Acknowledgments

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In addition, my sincere gratitude goes to the individuals of EPA Region III for their efforts and assistance on a variety of tasks related to this updated version, in particular Kevin Bilash and Adam Rosenblatt. A special thanks to my colleague Nancy Grundahl for the excellent graphic design work. The Committee members are also grateful to EPA Regions II & III for their financial support in the republication of this field guide.

We have added a Key to Soils that Lack Field Indicators on page 1.7 and have updated the user notes and made them specific to the Mid-Atlantic region. Additionally, the graphical representations of the indicators have been redone and updated.

Finally, we hope this field guide will enable you to recognize hydric soils more efficiently and effectively.

Ralph J. Spagnolo, Chair
Mid-Atlantic Hydric Soils Committee
US Environmental Protection Agency
Region III

Table of Contents

INTRODUCTION

Field Indicators of Hydric Soils in the Mid-Atlantic United States is a reference guide for identification and delineation of hydric soils. This field guide is an attempt to consolidate the "Field Indicators of Hydric Soils in the United States" and provide a more specific, user-friendly, regionalized guide by the Mid-Atlantic Hydric Soils Committee. This Committee was formed to address hydric soil issues that occur in the Mid-Atlantic region and convenes several times a year. The members of this Committee are representatives from the Federal and State agencies, universities, and private industry personnel with interest in hydric soil issues. The indicators listed in this guide are a subset of those found in Field Indicators of Hydric Soils in the United States; specifically, the indicators listed are those that occur in the Mid-Atlantic.

CONCEPT

Hydric soils are defined as soils that are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, July 13, 1994). The anaerobic activity of microorganisms causes the depletion of oxygen in saturated soils. This loss of oxygen promotes several biogeochemical processes that produce specific soil morphologies. These characteristic morphologies, developed from specific processes, are useful in identifying hydric soils. Hydric soil indicators, based on soil characteristics, are formed predominantly by the accumulation or loss of organic matter, iron, manganese, or sulfur.

CAUTION

Wetland hydrology is often dynamic and therefore indicators should not be considered absolute. The absence of some indicators listed in this guide should not preclude that soil from further consideration as hydric. Often times, presence of an indicator may be questionable, in which case a precise determination may not be possible without the aid of an experienced soil scientist. A basic knowledge of soil science, soil landscape relationships, and soil survey procedures is necessary for the intended use of this guide.

HOW TO USE THIS GUIDE

The six land resource regions (LRRs) described in this guide are L, N, P, R, S, and T. The indicators within these regions include organic and mineral (fine to sandy texture) soils. The guide is organized by the six LRRs in the Mid-Atlantic: L, N, P, R, S, and T (page 2.1). A key to soils that lack field indicators is provided on page 1.7, a simple key to hydric soil indicators on page 1.8, and a glossary on page G.1.

FIELD PROCEDURES

To document a hydric soil first remove all loose leaf matter, needles, bark, and other easily identified plant parts (often called duff layer) to expose the surface. Dig a hole and describe the soil profile to a depth of at least 50 cm (20 in.). Using the completed soil pedon sheet, specify which indicators have been matched.

Deeper examination of soil may be required where field indicators are not easily seen within 50 cm (20 in.) of the surface. It is always recommended that soils be excavated and described as deep as necessary to make reliable interpretations. For example, examination to less than 50 cm (20 in.) may suffice in soils with surface horizons of organic material or mucky mineral because these shallow organic accumulations only occur in hydric soil. Conversely, depth of excavation will often be greater than 50 cm (20 in.) in Mollisols because the upper horizons of these soils, due to the masking effect of organic material, often contain no visible redoximorphic (redox) features. In many sites it is necessary to make exploratory observations to a meter or more. These observations should be made with the intent of documenting and understanding the variability in soil properties and hydrologic relationships on the site.

Depths used in the indicators are measured from the muck or mineral soil surface unless otherwise indicated. All colors refer to moist Munsell colors. Soil colors specified in the indicators do not have decimal points listed; however, colors do not occur between Munsell chips. Soil colors should not be rounded to qualify as meeting an indicator. For example, soil matrix with a chroma between 2 and 3 should be listed as having a chroma of 2+. This soil material does not have a chroma of 2 and would not meet any indicator that requires a chroma of 2 or less.

Particular attention should be paid to changes in microtopography over short distances. Small changes in elevation may result in repetitive sequences of hydric/non-hydric soils which may complicate the delineation. Often the dominant condition (hydric/non-hydric) is the only reliable interpretation. The shape of the local landform can greatly affect the movement of water through the landscape. Significant changes in parent material or lithographic discontinuities in the soil can affect the hydrologic properties of the soil. After exploratory observations have been made sufficient to understand the soil-hydrologic relationships at the site, subsequent excavations may then be shallower if identification of appropriate indicators allows.

TO COMMENT ON THE INDICATORS

The indicators will be revised and updated as field data are collected to improve our understanding of hydric soil processes. If you know an area where the plant community and hydrologic data strongly suggest that an area is a wetland and there is no indicator that identifies that soil condition, please write first to Lenore Matula Vasilas, Ralph Spagnolo and/or Wade Hurt of the National Technical Committee for Hydric Soils (NTCHS) at the addresses below. To be most helpful, please provide supporting documentation and suggestions for modifications you feel are needed.

Supporting documentation should include data to support the definition and criteria of a hydric soil; this includes water table data, saturation data, redox potential measurements, alpha alpha dipyridyl test results, soil pedon descriptions, and vegetative data. The documentation should be submitted to:

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For more information or additional copies of this guide, please contact:

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REFERENCES

Unless otherwise noted the following references contain definitions of terms used throughout this document. They also contain additional information concerning the terms in the glossary at the back of this document.

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TEST INDICATORS OF HYDRIC SOILS

The indicators should be tested for use in LRRs other than those listed. Other indicators are for testing. This list of test indicators is not extensive. Users of indicators are encouraged to submit

descriptions of other soil morphologies that they think are indicative of hydric soils along with supporting data for inclusion in subsequent editions of Field Indicators of Hydric Soils in the United States. Indicators that fall under the "Testing Indicator" category have the abbreviation "T." The "T" will be followed by the letter abbreviation of one of the three soil types listed below.

SOIL TYPES

The three basic classes of soils, referred to throughout the book, are defined as follows:

"All soils" refers to soils with any USDA texture. Unless otherwise indicated, all mineral layers above any of the indicators have a dominant chroma 2 or less, or the layer(s) with dominant chroma of more than 2 is less than 15 cm (6 in.) thick. Also, unless otherwise noted, nodules and concretions are not considered to be redox concentrations. Use the "All Soils" indicators regardless of texture. Indicators that fall under the "All Soils" category have the abbreviation "A."

"Sandy soils" refers to those soils with USDA texture of loamy fine sand and coarser. Unless otherwise indicated, all mineral layers above any of the dominant indicators have a dominant chroma 2 or less, or the layer(s) with dominant chroma of 2 or more is less than 15 cm (6 in.) thick. Also, unless otherwise noted, nodules and concretions are not considered to be redox concentrations. Indicators found in sandy soils have the abbreviation "S."

"Loamy and clayey soils" refers to soils with USDA textures of loamy very fine sand or finer. Unless otherwise indicated, all mineral layers above any of the indicators have a dominant chroma 2 or less, or the layer(s) with dominant chroma of more than two is less than 15 cm (6 in.) thick. Also, unless otherwise noted, nodules and concretions are not considered to be redox concentrations. Indicators found in loamy and clayey soils have the abbreviation "F."

KEY TO SOILS THAT LACK FIELD INDICATORS*

1. Remove Duff (loose leaf matter, needles, etc.).

2. Dig a hole to 6+ in., describe texture and color and document on profile description form**.**

3. Answer the following questions with regard to 0-6 inch layer(s):

   A. Do organic soil materials or mucky modified layers exist?

   B. Does chroma of $\leq$ 2 exist?

   C. Are there any distinct or prominent redox concentrations as soft masses or pore linings?

   If the answer to all three is no – no field indicators are present.
   Consider possible problematic situation, i.e. hydrology, predominance of FACW & OBL.

   Move to next observation site!

   If the answer is yes – proceed with evaluation to identify indicator.

4. Excavate hole to about 20 in., describe profile and document on profile description form.

5. Select class of soil indicators, i.e.

   A = Presence of organic soil materials.

   S = Textures of loamy fine sand or coarser within indicator layer(s).

   F = Textures of loamy very fine sand or finer within indicator layer(s).

6. Proceed through Key to Hydric Soil Indicators, or

7. Select set of indicators applicable to your LRR and proceed to A, S, or F indicators.

8. Select indicator(s) applicable to this pedon and document.

9. Check test indicators.

   * While a soil may <u>not</u> classify as hydric based on field indicators, it may still classify as "hydric" based on COE '87 Manual definition**.**

KEY TO FIELD INDICATORS OF HYDRIC SOILS IN THE MID-ATLANTIC UNITED STATES

This key is to help identify potential indicators you may meet based on general characteristics of your soil. To insure that an indicator's requirements are met, go to specific criteria requirements

listed in the indicator and explained in the user notes for the indicator referred to you in this key. If the soil does not meet the specific criteria for that indicator, continue with the key to identify all other potential indicators your soil may meet.

1. Do you have a hydrogen sulfide (rotten egg) odor in the upper 30 cm (12 in.)?
    a. No – Go to step 2
    b. Yes – See indicator A4 Hydrogen Sulfide
2. Do you have a layer of organic soil material in the upper 80 cm (32 in.)?
    a. No – Go to step 3
    b. Yes
        i. Is the soil a Histosol?
            1. No – Go to step 2bii
            2. Yes – See indicator A1. Histosol
        ii. Do you have a histic epipedon?
            1. No – Go to step 2biii
            2. Yes – See indicator A2. Histic Epipedon
        iii. Do you have $ 20 cm (8 in.) of organic soil material starting in the upper 15 cm (6 in.)?
            1. No – Go to step 2biv
            2. Yes – See indicator A3. Black Histic
        iv. Do you have stratified layers starting in the upper 15 cm (6 in.)?
            1. No – Go to step 2bv
            2. Yes – See indicator A5. Stratified layers
        v. Are you in LRRs P or T and have a $ 1 cm (0.5 in.) thick layer of muck starting in the upper 15 cm (6 in.)?
            1. No – Go to step 2bvi
            2. Yes – See indicator A9. 1 cm Muck
        vi. Are you in LRR N (for testing in LRR L and S) and have a $ 2 cm (0.75 in.) thick layer of muck starting in the upper 15 cm (6 in.)?
            1. No – Go to step 2bvii
            2. Yes – See indicator A10. 2 cm Muck
        vii. Are you in LRR R and in a concave position or depression and have $ 2 cm (0.75 in.) of muck with no soil structure starting in the upper 15 cm (6 in.)?
            1. No – Go to step 3
            2. Yes – See test indicator TA2. Structureless Muck
3. Are you in LRR P or T and have organic bodies starting in the upper 15 cm (6 in.)?
    a. No – Go to step 4
    b. Yes – See indicator A6. Organic Bodies
4. Do you have mucky modified mineral textures in the upper 15 cm (6 in.)?
    a. No – Go to step 5
    b. Yes
        i. Are you in LRR P or T and have $5 cm (2 in.) of mucky modified mineral textures starting in the upper 15 cm (6 in.)?
            1. No – Go to step 4bii
            2. Yes – See indicator A7. Mucky Mineral
        ii. Do you have a mucky modified sandy mineral texture $5 cm (2 in.) thick starting in the upper 15 cm (6 in.)?

1. No – Go to step 4biii
2. Yes – See indicator S1. Sandy Mucky Mineral

iii. Are you in LRR L and have a mucky modified loamy or clayey mineral texture $10 cm (4 in.) or more thick starting in the upper 15 cm (6 in.)?

1. No – Go to step 5
2. Yes – See indicator F1. Loamy Mucky Mineral

5. Do you have a gleyed matrix starting in the upper 30 cm (12 in.)?
   a. No – Go to step 6
   b. Yes
      i. Is the layer sandy and does the gleyed matrix start in the upper 15 cm (6 in.)?
         1. No – Go to step 5bii
         2. Yes – See indicator S4. Sandy Gleyed Matrix
      ii. Is the layer loamy or clayey and does the gleyed matrix start in the upper 30 cm (12 in.)?
         1. No – Go to step 6
         2. Yes – See indicator F2. Loamy Gleyed Matrix
6. Do you have a dark surface (value 3 or less, chroma 2 or less) in the upper 30 cm (12 in.)?
   a. No – Go to step 7
   b. Yes
      i. Do you have a sandy layer $ 10 cm (4 in.) thick starting in the upper 15 cm (6 in.) with a matrix value 3 or less and chroma 1 or less with a sandy layer below that has a chroma 2 or less?
         1. No – Go to step 6bii
         2. Yes – See indicator S7. Dark Surface
      ii. Are you in LRR R, S or T (testing in L) and have a sandy layer value 3 or less and chroma 1 or less starting in the upper 15 cm (6 in.) underlain by a sandy layer where translocated organic matter forms a diffuse splotchy pattern?
         1. No – Go to step 6biii
         2. Yes – See indicator S8. Polyvalue Below Dark Surface
      iii. Are you in LRR R, S or T (testing in L) and have a sandy layer $5 cm (2 in.) thick in the upper 15 cm (6 in.) with value 3 or less and chroma 1 or less underlain by a sandy layer with value 4 or less and chroma 1 or less to a depth of 30 cm (12 in.) or to a spodic horizon?
         1. No – Go to step 6biv
         2. Yes – See indicator S9. Thin Dark Surface
      iv. Do you have a loamy or clayey depleted matrix starting in the upper 30 cm (12 in.) with the loamy or clayey layer(s) above the depleted matrix having value 3 or less and chroma 2 or less?
         1. No – Go to step 6bv
         2. Yes – See indicator F4. Depleted Below Dark Surface

v. Do you have a loamy or clayey depleted matrix $ 15 cm (6 in.) thick with the loamy or clayey layers above the depleted matrix having a hue of N and value 3 or less to a depth of 30 cm (12 in.) and value of 3 or less and chroma of 1 in the remainder of the layers above the depleted matrix?
   1. No – Go to step 6bvi
   2. Yes – See indicator F5. Thick Dark Surface

vi. Do you have a loamy or clayey layer $ 10 cm (4 in.) thick entirely in the upper 30 cm (12 in.) that has a value 3 or less and chroma 2 or less with at least 2 percent redox concentrations as soft masses or pore linings?
   1. No – Go to step 6bvii
   2. Yes – See indicator F6. Redox Dark Surface

vii. Do you have a loamy or clayey layer $ 10 cm (4 in.) thick entirely in the upper 30 cm (12 in.) that has a value 3 or less and chroma 2 or less with at least 10 percent redox depletions?
   1. No – Go to step 6bviii
   2. Yes – See indicator F7. Depleted Dark Surface

viii. Are you in LRR P or T and in a depression or concave landform and have a loamy or clayey layer $ 25 cm (10 in.) thick starting in 15 cm (6 in.) in which the upper 15 cm (6 in.) is value 3 or less and chroma 1 or less and the lower 10 cm (4 in.) has chroma 2 or less?
   1. No – Go to step 6bix
   2. Yes – See indicator F13. Umbric Surface

ix. Are you in LRR N, P, S or T and have a loamy or clayey layer $ 15 cm (6 in.) thick with 60 percent or more hue 2.5Y or yellower, value 4 or more, and chroma 1; or hue 5Y or yellower, value 4 or more, and chroma 2 or less starting in the upper 30 cm (12 in.) with the layer(s) above having value 3 or less and chroma 2 or less?
   1. No – Go to step 6bx
   2. Yes – See test indicator TF4. 2.5Y/5Y Below Dark Surface

x. Are you in LRR L, N, R or S and have a layer $ 15 cm (6 in.) thick with a loamy or clayey depleted matrix starting below 30 cm (12 in.) with the loamy or clayey layer(s) above having hue 10YR or yellower, value 2.5 or less, and chroma 1 or less to a depth of 30 cm (12 in.) and value 3 or less and chroma 1 in the remainder of the epipedon?
   1. No – Go to step 7
   2. Yes – See test indicator TF7. Thick Dark Surface 2/1

7. Do you have a matrix with $60% chroma 2 or less with redox concentrations in the upper 30 cm (12 in.)?
   a. No – Go to step 8
   b. Yes

i. Do you have a sandy layer starting in the upper 15 cm (6 in.) that is $ 10 cm (4 in.) thick and has a matrix with $60 percent chroma 2 or less with 2 percent or more redox concentrations as soft masses or pore linings?
   1. No – Go to step 7bii
   2. Yes – See indicator S5. Sandy Redox

ii. Do you have a loamy or clayey layer with a depleted matrix $5 cm (2 in.) thick that is entirely in the upper 15 cm (6 in.) or 15 cm (6 in.) and is entirely in the upper 25 cm (10 in.)?
   1. 1 No – Go to 8
   2. Yes – See indicator F3. Depleted Matrix

8. Are you on a floodplain?
   a. No – Go to step 9
   b. Yes
      i. Are you in LRR N, P, or T and have a loamy or clayey layer $10 cm (4 in.) thick with $40 percent chroma 2 or less, and 2 percent redox concentrations as soft iron/manganese masses with diffuse boundaries entirely in the upper 30 cm (12 in.) or any thickness if the layer starts at the soil surface?
         1. No – Go to step 8ii
         2. Yes – See indicator F12. Iron/Manganese Masses

      ii. Are you in LRR N or S and have a loamy or clayey layer that has $60 percent chroma 3 or less with 2 percent redox concentrations as soft masses starting in he upper 15 cm (6 in.) and extending to a depth of Bn>30 cm (12 in.)?
         1. No – Go to step 9
         2. Yes – See test indicator TF10. Alluvial Depleted Matrix

9. Do you have a sandy layer starting in the upper 15 cm (6 in.) in which iron/manganese has been stripped to expose the primary base colors of the soil material, forming a diffuse splotchy pattern?
   a. No – Go to step 10
   b. Yes – See indicator S6. Stripped Matrix

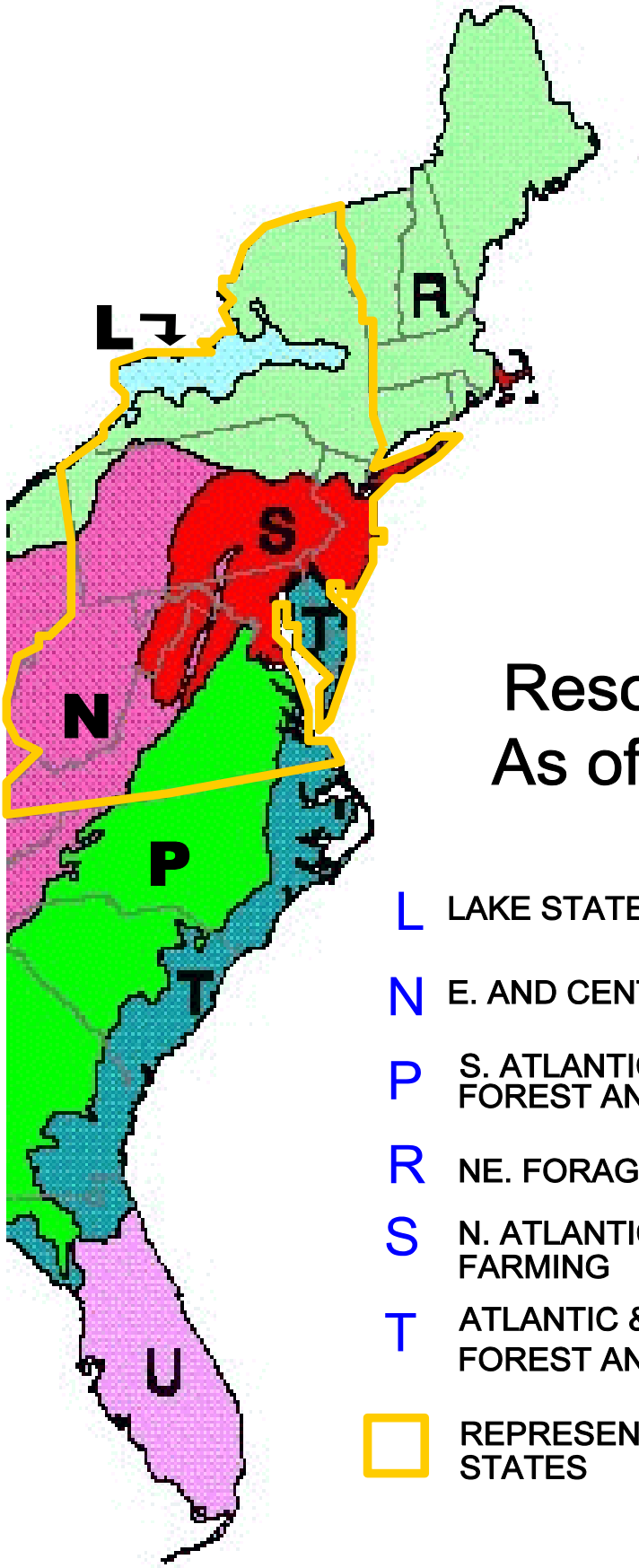
10. Are you in a closed depression subject to ponding with $5 percent redox concentrations as soft masses or pore linings in a loamy or clayey layer $5 cm (2 in.) thick entirely in the upper 15 cm (6 in.)?
   a. No – Go to step 11
   b. Yes – See indicator F8. Redox Depressions

11. Are you in LRR L or R and have a sandy layer starting in the upper 15 cm (6 in.) that is $ 10 cm (4 in.) thick and has a matrix chroma 3 or less with 2 percent or more redox concentrations as soft masses and/or pore linings?
   a. No – Go to step 12
   b. Yes See test indicator TS5. Chroma 3 Sandy Redox

12. Are you in an area that has red parent material and have a loamy or clayey layer with hue 7.5YR or redder with a matrix value 4 or less and chroma 4 or less and $2 percent redox

depletions and/or concentrations that is $ 10 cm (4 in.) thick entirely in the upper 30 cm (12 in.) or $5 cm (2 in.) if the layer starts at the soil surface?

a. No – Does not meet an indicator
b. Yes – See test indicator TF2. Red Parent Material



Resource Regions
As of January 2003

L LAKE STATES FRUIT, TRUCK AND DAIRY

N E. AND CENTRAL FARMING AND FORAGE

P S. ATLANTIC & GULF SLOPE CASH CROPS FOREST AND LIVESTOCK

R NE. FORAGE AND FOREST

S N. ATLANTIC SLOPE DIVERSIFIED FARMING

T ATLANTIC & GULF COAST LOWLAND FOREST AND CROP

☐ REPRESENTS MID-ATLANTIC REGION STATES

LRR - L

A1, A2, A3, A4, A5, A10 (test only), S1, S4, S5, S6, S8 (test only), S9 (test only), F1, F2, F3, F4, F5, F6, F7, F8, TS5, TF2, TF7.

***Unless otherwise indicated, all mineral layers above any of the dominant indicators have a dominant chroma 2 or less, or the layer(s) with dominant chroma of 2 or more is less than 15 cm (6 in.) thick.**

A1. Histosol or Histel. Classifies as a Histosol (except Folist) or as a Histel (except Folistel).

Histosol User Notes: A Histosol has 40 cm (16 in.) or more of the upper 80 cm (32 in.) as organic soil material. Organic soil material has an organic carbon content (by weight) of 12 to 18 percent or more, depending on the clay content of the soil. The materials includes muck (sapric soil material), mucky peat (hemic soil material), or peat (fibric soil material). See glossary for definition of muck, mucky peat, peat, and organic soil material. Histels are similar to Histosols except that they are underlain by permafrost.

A2. Histic Epipedon. A Histic epipedon.

Histic Epipedon User Notes: Most Histic epipedons are surface horizons 20 cm (8 in.) or more thick of organic soil material. Aquic conditions or artificial drainage are required. See Soil Taxonomy (USDA, NRCS, Soil Survey Staff, 1999). Slightly lower organic carbon contents are allowed in plowed soils (ibid). See glossary for definitions.

A3. Black Histic. A layer of peat, mucky peat, or muck 20 cm (8 in.) or more thick starting within the upper 15 cm (6 in.) of the soil surface having hue 10YR or yellower, value 3 or less, and chroma 1 or less.

Black Histic User Notes: Unlike indicator A2, this indicator does not require proof of aquic conditions or artificial drainage. See glossary for definitions of muck, mucky peat, and peat.

A4. Hydrogen Sulfide. A hydrogen sulfide odor within 30 cm (12 in.) of the soil surface.

Hydrogen Sulfide User Notes: The rotten egg smell indicates that sulfate-sulfur has been reduced, and therefore the soil is anaerobic. In most hydric soils the sulfidic odor is only present when the soil is saturated and anaerobic. Most commonly found in brackish or marine environments. When sulfides are oxidized you can see pyrite with a hand lens.

A5. Stratified Layers. Several stratified layers starting within the upper 15 cm (6 in.) of the soil surface. One or more of the layers has value 3 or less with chroma 1 or less and/or it is muck, mucky peat, peat, or mucky modified mineral texture. The remaining layers have value 4 or more and chroma 2 or less.

Stratified Layers User Notes: Use of this indicator may require assistance from a trained soil scientist that has local experience. The minimum organic carbon content of at least one layer of this indicator is slightly less than required for indicator A7 Mucky Modified Mineral Texture. An undisturbed sample must be observed. Individual strata are dominantly less than 2.5 cm (1 in.) thick. A hand lens is an excellent tool to aid in the identification of this indicator. Many alluvial soils have stratified layers at the required depths, but lack chroma 2 or less; these do not fit this indicator. Stratified layers occur in any type soil material.
*This indicator has not been observed in the Mid-Atlantic region.

A10. 2 cm Muck. A layer of muck 2 cm (0.75 in.) or more thick with value 3 or less and chroma 1 or less starting within 15 cm (6 in.) of the soil surface.

2 cm Muck User Notes: Normally this expression of anaerobiosis is at the soil surface; however, it may occur at any depth within 15 cm (6 in.). Muck is sapric soil material with at least 12 to 18 percent organic carbon. Organic soil material is called muck (sapric soil material) if virtually all of the material has undergone sufficient decomposition to limit recognition of the plant parts. Hemic (mucky peat) and fibric (peat) soil materials do not qualify. To determine if muck is present, first remove loose leaves, needles, bark, and other easily identified plant remains. This is sometimes called the leaf/root mat or duff. Then, examine for decomposed organic soil material. Generally muck is black and has a "greasy" feel; sand grains should not be evident. By definition, organic soil material accumulates due to long periods of saturation. In LRR L, sapric material may accumulate for other reasons, so this indicator is difficult to use in these regions if you are unsure whether aquic conditions exist.

S1. Sandy Mucky Mineral. A mucky modified mineral surface layer 5 cm (2 in.) or more thick starting within 15 cm (6 in.) of the soil surface.

Sandy Mucky Mineral User Notes: *Mucky* is a USDA texture modifier for mineral soils. The organic carbon content is at least 5 percent and ranges as high as 14 percent for sandy soils. The percentage requirement is dependent upon the clay content of the soil; the higher the clay content, the higher the organic carbon requirement. An example is mucky fine sand that has at least 5 percent organic carbon, but not more than about 12 percent carbon. See glossary for definition of mucky modified mineral texture.

S4. Sandy Gleyed Matrix. A gleyed matrix which occupies 60 percent or more of a layer within 15 cm (6 in.) of the soil surface.

Sandy Gleyed Matrix User Notes: Gley colors are not synonymous with gray colors. Gley colors are those colors that are found on the gley page (Gretag/Macbeth, 2000). They have a hue of N, 10Y, 5GY, 10GY, 5G, 10G, 5BG, 10BG, 5B, 10B, or 5PB that have value 4 or more. The gleyed matrix only has to be present within 15 cm (6 in.) of the surface. Soils with gleyed matrices are commonly saturated for very long (1 month) duration; this is why no thickness of the layer is required. See glossary for definition of gleyed matrix. Gleyed matrices are commonly reduced matrices and will change color upon exposure to air.

S5. Sandy Redox. A layer starting within 15 cm (6 in.) of the soil surface that is at least 10 cm (4 in.) thick, and has a matrix with 60 percent or more chroma 2 or less with 2 percent or more distinct or prominent redox concentrations as soft masses and/or pore linings.

Sandy Redox User Notes: Distinct and prominent are defined in the glossary. Redox concentrations include iron and manganese masses (reddish mottles) and pore linings (Vepraskas, 1994). Included within this concept of redox concentrations are iron/manganese bodies as soft masses with diffuse boundaries. The iron/manganese masses are 2 to 5 mm (0.08 to 0.2 in.) and have value 3 or less and chroma 3 or less; most commonly they are black. Iron/manganese masses should not be confused with concentrations and nodules associated with plinthitic (USDA, NRCS, Soil Survey Staff, 1999) or relict concretions. Common to many redox concentrations (USDA, NRCS, 1998a) are required. Caution should be used when using this indicator in disturbed landscapes where compaction has occurred. Compaction may result in the formation of concentrations.

S6. Stripped Matrix. A layer starting within 15 cm (6 in.) of the soil surface in which iron/manganese oxides and/or organic matter have been stripped from the matrix exposing the primary base color of soil materials. The stripped areas and translocated oxides and/or organic matter form a diffuse splotchy pattern of two or more colors. The stripped zones are 10 percent or more of the volume; they are rounded, and approximately 1 to 3 cm (0.5 to 1 in.) in diameter.

Stripped Matrix User Notes: This indicator includes the indicator *streaking* (Environmental Laboratory, 1987) Common to many (USDA, Soil Survey Division Staff, 1993) areas of stripped (uncoated) soil materials 1 to 3 cm (0.5 to 1 in.) in size is a requirement. Commonly the splotches of color have value 5 or more and chroma 1 and/or 2 (stripped) and chroma 3 and/or 4 (unstripped). The matrix may lack the 3 and/or 4 chroma material. The mobilization and translocation of the oxides and/or organic matter is the important process and should result in splotchy coated and uncoated soil areas. The stripped zones are usually associated with fine roots. Wet soils with thick dark surfaces that have been drained may have a similar look to the

stripped matrix as the organic matter starts to oxidize. A clean face should be described to ensure that splotches are not created through smearing and mixing in the excavation process. *Stripped Matrices have not been observed in the Mid-Atlantic region, but they are typically below 15 cm (6 in.) and do not meet this indicator.

S8. Polyvalue Below Surface. A layer with value 3 or less and chroma 1 or less starting within 15 cm (6 in.) of the soil surface underlain by a layer(s) where translocated organic matter unevenly covers the soil material forming a diffuse splotchy pattern. At least 70 percent of the visible soil particles in the upper layer must be covered, coated, or masked with organic material. Immediately below this layer, the organic coating occupies 5 percent or more of the soil volume and has value 3 or less and chroma 1 or less. The remainder of the soil volume has value 4 or more and chroma 1 or less.

Polyvalue Below Surface User Notes: This indicator describes soils that have a very dark gray or black surface or near-surface layer less than 10 cm (4 in.) thick underlain by a layer where organic matter has been differentially distributed within the soil by water movement. The mobilization and translocation of organic matter results in splotchy coated and uncoated soil areas as described in the Sandy Redox and Stripped Matrix indicators except that for S8 the whole soil is in shades of black and gray. The chroma 1 or less is critical because it limits application of this indicator previously termed streaking (Environmental Laboratory, 1987). Wet soils with thick dark surfaces that have been drained may have a similar look to the stripped matrix as the organic matter starts to oxidize. A clean face should be described to ensure that splotches are not created through smearing and mixing in the excavation process.

S9. Thin Dark Surface. A layer 5 cm (2 in.) or more thick within the upper 15 cm (6 in.) of the surface, with value 3 or less and chroma 1 or less. At least 70 percent of the visible soil particles in this layer must be covered, coated, or masked with organic material. This layer is underlain by a layer(s) with value 4 or less and chroma 1 or less to a depth of 30 cm (12 in.) or to the spodic horizon, whichever is less.

Thin Dark Surface User Notes: This indicator describes soils with a very dark gray or black near-surface layer at least 5 cm (2 in.) thick underlain by a layer where organic matter has been carried downward by flowing water. The mobilization and translocation of organic matter results in an even distribution of organic matter in the eluvial (E) horizon. The chroma 1 or less is critical because it limits application of this indicator to only those soils which are depleted of iron. This indicator commonly occurs in hydric Spodosols; however, a spodic horizon is not required. Concentrations in the E horizon (4/1) can support your call.

F1. Loamy Mucky Mineral. A mucky modified mineral layer 10 cm (4 in.) or more thick starting within 15 cm (6 in.) of the soil surface.

Loamy Mucky Mineral User Notes: *Mucky* is a USDA texture modifier for mineral soils. The organic carbon is at least 8 percent, but can range to as high as 18 percent. The percentage requirement is dependent upon the clay content of the soil; the higher the clay content, the higher the organic carbon requirement. An example is mucky sandy loam that has at least 8 percent organic carbon, but not more than about 14 percent organic carbon. See glossary for the definition of mucky modified mineral texture. *This indicator works well in LRR L.

F2. Loamy Gleyed Matrix. A gleyed matrix which occupies 60 percent or more of a layer starting within 30 cm (12 in.) of the soil surface.

Loamy Gleyed Matrix User Notes: Gley colors are not synonymous with gray colors. Gleyed colors are those colors that are found on the gleyed pages (Gretag/Macbeth, 2000). They have a hue of N, 10Y, 5GY, 10GY, 5G, 10G, 5BG, 10BG, 5B, 10B, or 5PB that have value 4 or more. The gleyed matrix only has to be present within 30 cm (12 in.) of the surface. Soils with gleyed matrices are saturated for a significant duration; this is why no thickness of the layer is required. See glossary for the definition of gleyed matrix.

F3. Depleted Matrix. A layer with a depleted matrix that has 60 percent or more chroma 2 or less that has a minimum thickness of either:

a. 5 cm (2 in.) if 5 cm (2 in.) is entirely within the upper 15 cm (6 in.) of the soil surface, or

b. 15 cm (6 in.) and starts within 25 cm (10 in.) of the soil surface.

Depleted Matrix User Notes: Redox concentrations including iron/manganese soft masses or pore linings, or both, are required in soils with matrix colors of 4/1, 4/2, or 5/2. 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 common or many, distinct or prominent redox concentrations as soft masses or pore linings are present. See glossary for the complete definition of a depleted matrix. The low chroma matrix must be caused by wetness and not be a relict or parent material feature. *This is the most common indicator in the Mid-Atlantic region. It fits the standard wet soil paradigm.

F4. Depleted Below Dark Surface. A layer with a depleted matrix that has 60 percent or more chroma 2 or less starting within 30 cm (12 in.) of the soil surface that has a minimum thickness of either:

a. 15 cm (6 in.), or

b. 5 cm (2 in.) if the 5 cm (2 in.) consists of fragmented soil material

The layer(s) above the depleted matrix have value 3 or less and chroma 2 or less.

Depleted Below Dark Surface User Notes: This indicator often occurs in Mollisols, but also applies to soils that have umbric epipedons and dark colored ochric epipedons. For soils that have dark colored epipedons greater than 30 cm (12 in.) thick, use indicator F5. Redox concentrations including iron/manganese soft masses, pore linings, or both, are required in soils that have a matrix color of 4/1, 4/2, or 5/2. A, E and calcic horizons may have low chromas and high values and may be mistaken for a depleted matrix. They are excluded, however, from the concept of a depleted matrix unless common or many, distinct or prominent redox concentrations as soft masses or pore linings are present. See glossary for definition of depleted matrix.

F5. Thick Dark Surface. A layer at least 15 cm (6 in.) thick with a depleted matrix that has 60 percent or more chroma 2 or less (or a gleyed matrix) starting below 30 cm (12 in.) of the surface. The layer(s) above the depleted or gleyed matrix have hue N and value 3 or less to a depth of 30 cm (12 in.) and value 3 or less and chroma 1 or less in the remainder of the epipedon.

Thick Dark Surface User Notes: The soil has a black or very dark gray surface layer 30 cm (12 in.) or more thick. The dark subsoil has value 3 or less, and chroma 1 or less. Below the dark colored epipedon is a depleted matrix or gleyed matrix. This indicator is most often associated with over-thickened soils in concave landscape positions. Redox concentrations including iron/manganese soft masses or pore linings, or both, are required in soils that have matrix colors 4/1, 4/2, or 5/2. A, E and calcic horizons may have low chromas and high values and may be mistaken for a depleted matrix. They are excluded, however, from the concept of a depleted matrix unless common or many, distinct or prominent redox concentrations as soft masses or pore linings are present. See glossary for definition of depleted matrix. *This indicator is seldom seen in the Mid-Atlantic region. Black colors should be due to humic materials and not to parent material (e.g. coal fines, black shale alluvium).

F6. Redox Dark Surface. A layer at least 10 cm (4 in.) thick entirely within the upper 30 cm (12 in.) of the mineral soil that has:

a. matrix value 3 or less and chroma 1 or less and 2 percent or more distinct or prominent redox concentrations as soft masses or pore linings, or

b. matrix value 3 or less and chroma 2 or less and 5 percent or more distinct or prominent redox concentrations as soft masses or pore linings.

Redox Dark Surface User Notes: Redox concentrations in high organic matter mineral soils that have dark surfaces are often difficult to see. The organic matter masks some or all of the concentrations that may be present. Careful examination is required to see what are often brownish mottles in the darkened materials. In some instances, drying of the sample makes the concentrations (if present) easier to see. Dried colors, if used, need to have matrix chromas of 1 or 2, and the redox concentrations need to be distinct or prominent.

In soils that are wet because of subsurface saturation, the layer immediately below the dark epipedon should have a depleted or gleyed matrix. Soils that are wet because of ponding or a shallow, perched layer of saturation may not always have a depleted/gleyed matrix below the dark surface. This morphology has been observed in soils that have been compacted by tillage or other means. It is recommended that delineators evaluate the hydrologic source and examine and describe the layer below the dark colored epipedon when applying this indicator. Redox concentrations including iron/manganese masses or pore linings, or both, are required in soils that have matrix colors of 4/1, 4/2, or 5/2. 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 common or many, distinct or prominent redox concentrations as soft masses or pore linings are present.

F7. Depleted Dark Surface. Redox depletions, with value 5 or more and chroma 2 or less, in a layer at least 10 cm (4 in.) thick entirely within the upper 30 cm (12 in.) of the mineral soil that has:

a. matrix value 3 or less and chroma 1 or less and 10 percent or more redox depletions, or

b. matrix value 3 or less and chroma 2 or less and 20 percent or more redox depletions.

Depleted Dark Surface User Notes: Care should be taken not to mistake mixing of an E or calcic horizon into the surface layer as depletions. The pieces of E and calcic horizons are not redox

depletions. Knowledge of local conditions is required in areas where E and/or calcic horizons may be present. In soils which are wet because of subsurface saturation, the layer immediately below the dark surface should have a depleted or gleyed matrix. Redox depletions should have associated microsites of redox concentrations that occur as Fe pore linings or masses within the depletion(s) or surrounding the depletion(s).

F8. Redox Depressions. In closed depressions subject to ponding, 5 percent or more distinct or prominent redox concentrations as soft masses or pore linings in a layer 5 cm (2 in.) or more thick entirely within the upper 15 cm (6 in.) of the soil surface.

Redox Depressions User Notes: This indicator occurs on depressional landforms such as vernal pools, sinkholes, kettles, Delmarva Bays (whale wallows, Carolina bays), sloughs and backswamp areas on flood plains, but not microdepressions (small puddles) on convex or plane landscapes.

TS5. Chroma 3 Sandy Redox. A layer starting within 15 cm (6 in.) of the soil surface that is at least 10 cm (4 in.) thick and has a matrix chroma 3 or less with 2 percent or more distinct or prominent redox concentrations as soft masses and/or pore linings.

Chroma 3 Sandy Redox User Notes: Redox Concentrations include iron and manganese masses (reddish mottles) and pore linings (Vepraskas, 1994). Included within this concept of redox concentrations are iron/manganese bodies as soft masses with diffuse boundaries. The iron/manganese masses are 2 to 5 mm (0.08 to 0.2 in) and have a value 3 or less and a chroma 3 or less; most commonly they are black. Iron/manganese masses should not be confused with the larger and redder iron nodules associated with plinthitic soils or relict concretions (USDA, NRCS, Soil Survey Staff, 1999). Common to many redox concentrations (USDA, NRCS, 1998a) are required.

TF2. Red Parent Material. In parent material with a hue of 7.5YR or redder, a layer at least 10 cm (4 in.) thick with a matrix value 4 or less and chroma 4 or less and 2 percent or more redox depletions and/or redox concentrations as soft masses and/or pore linings. The layer is entirely within 30 cm (12 in.) of the soil surface. The minimum thickness requirement is 5 cm (2 in.) if the layer is the mineral surface layer.

Red Parent Material User Notes: This indicator was developed for use in areas of red parent material, such as Triassic/Jurassic sediments in the Piedmont and Ridge and Valley, red shales, red mudstones, or red sandstones of the Hampshire and Mauch Chunck formations in Maryland, West Virginia and Pennsylvania, and in alluvium and colluvium from these areas. If you are unsure whether you may be in Red Parent material, talk to the local NRCS soils scientist. Redox features most noticeable in Red Parent material include redox depletions and soft manganese masses that are black or dark reddish black.

TF7. Thick Dark Surface 2/1. A layer at least 15 cm (6 in.) thick with a depleted matrix that has 60 percent or more chroma 2 or less (or a gleyed matrix) starting below 30 cm (12 in.) of the soil surface. The layer(s) above the depleted or gleyed matrix have hue of 10YR or yellower, value 2.5 or less and chroma 1 or less to a depth of 30 cm (12 in.) and value 3 or less and chroma 1 or less in the remainder of the epipedon.

Thick Dark Surface 2/1 User Notes: The soil has a black surface layer 30 cm (12 in.) or more thick. The dark subsoil has value of 3 or less and chroma 1. Below the mollic (umbric) epipedon is a depleted matrix or gleyed matrix. This indicator is most often associated with over-thickened soils in concave landscape positions. Further testing is needed to determine if cumulic soil that has a surface hue of 10YR or yellower is hydric. Testing notes need to indicate on what landscape positions this indicator falls. It may be necessary to limit this indicator to concave landscapes.

LRR - N

A1, A2, A3, A4, A5, A10, S1, S4, S5, S6, S7, F2, F3, F4, F5, F6, F7, F8, F12, TF2, TF4, TF7, TF10.

***Unless otherwise indicated, all mineral layers above any of the dominant indicators have a dominant chroma 2 or less, or the layer(s) with dominant chroma of 2 or more is less than 15 cm (6 in.) thick.**

A1. Histosol or Histel. Classifies as a Histosol (except Folist) or as a Histel (except Folistel).

Histosol User Notes: A Histosol has 40 cm (16 in.) or more of the upper 80 cm (32 in.) as organic soil material. Organic soil material has an organic carbon content (by weight) of 12 to 18 percent or more, depending on the clay content of the soil. The materials includes muck (sapric soil material), mucky peat (hemic soil material), or peat (fibric soil material). See glossary for definition of muck, mucky peat, peat, and organic soil material. Histels are similar to Histosols except that they are underlain by permafrost.

A2. Histic Epipedon. A Histic epipedon.

Histic Epipedon User Notes: Most Histic epipedons are surface horizons 20 cm (8 in.) or more thick of organic soil material. Aquic conditions or artificial drainage are required. See Soil Taxonomy (USDA, NRCS, Soil Survey Staff, 1999). Slightly lower organic carbon contents are allowed in plowed soils (ibid). See glossary for definitions.

A3. Black Histic. A layer of peat, mucky peat, or muck 20 cm (8 in.) or more thick starting within the upper 15 cm (6 in.) of the soil surface having hue 10YR or yellower, value 3 or less, and chroma 1 or less.

Black Histic User Notes: Unlike indicator A2, this indicator does not require proof of aquic conditions or artificial drainage. See glossary for definitions of muck, mucky peat, and peat.

A4. Hydrogen Sulfide. A hydrogen sulfide odor within 30 cm (12 in.) of the soil surface.

Hydrogen Sulfide User Notes: The rotten egg smell indicates that sulfate-sulfur has been reduced, and therefore the soil is anaerobic. In most hydric soils the sulfidic odor is only present when the soil is saturated and anaerobic. Most commonly found in brackish or marine environments. When sulfides are oxidized you can see pyrite with a hand lens.

A5. Stratified Layers. Several stratified layers starting within the upper 15 cm (6 in.) of the soil surface. One or more of the layers has value 3 or less with chroma 1 or less and/or it is muck, mucky peat, peat, or mucky modified mineral texture. The remaining layers have value 4 or more and chroma 2 or less.

Stratified Layers User Notes: Use of this indicator may require assistance from a trained soil scientist that has local experience. The minimum organic carbon content of at least one layer of this indicator is slightly less than required for indicator A7 Mucky Modified Mineral Texture. An undisturbed sample must be observed. Individual strata are dominantly less than 2.5 cm (1 in.) thick. A hand lens is an excellent tool to aid in the identification of this indicator. Many alluvial soils have stratified layers at the required depths, but lack chroma 2 or less; these do not fit this indicator. Stratified layers occur in any type soil material.
*This indicator has not been observed in the Mid-Atlantic region.

A10. 2 cm Muck. A layer of muck 2 cm (0.75 in.) or more thick with value 3 or less and chroma 1 or less starting within 15 cm (6 in.) of the soil surface.

2 cm Muck User Notes: Normally this expression of anaerobiosis is at the soil surface; however, it may occur at any depth within 15 cm (6 in.). Muck is sapric soil material with at least 12 to 18 percent organic carbon. Organic soil material is called muck (sapric soil material) if virtually all of the material has undergone sufficient decomposition to limit recognition of the plant parts. Hemic (mucky peat) and fibric (peat) soil materials do not qualify. To determine if muck is present, first remove loose leaves, needles, bark, and other easily identified plant remains. This is sometimes called the leaf/root mat or duff. Then, examine for decomposed organic soil material. Generally muck is black and has a “greasy” feel; sand grains should not be evident. By definition, organic soil material accumulates due to long periods of saturation.

S1. Sandy Mucky Mineral. A mucky modified mineral surface layer 5 cm (2 in.) or more thick starting within 15 cm (6 in.) of the soil surface.

Sandy Mucky Mineral User Notes: *Mucky* is a USDA texture modifier for mineral soils. The organic carbon content is at least 5 percent and ranges as high as 14 percent for sandy soils. The percentage requirement is dependent upon the clay content of the soil; the higher the clay content, the higher the organic carbon requirement. An example is mucky fine sand that has at least 5 percent organic carbon, but not more than about 12 percent carbon. See glossary for definition of mucky modified mineral texture.

S4. Sandy Gleyed Matrix. A gleyed matrix which occupies 60 percent or more of a layer within 15 cm (6 in.) of the soil surface.

Sandy Gleyed Matrix User Notes: Gley colors are not synonymous with gray colors. Gley colors are those colors that are found on the gley page (Gretag/Macbeth, 2000). They have a hue of N, 10Y, 5GY, 10GY, 5G, 10G, 5BG, 10BG, 5B, 10B, or 5PB that have value 4 or more. The gleyed matrix only has to be present within 15 cm (6 in.) of the surface. Soils with gleyed matrices are commonly saturated for very long (1 month) duration; this is why no thickness of the layer is required. See glossary for definition of gleyed matrix. Gleyed matrices are commonly reduced matrices and will change color upon exposure to air.

S5. Sandy Redox. A layer starting within 15 cm (6 in.) of the soil surface that is at least 10 cm (4 in.) thick, and has a matrix with 60 percent or more chroma 2 or less with 2 percent or more distinct or prominent redox concentrations as soft masses and/or pore linings.

Sandy Redox User Notes: Distinct and prominent are defined in the glossary. Redox concentrations include iron and manganese masses (reddish mottles) and pore linings (Vepraskas, 1994). Included within this concept of redox concentrations are iron/manganese bodies as soft masses with diffuse boundaries. The iron/manganese masses are 2 to 5 mm (0.08 to 0.2 in.) and have value 3 or less and chroma 3 or less; most commonly they are black. Iron/manganese masses should not be confused with concentrations and nodules associated with plinthitic (USDA, NRCS, Soil Survey Staff, 1999) or relict concretions. Common to many redox concentrations (USDA, NRCS, 1998a) are required. Caution should be used when using this indicator in disturbed landscapes where compaction has occurred. Compaction may result in the formation of concentrations.

S6. Stripped Matrix. A layer starting within 15 cm (6 in.) of the soil surface in which iron/manganese oxides and/or organic matter have been stripped from the matrix exposing the primary base color of soil materials. The stripped areas and translocated oxides and/or organic matter form a diffuse splotchy pattern of two or more colors. The stripped zones are 10 percent or more of the volume; they are rounded, and approximately 1 to 3 cm (0.5 to 1 in.) in diameter.

Stripped Matrix User Notes: This indicator includes the indicator *streaking* (Environmental Laboratory, 1987) Common to many (USDA, Soil Survey Division Staff, 1993) areas of stripped (uncoated) soil materials 1 to 3 cm (0.5 to 1 in.) in size is a requirement. Commonly the splotches of color have value 5 or more and chroma 1 and/or 2 (stripped) and chroma 3 and/or 4 (unstripped). The matrix may lack the 3 and/or 4 chroma material. The mobilization and translocation of the oxides and/or organic matter is the important process and should result in splotchy coated and uncoated soil areas. The stripped zones are usually associated with fine

roots. Wet soils with thick dark surfaces that have been drained may have a similar look to the stripped matrix as the organic matter starts to oxidize. A clean face should be described to ensure that splotches are not created through smearing and mixing in the excavation process.

*Stripped Matrices have not been observed in the Mid-Atlantic region, but they are typically below 15 cm (6 in.) and do not meet this indicator.

S7. Dark Surface. A layer 10 cm (4 in.) or more thick starting within the upper 15 cm (6 in.) of the soil surface with a matrix value 3 or less and chroma 1 or less. At least 70 percent of the visible soil particles must be covered, coated, or similarly masked with organic material. The matrix color of the layer immediately below the dark layer must have chroma 2 or less.

Dark Surface User Notes: The organic carbon content of this indicator is slightly less than required for mucky. An undisturbed sample must be observed. A 10X or 15X hand lens is an excellent tool to help aid in this decision. Many wet soils have a ratio of about 50 percent soil particles that are covered or coated with organic matter and about 50 percent uncoated or uncovered soil particles, giving the soil a salt and pepper appearance. Where the percentage is less than 70 percent, a Dark Surface indicator is not present. Only 10 cm (4in.) of a value of 3 or less and chroma of 1 or less is required for this indicator. If a value of 3 or less and chroma 1 or less extends below 10 cm (4 in.), the soil meets this indicator. In cropped fields, you may get artificial segregation of sand grains due to plowing. Although the soil will not meet this indicator due to lack of 70 percent coated and covered sand grains, you may want to dig deeper than plow layer or use a soil in an adjacent undisturbed reference area to assess if the soil is hydric.

F2. Loamy Gleyed Matrix. A gleyed matrix which occupies 60 percent or more of a layer starting within 30 cm (12 in.) of the soil surface.

Loamy Gleyed Matrix User Notes: Gley colors are not synonymous with gray colors. Gleyed colors are those colors that are found on the gleyed pages (Gretag/Macbeth, 2000). They have a hue of N, 10Y, 5GY, 10GY, 5G, 10G, 5BG, 10BG, 5B, 10B, or 5PB that have value 4 or more. The gleyed matrix only has to be present within 30 cm (12 in.) of the surface. Soils with gleyed matrices are saturated for a significant duration; this is why no thickness of the layer is required. See glossary for the definition of gleyed matrix.

F3. Depleted Matrix. A layer with a depleted matrix that has 60 percent or more chroma 2 or less that has a minimum thickness of either:

a. 5 cm (2 in.) if 5 cm (2 in.) is entirely within the upper 15 cm (6 in.) of the soil surface, or

b. 15 cm (6 in.) and starts within 25 cm (10 in.) of the soil surface.

Depleted Matrix User Notes: Redox concentrations including iron/manganese soft masses or pore linings, or both, are required in soils with matrix colors of 4/1, 4/2, or 5/2. 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 common or many, distinct or prominent redox concentrations as soft masses or pore linings are present. See glossary for the complete definition of a depleted matrix. The low chroma matrix must be caused by wetness and not be a relict or parent material feature. *This is the most common indicator in the Mid-Atlantic region. It fits the standard wet soil paradigm.

F4. Depleted Below Dark Surface. A layer with a depleted matrix that has 60 percent or more chroma 2 or less starting within 30 cm (12 in.) of the soil surface that has a minimum thickness of either:

a. 15 cm (6 in.), or

b. 5 cm (2 in.) if the 5 cm (2 in.) consists of fragmented soil material

The layer(s) above the depleted matrix have value 3 or less and chroma 2 or less.

Depleted Below Dark Surface User Notes: This indicator often occurs in Mollisols, but also applies to soils that have umbric epipedons and dark colored ochric epipedons. For soils that have dark colored epipedons greater than 30 cm (12 in.) thick, use indicator F5. Redox concentrations including iron/manganese soft masses, pore linings, or both, are required in soils that have a matrix color of 4/1, 4/2, or 5/2. A, E and calcic horizons may have low chromas and high values and may be mistaken for a depleted matrix. They are excluded, however, from the concept of a depleted matrix unless common or many, distinct or prominent redox concentrations as soft masses or pore linings are present. See glossary for definition of depleted matrix.

F5. Thick Dark Surface. A layer at least 15 cm (6 in.) thick with a depleted matrix that has 60 percent or more chroma 2 or less (or a gleyed matrix) starting below 30 cm (12 in.) of the surface. The layer(s) above the depleted or gleyed matrix have hue N and value 3 or less to a depth of 30 cm (12 in.) and value 3 or less and chroma 1 or less in the remainder of the epipedon.

Thick Dark Surface User Notes: The soil has a black or very dark gray surface layer 30 cm (12 in.) or more thick. The dark subsoil has value 3 or less, and chroma 1 or less. Below the dark colored epipedon is a depleted matrix or gleyed matrix. This indicator is most often associated with over-thickened soils in concave landscape positions. Redox concentrations including iron/manganese soft masses or pore linings, or both, are required in soils that have matrix colors 4/1, 4/2, or 5/2. A, E and calcic horizons may have low chromas and high values and may be mistaken for a depleted matrix. They are excluded, however, from the concept of a depleted matrix unless common or many, distinct or prominent redox concentrations as soft masses or pore linings are present. See glossary for definition of depleted matrix. *This indicator is seldom seen in the Mid-Atlantic region. Black colors should be due to humic materials and not to parent material (e.g. coal fines, black shale alluvium).

F6. Redox Dark Surface. A layer at least 10 cm (4 in.) thick entirely within the upper 30 cm (12 in.) of the mineral soil that has:

a. matrix value 3 or less and chroma 1 or less and 2 percent or more distinct or prominent redox concentrations as soft masses or pore linings, or

b. matrix value 3 or less and chroma 2 or less and 5 percent or more distinct or prominent redox concentrations as soft masses or pore linings.

Redox Dark Surface User Notes: Redox concentrations in high organic matter mineral soils that have dark surfaces are often difficult to see. The organic matter masks some or all of the concentrations that may be present. Careful examination is required to see what are often brownish mottles in the darkened materials. In some instances, drying of the sample makes the concentrations (if present) easier to see. Dried colors, if used, need to have matrix chromas of 1 or 2, and the redox concentrations need to be distinct or prominent.

In soils that are wet because of subsurface saturation, the layer immediately below the dark epipedon should have a depleted or gleyed matrix. Soils that are wet because of ponding or a shallow, perched layer of saturation may not always have a depleted/gleyed matrix below the dark surface. This morphology has been observed in soils that have been compacted by tillage or other means. It is recommended that delineators evaluate the hydrologic source and examine and

describe the layer below the dark colored epipedon when applying this indicator. Redox concentrations including iron/manganese masses or pore linings, or both, are required in soils that have matrix colors of 4/1, 4/2, or 5/2. 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 common or many, distinct or prominent redox concentrations as soft masses or pore linings are present.

F7. Depleted Dark Surface. Redox depletions, with value 5 or more and chroma 2 or less, in a layer at least 10 cm (4 in.) thick entirely within the upper 30 cm (12 in.) of the mineral soil that has:

a. matrix value 3 or less and chroma 1 or less and 10 percent or more redox depletions, or

b. matrix value 3 or less and chroma 2 or less and 20 percent or more redox depletions.

Depleted Dark Surface User Notes: Care should be taken not to mistake mixing of an E or calcic horizon into the surface layer as depletions. The pieces of E and calcic horizons are not redox depletions. Knowledge of local conditions is required in areas where E and/or calcic horizons may be present. In soils which are wet because of subsurface saturation, the layer immediately below the dark surface should have a depleted or gleyed matrix. Redox depletions should have associated microsites of redox concentrations that occur as Fe pore linings or masses within the depletion(s) or surrounding the depletion(s).

F8. Redox Depressions. In closed depressions subject to ponding, 5 percent or more distinct or prominent redox concentrations as soft masses or pore linings in a layer 5 cm (2 in.) or more thick entirely within the upper 15 cm (6 in.) of the soil surface.

Redox Depressions User Notes: This indicator occurs on depressional landforms such as vernal pools, sinkholes, kettles, Delmarva Bays (whale wallows, Carolina bays), sloughs and backswamp areas on flood plains, but not microdepressions (small puddles) on convex or plane landscapes.

F12. Iron/Manganese Masses. On flood plains, a layer 10 cm (4 in.) or more thick with 40 percent or more chroma 2 or less, and 2 percent or more distinct or prominent redox concentrations as soft iron/manganese masses with diffuse boundaries. The layer occurs entirely within 30 cm (12 in.) of the soil surface. Iron/manganese masses have value 3 or less and chroma 3 or less; most commonly they are black. The thickness requirement is waived if the layer is the mineral surface layer.

Iron/Manganese Masses User Notes: These iron/manganese masses are usually small (2 to 5 mm (0.08 to 0.2 in.) and have a value and chroma 3 or less. They can be black. The low chroma is because of wetness and is not a relict or parent material feature. Iron/manganese masses should not be confused with the larger and redder iron nodules associated with plinthite (USDA, NRCS, 1998a) or with concentrations that have sharp boundaries. This indicator occurs on flood plains of rivers such as the Youghiogheny River.

TF2. Red Parent Material. In parent material with a hue of 7.5YR or redder, a layer at least 10 cm (4 in.) thick with a matrix value 4 or less and chroma 4 or less and 2 percent or more redox depletions and/or redox concentrations as soft masses and/or pore linings. The layer is entirely within 30 cm (12 in.) of the soil surface. The minimum thickness requirement is 5 cm (2 in.) if the layer is the mineral surface layer.

Red Parent Material User Notes: This indicator was developed for use in areas of red parent material, such as Triassic/Jurassic sediments in the Piedmont and Ridge and Valley, red shales, red mudstones, or red sandstones of the Hampshire and Mauch Chunck formations in Maryland, West Virginia and Pennsylvania, and in alluvium and colluvium from these areas. If you are unsure whether you may be in Red Parent material, talk to the local NRCS soils scientist. Redox features most noticeable in Red Parent material include redox depletions and soft manganese masses that are black or dark reddish black.

TF4. 2.5Y/ 5Y Below Dark Surface. A layer at least 15 cm (6 in.) thick with 60 percent or more hue 2.5Y or yellower, value 4 or more, and chroma 1; or hue 5Y or yellower, value 4 or more, and chroma 2 or less starting within 30 cm (12 in.) of the soil surface. The layer(s) above the 2.5Y/5Y layer have value 3 or less and chroma 2 or less.

2.5Y/5Y Below Dark Surface User Notes: Further testing is required to investigate whether these colors below a Mollic epipedon are indicative of wetness.

TF7. Thick Dark Surface 2/1. A layer at least 15 cm (6 in.) thick with a depleted matrix that has 60 percent or more chroma 2 or less (or a gleyed matrix) starting below 30 cm (12 in.) of the soil surface. The layer(s) above the depleted or gleyed matrix have hue of 10YR or yellower, value 2.5 or less and chroma 1 or less to a depth of 30 cm (12 in.) and value 3 or less and chroma 1 or less in the remainder of the epipedon.

Thick Dark Surface 2/1 User Notes: The soil has a black surface layer 30 cm (12 in.) or more thick. The dark subsoil has value of 3 or less and chroma 1. Below the mollic (umbric) epipedon is a depleted matrix or gleyed matrix. This indicator is most often associated with over-thickened soils in concave landscape positions. Further testing is needed to determine if cumulic soil that has a surface hue of 10YR or yellower is hydric. Testing notes need to indicate

on what landscape positions this indicator falls. It may be necessary to limit this indicator to concave landscapes.

TF10. Alluvial depleted matrix. **On frequently flooded flood plains, a layer with a matrix that has 60 percent or more chroma 3 or less with 2 percent redox concentrations as soft iron masses, starting within 15 cm (6 in.) of the soil surface and extending to a depth of more than 30 cm (12 in.).**

LRR - P

A1, A2, A3, A4, A5, A6, A7, A9, S1, S4, S5, S6, S7, F2, F3, F4, F5, F6, F7, F8, F12, F13, TF2, TF4.

***Unless otherwise indicated, all mineral layers above any of the dominant indicators have a dominant chroma 2 or less, or the layer(s) with dominant chroma of 2 or more is less than 15 cm (6 in.) thick.**

A1. Histosol or Histel. Classifies as a Histosol (except Folist) or as a Histel (except Folistel).

Histosol User Notes: A Histosol has 40 cm (16 in.) or more of the upper 80 cm (32 in.) as organic soil material. Organic soil material has an organic carbon content (by weight) of 12 to 18 percent or more, depending on the clay content of the soil. The materials includes muck (sapric soil material), mucky peat (hemic soil material), or peat (fibric soil material). See glossary for definition of muck, mucky peat, peat, and organic soil material. Histels are similar to Histosols except that they are underlain by permafrost.

A2. Histic Epipedon. A Histic epipedon.

Histic Epipedon User Notes: Most Histic epipedons are surface horizons 20 cm (8 in.) or more thick of organic soil material. Aquic conditions or artificial drainage are required. See Soil Taxonomy (USDA, NRCS, Soil Survey Staff, 1999). Slightly lower organic carbon contents are allowed in plowed soils (ibid). See glossary for definitions.

A3. Black Histic. A layer of peat, mucky peat, or muck 20 cm (8 in.) or more thick starting within the upper 15 cm (6 in.) of the soil surface having hue 10YR or yellower, value 3 or less, and chroma 1 or less.

Black Histic User Notes: Unlike indicator A2, this indicator does not require proof of aquic conditions or artificial drainage. See glossary for definitions of muck, mucky peat, and peat.

A4. Hydrogen Sulfide. A hydrogen sulfide odor within 30 cm (12 in.) of the soil surface.

Hydrogen Sulfide User Notes: The rotten egg smell indicates that sulfate-sulfur has been reduced, and therefore the soil is anaerobic. In most hydric soils the sulfidic odor is only present when the soil is saturated and anaerobic. Most commonly found in brackish or marine environments. When sulfides are oxidized you can see pyrite with a hand lens.

A5. Stratified Layers. Several stratified layers starting within the upper 15 cm (6 in.) of the soil surface. One or more of the layers has value 3 or less with chroma 1 or less and/or it is muck, mucky peat, peat, or mucky modified mineral texture. The remaining layers have value 4 or more and chroma 2 or less.

Stratified Layers User Notes: Use of this indicator may require assistance from a trained soil scientist that has local experience. The minimum organic carbon content of at least one layer of this indicator is slightly less than required for indicator A7 Mucky Modified Mineral Texture. An undisturbed sample must be observed. Individual strata are dominantly less than 2.5 cm (1 in.) thick. A hand lens is an excellent tool to aid in the identification of this indicator. Many alluvial soils have stratified layers at the required depths, but lack chroma 2 or less; these do not fit this indicator. Stratified layers occur in any type soil material.
*This indicator has not been observed in the Mid-Atlantic region.

A6. Organic Bodies. Presence of 2 percent or more organic bodies of muck or a mucky modified mineral texture, approximately 1 to 3 cm (0.5 to 1 in.) in diameter, starting within 15 cm (6 in.) of the soil surface.

Organic Bodies User Notes: The percent organic carbon in organic bodies is the same as that in the Muck or Mucky Modified Texture indicators. Many organic bodies do not have the required amount of organic carbon and are not indicative of hydric soils. The content of organic carbon should be known before the indicator is used. Organic bodies of hemic (mucky peat) or fibric (peat) soil materials, or both, do not qualify as this indicator. Material consisting of partially decomposed root tissue does not qualify as this indicator. The organic bodies are associated with the tips of fine roots and can most easily be seen by carefully removing the roots to see if the organic bodies are attached. *This indicator has only been observed in the Mid-Atlantic region in soils that also met another Field Indicator.

A7. 5 cm Mucky Mineral. A mucky modified mineral surface layer 5 cm (2 in.) or more thick starting within 15 cm (6 in.) of the soil surface.

5 cm Mucky Mineral User Notes: *Mucky* is a USDA texture modifier for mineral soil. The organic carbon content is at least 5 percent and ranges as high as 18 percent. The percentage requirement is dependent upon the clay content of the soil; the higher the clay content, the higher the organic carbon requirement. An example is mucky fine sand that has at least 5 percent organic carbon, but no more than about 12 percent organic carbon. Another example is mucky sandy loam that has at least 7 percent organic carbon, but no more than about 14 percent organic carbon. See the glossary for definition of mucky modified mineral texture. Mucky modified mineral textures can be difficult to identify, therefore an experienced soil scientist can be helpful to confirm this indicator.

A9. 1 cm Muck. A layer of muck 1 cm (0.5 in.) or more thick with value 3 or less and chroma 1 or less starting within 15 cm (6 in.) of the soil surface.

1 cm Muck User Notes: Normally this expression of anaerobiosis is at the soil surface; however, it may occur at any depth within 15 cm (6 in.). Muck is sapric soil material with at least 12 to 18 percent organic carbon. Organic soil material is called muck (sapric soil material) if virtually all of the material has undergone sufficient decomposition to limit recognition of the plant parts. Hemic (mucky peat) and fibric (peat) soil material do not qualify. To determine if muck is present, first remove loose leaves, needles, bark, and other easily identified plant remains. This is sometimes called the leaf/root mat or duff. Then, examine for decomposed organic soil material. Generally, muck is black and has a greasy feel; sand grains should not be evident.

S1. Sandy Mucky Mineral. A mucky modified mineral surface layer 5 cm (2 in.) or more thick starting within 15 cm (6 in.) of the soil surface.

Sandy Mucky Mineral User Notes: *Mucky* is a USDA texture modifier for mineral soils. The organic carbon content is at least 5 percent and ranges as high as 14 percent for sandy soils. The percentage requirement is dependent upon the clay content of the soil; the higher the clay content, the higher the organic carbon requirement. An example is mucky fine sand that has at least 5 percent organic carbon, but not more than about 12 percent carbon. See glossary for definition of mucky modified mineral texture.

S4. Sandy Gleyed Matrix. A gleyed matrix which occupies 60 percent or more of a layer within 15 cm (6 in.) of the soil surface.

Sandy Gleyed Matrix User Notes: Gley colors are not synonymous with gray colors. Gley colors are those colors that are found on the gley page (Gretag/Macbeth, 2000). They have a hue of N, 10Y, 5GY, 10GY, 5G, 10G, 5BG, 10BG, 5B, 10B, or 5PB that have value 4 or more. The gleyed matrix only has to be present within 15 cm (6 in.) of the surface. Soils with gleyed matrices are commonly saturated for very long (1 month) duration; this is why no thickness of the layer is required. See glossary for definition of gleyed matrix. Gleyed matrices are commonly reduced matrices and will change color upon exposure to air.

S5. Sandy Redox. A layer starting within 15 cm (6 in.) of the soil surface that is at least 10 cm (4 in.) thick, and has a matrix with 60 percent or more chroma 2 or less with 2 percent or more distinct or prominent redox concentrations as soft masses and/or pore linings.

Sandy Redox User Notes: Distinct and prominent are defined in the glossary. Redox concentrations include iron and manganese masses (reddish mottles) and pore linings (Vepraskas, 1994). Included within this concept of redox concentrations are iron/manganese