- Hydric mineral soils fail thickness requirements of indicators.

Guidance

- Indicator F22, Very Shallow Dark Surface, was established to handle this issue (testing for all PA MLRAs).
  - 15cm < bedrock < 25cm - 2.5/1 colors; 15cm layer starts within 10 cm.
  - 15cm > bedrock - 2.5/1 colors; 50 percent of layer

Setting 17 – Seasonally Dynamic Hydric Soil Morphology

SDHSM Soils

Identifying Properties and Challenges

- Landscape hydrology must alternate seasonally between throughflow and discharge.
- High silt content is common, often in Slate Belt region.
- Dry season has similar conditions to setting 14 (for discharge areas).
- In wet season, soils will deplete as Fe remains itinerant and mobile as short-term residency minerals.

Guidance

- Field visits for determinations should be conducted during wet season.
- Requirements for some indicators, such as F3, could be met.
- Can often use dipyridyl die or test strips.

B. Non-Hydric Soils that Appear to Meet the Requirements of an Indicator

1. Marl Soils
2. Soils Derived from Dark or Gray Parent Materials
3. Black Parent Materials
4. Spodic Materials

C. Disturbed Hydric Soils

1. Filled Hydric Soils (Historic Hydric Soils)
   - Filled: Criterion 1
   - Filled: Criterion 2
   - Filled: Criteria 3 and 4
2. Drained Hydric Soils
3. Recently Developed
4. Tilled Wetlands

D. Relict or Induced Hydric Soils

1. Northeast Region
2. Western Mountains Region
3. Atlantic and Gulf Coast Region

Relict Hydric Soils of the Northeast

Marl Soils - Sediments originally deposited in subaqueous environments by algal precipitation of calcium carbonate.

- Inherent color of precipitated calcium carbonate is gray to white with matrix chroma of 1 or 2.
- Sediment deposits naturally contain few to common distinct or prominent Fe oxide concentrations.
- Consequently, drier areas of these soils could easily be misinterpreted as meeting the requirements for F3

E. Solutions to Problematic Hydric Soils

1 Test Indicator
2. Hydric Soil Technical Standard (HSTS)
3. Reduced Matrix
4. Transect
5. Soil Survey Data

Test Indicators

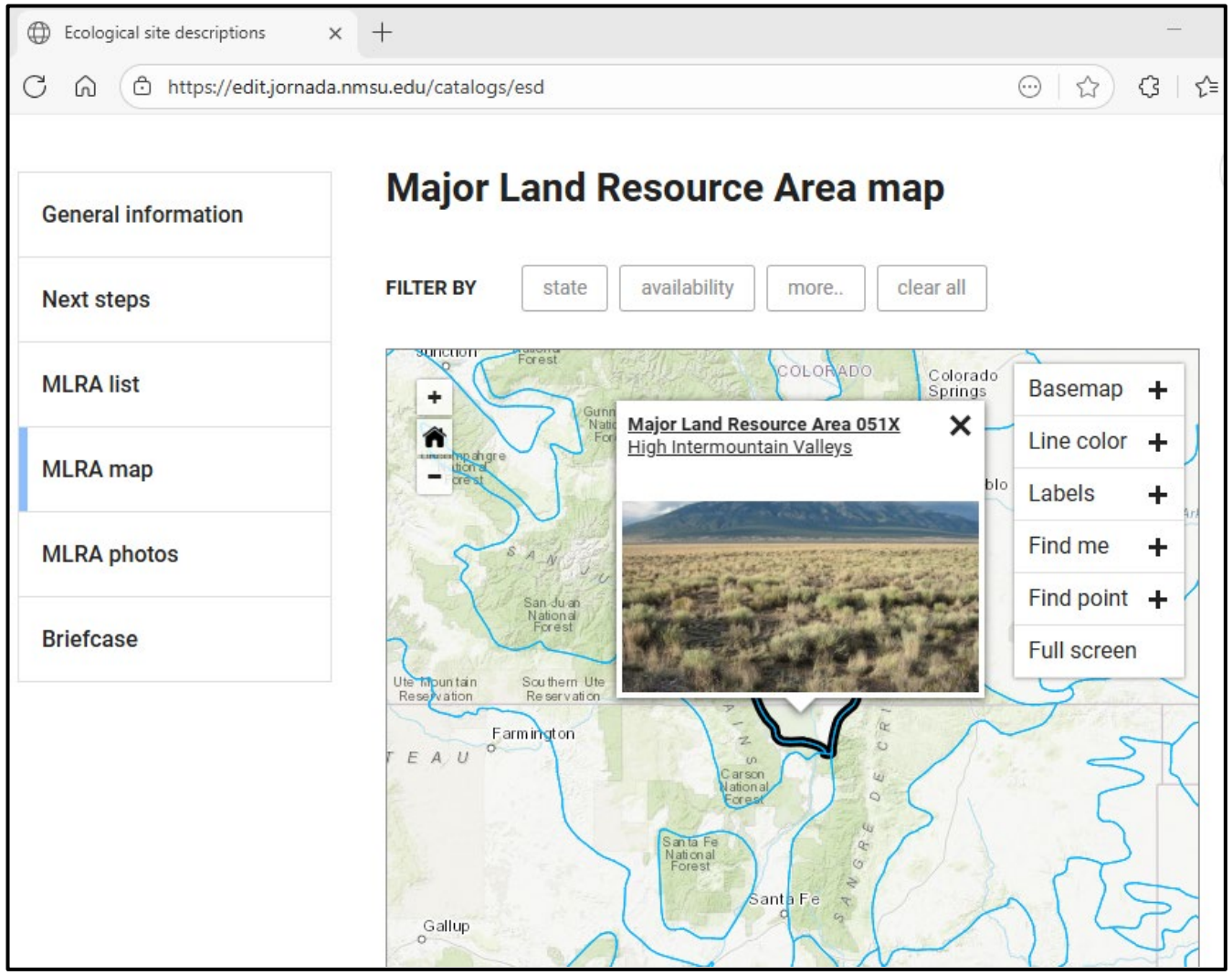
For Pennsylvania
LRRS – N, R, S

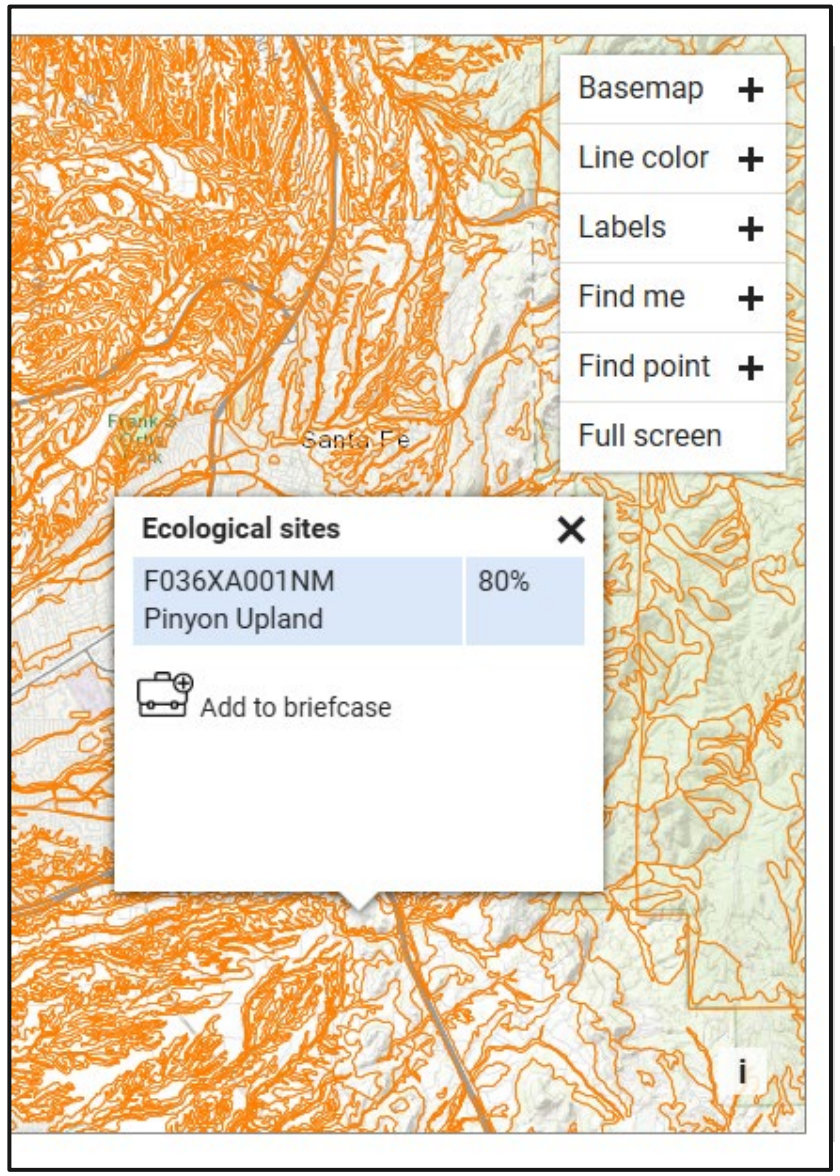
Field Indicators of Hydric Soils

Appendix 2: Test Indicators by Land Resource Regions (LRRs) and Certain Major Land Resource Regions (MLRAs)

LRR	Indicators
A	A10, F21, F22
B	A10, F18, F21, F22
C	A9, F18 (MLRA 14), F21, F22
D	F12, F21,F22
E	A10, F21, F22
F	F18 (MLRA 56), F21, F22
G	F21, F22
H	F16 (except for MLRAs 72 and 73), F21, F22
I	A9, F21, F22
J	A9, F18 (MLRA 86), F21, F22
K	A10, S3, S8, S9, F12, F21, F22
L	A10, S3, S8, S9, F12, F21, F22
M	F12, F21, F22
N	F21, F22
O	A9, F18 (MLRA 131), F21 (MLRA 131C), F22
P	F18 (MLRA 135), F19, F21, F22 (except for MLRA 138 and West Florida portion of MLRA 152A
Q	A5, F21, F22
R	S3, F12, F21, F22, TA6 (MLRAs 144A and 145)
S	A10 (except for MLRA 148), A16 (except for MLRA 149B), F19 (except for MLRAs 148 and 149A), TA6 (MLRA 149B), F21, F22
T	F19, F20 (MLRA 153B), F21, F22, TS7 (153B and 153D)
U	F21, F22 (except for MLRA 154)
V	A5, F21, F22
W	A11, F3, F6, F7, F8, F21, F22
X	A11, F3, F6, F7, F8, F21, F22
Y	A11, F3, F6, F7, F8, F21, F22
Z	A5, F21, F22

MLRA via EDIT Database





Guidance for Using Test Indicators

- Is this test indicator (TI) adjacent to, or on the perimeter of, a determined wetland or hydric soil using approved validation methods*?
- Is this a listed test indicator for the MLRA in current Field Indicators of Hydric Soils publication?
- Has this TI previously been documented as validated in other parts of this MLRA? In similar environments?
  - If not, you can meet this point by including additional documentation of saturation period and antecedent rainfall, much as HSTS requires.

Hydric Soil Technical Standard

- Scientific-based, standardized methodology established to document the hydric soil function for wetlands.
- The most effective, most tedious, and least common way to validate a functioning hydric soil.
- Methodology to demonstrate:
  - Saturation of upper soil layers during growing period.
  - Anaerobic conditions with reduction that can mobilize Fe*.
  - Normal or drier period of observation.

Reduced Matrix

- In a saturated soil, the presence of reduced iron observable as detectable change in hue or chroma within 30 min exposure to air, or positive reaction to dipyridyl dye.

- In absence, or obscurity of redox features:

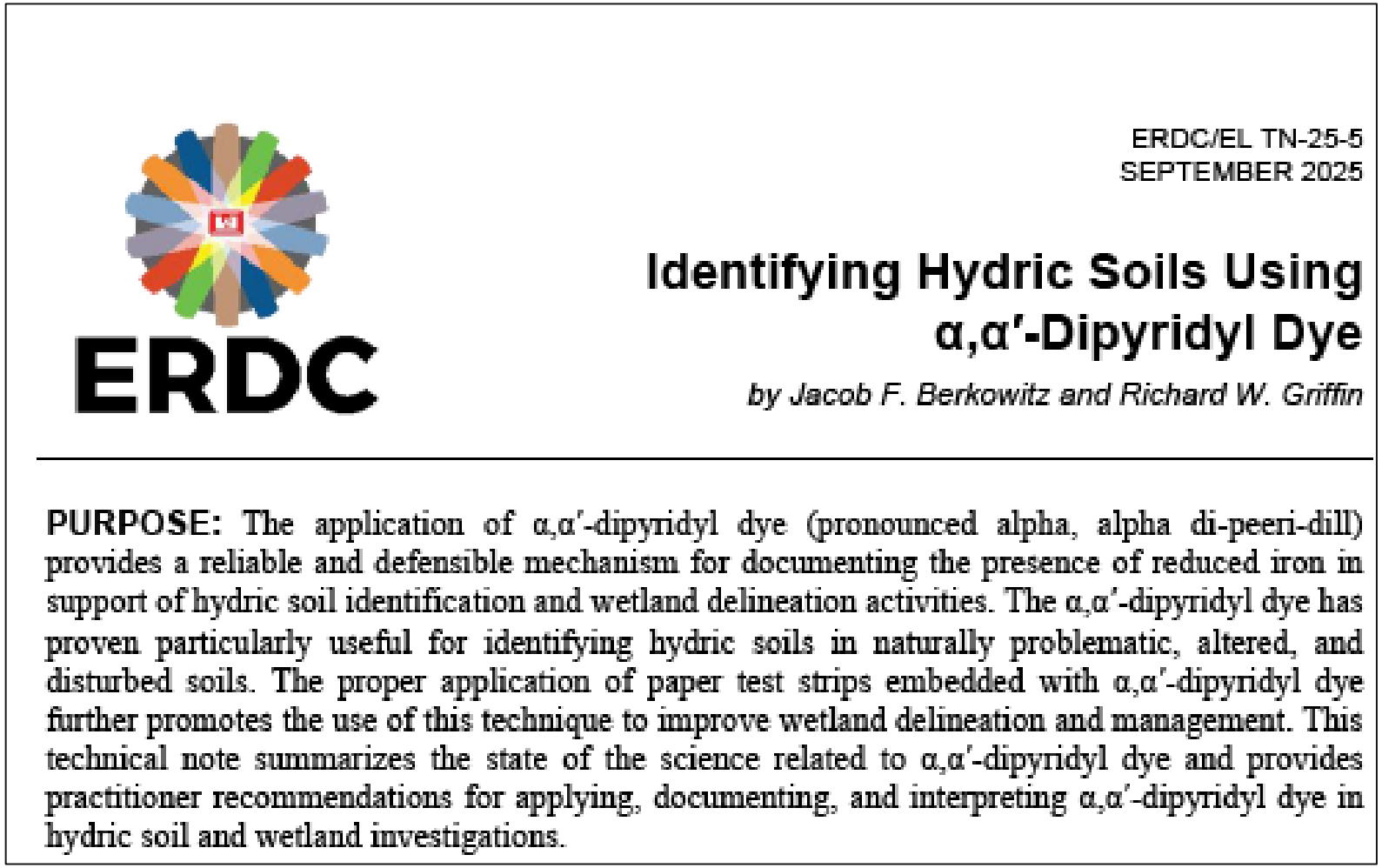
  use of “reduced matrix” can satisfy requirements of indicators, within thickness and depth.

- F3 (Depleted Matrix) and F6, F7, F8, F12, F16, F18, F19, F20, F21
- S5 (Sandy Redox) and S6, S7, S8, S11

Use of Dipyridyl Dye

- Even high chroma soils will demonstrate a positive reaction to dipyridyl die when they are reduced.

Reduced Matrix—Use of dipyridyl dye



ERDC

ERDC/EL TN-25-5
SEPTEMBER 2025

Identifying Hydric Soils Using α,α′-Dipyridyl Dye

by Jacob F. Berkowitz and Richard W. Griffin

PURPOSE: The application of α,α′-dipyridyl dye (pronounced alpha, alpha di-peeri-dill) provides a reliable and defensible mechanism for documenting the presence of reduced iron in support of hydric soil identification and wetland delineation activities. The α,α′-dipyridyl dye has proven particularly useful for identifying hydric soils in naturally problematic, altered, and disturbed soils. The proper application of paper test strips embedded with α,α′-dipyridyl dye further promotes the use of this technique to improve wetland delineation and management. This technical note summarizes the state of the science related to α,α′-dipyridyl dye and provides practitioner recommendations for applying, documenting, and interpreting α,α′-dipyridyl dye in hydric soil and wetland investigations.

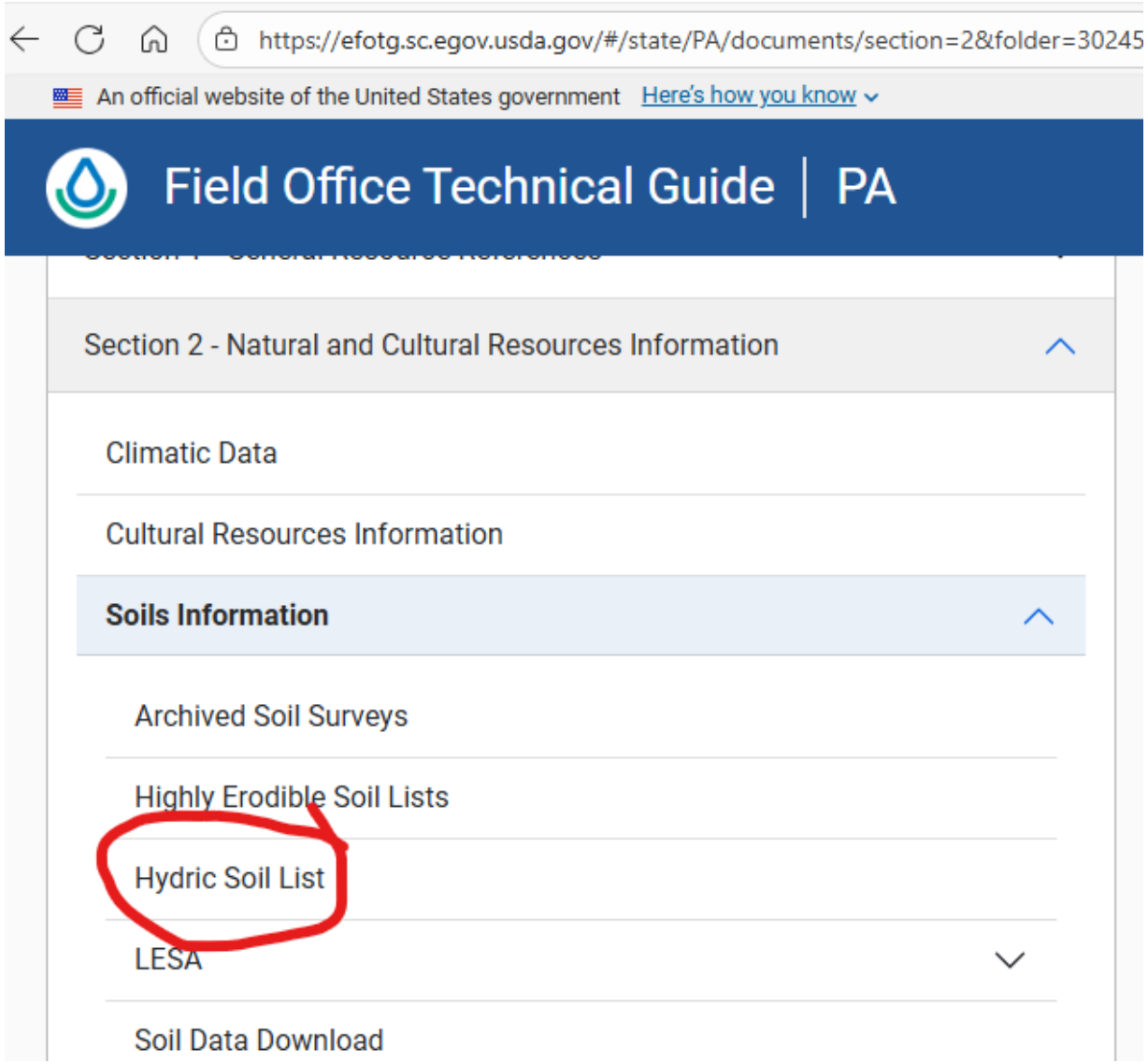
Transect Method

A methodical approach to determine the hydric soil boundary. Soil and landscape conditions should be documented thoroughly and should include the rationale for considering the soil to be hydric (e.g., landscape position, vegetation, evidence of hydrology).

- Investigate soil properties on obvious endpoints between wetland and upland and work inward using mix of all soil, landscape, and vegetative indicators as a custom guide.
- Document, document, document.

Soil Survey Data

- Use of known, listed soil components from the Field Office Technical Guide can validate the hydric boundary.
- A deeper familiarity of the soils in an area is required.



https://www.nrcs.usda.gov/resources/guides-and-instructions/field-office-technical-guides

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National Technical Committee for Hydric Soils (NTCHS)

Quick Links

Questions

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