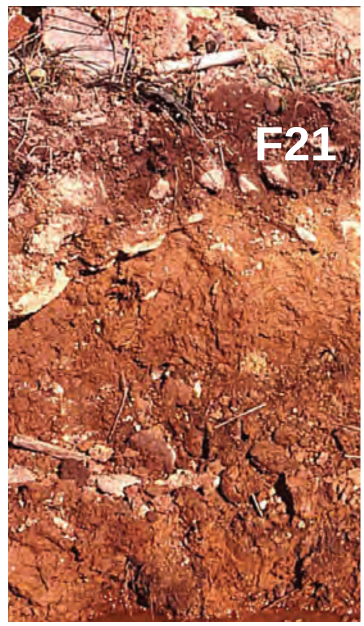
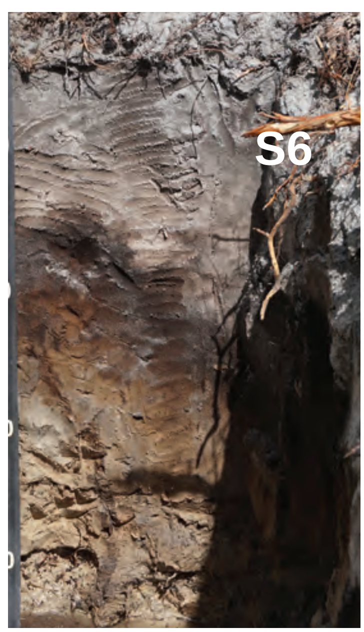
Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

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 9.3, 2026





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A Guide for Identifying and Delineating Hydric Soils
Version 9.3, 2026
(including revisions to versions 9.0, 9.1, and 9.2)

United States Department of Agriculture,
Natural Resources Conservation Service,
in cooperation with the
National Technical Committee for Hydric Soils

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Cover: A variety of hydric soil profiles meeting a field indicator of hydric soils. The top row of pictures from left to right represent S7, Dark Surface; A11, Depleted Below Dark Surface; F21, Red Parent Material; and A3, Black Histic. The bottom row from left to right represent A1, Histosol; F3, Depleted Matrix; S6, Stripped Matrix; and A18, Iron Monosulfide.

Foreword

“Field Indicators of Hydric Soils in the United States” has been developed by soil scientists of the Natural Resources Conservation Service (NRCS) in cooperation with the U.S. Fish and Wildlife Service; the U.S. Army Corps of Engineers; the Environmental Protection Agency; various regional, State, and local agencies; universities; and the private sector. The editors recognize that this guide could not have been developed without the efforts of many individuals. Included in this publication are the hydric soil indicators approved by the NRCS and the National Technical Committee for Hydric Soils (NTCHS) for use in identifying, delineating, and verifying hydric soils in the field.

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Introduction

"Field Indicators of Hydric Soils in the United States" is a guide to help identify and delineate hydric soils in the field (fig. 1). Field indicators are not intended to replace or modify the requirements contained in the definition of a hydric soil. Proper use of the indicators requires a basic knowledge of soil-landscape relationships and soil survey procedures. The National Technical Committee for Hydric Soils (NTCHS) defines a hydric soil as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part ("Changes in Hydric Soils of the United States, 60 Fed. Reg. 10349," 1995). Most hydric soils exhibit characteristic morphologies that result from repeated periods of saturation or inundation that last more than a few days.

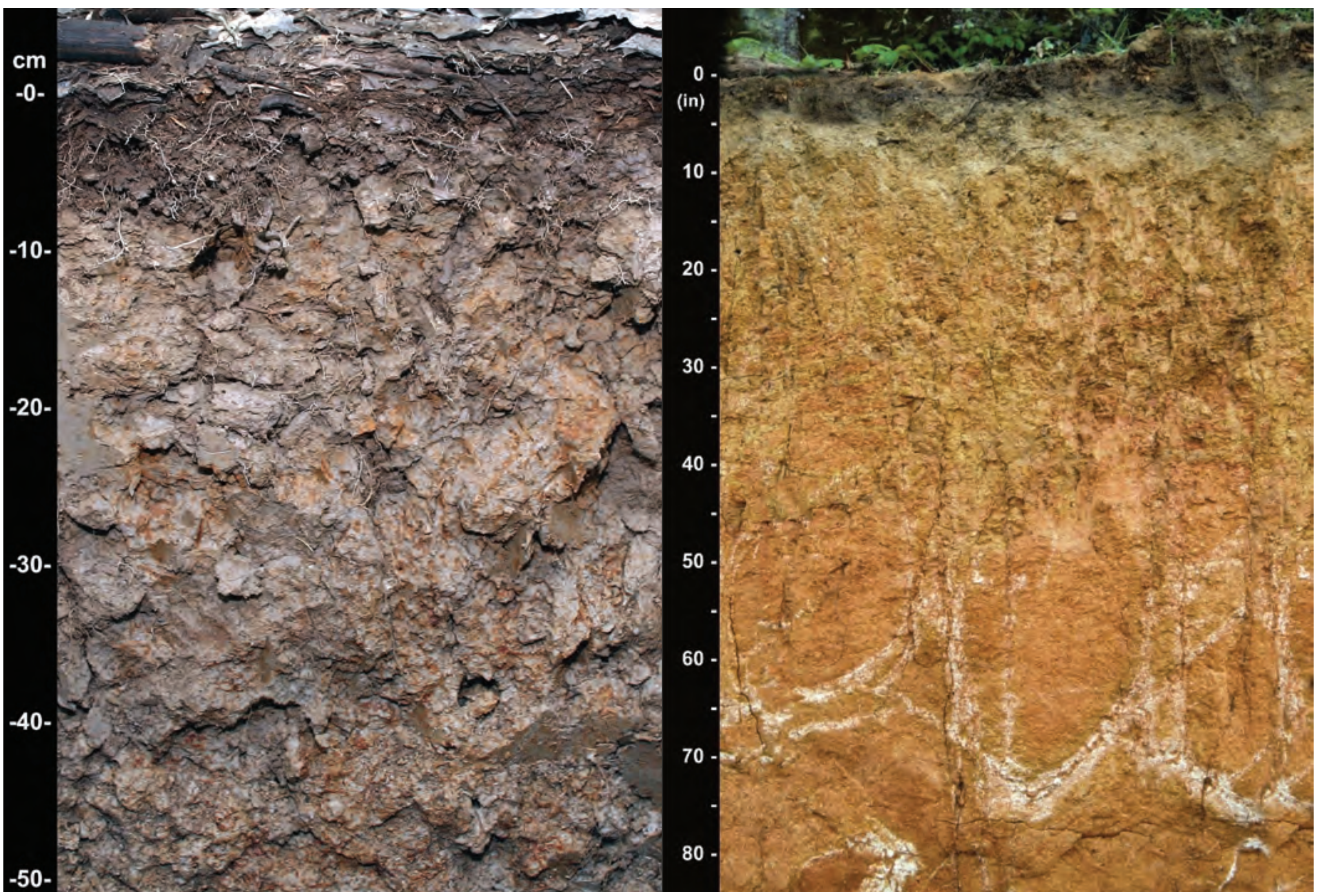

Figure 1.—The soil on the left is a hydric soil. It meets the requirements of indicator F3, Depleted Matrix. The soil on the right has indicators of wetness (redox depletions) too deep in the soil profile to meet the requirements of any field indicator and does not meet the definition of a hydric soil.

Saturation or inundation, when combined with microbial activity in the soil, causes the depletion of oxygen. Prolonged anaerobic conditions promote certain biogeochemical processes, such as the accumulation of organic matter, denitrification, and the chemical transformation and translocation of oxidized iron, manganese, and sulfur species as these compounds become reduced. These processes indicate that wetland functions are occurring within the soil and result in distinctive characteristics that persist during both wet and dry periods that are useful for identifying hydric soils in the field. The indicators are used to identify the hydric soil component of wetlands; however, there are some hydric soils that lack any of the currently approved indicators. Therefore, the failure to meet the requirements of an indicator does not prevent classification of the soil as hydric. Such soils can be observed and documented, and repeated morphologies may be used to develop a new field indicator for inclusion in this guide.

The indicators are designed to be regionally specific. The description of each indicator identifies the land resource regions (LRRs) and major land resource areas (MLRAs) in which the indicator can be applied. The geographic extent of LRRs and MLRAs is defined in “U.S. Department of Agriculture Handbook 296” (USDA, NRCS, 2022). See the map of LRRs (see figs. 6 and 7) and the list of LRR-specific indicators (Appendices 1 and 2).

The list of indicators is dynamic; changes and additions are anticipated with new research and field testing. The section “To Comment on the Indicators” (see p. 7) provides guidance on how to recommend updates and other edits. Any modifications to the indicators must be approved by NRCS and the NTCHS. The user of this guidance is required to check the current version of the indicators, available on the NTCHS web page.

Concept

Hydric soil indicators are formed predominantly by the accumulation, loss, or redistribution of manganese, iron, sulfur, or carbon compounds under saturated and anaerobic conditions. The processes and the soil features that develop under these conditions are described in the following paragraphs.

Iron and Manganese Reduction, Translocation, and Accumulation

In an anaerobic environment, soil microbes reduce iron from the ferric (Fe^{3+}) to the ferrous (Fe^{2+}) form and manganese from the manganic (Mn^{4+}) to the manganous (Mn^{2+}) form. Of the two, evidence of iron reduction is observed more widespread in soils due to the relatively strong appearance of even small amounts of its rust-colored pigments that ferric minerals impart on the soil matrix (predominant color).

Areas in the soil where iron is reduced often develop characteristic bluish-gray or greenish-gray colors known as gley (colors with value of 4 or more on the gley pages in the “Munsell Soil Color Book” (X-Rite, 2009)). Ferric iron is insoluble, but ferrous iron enters the soil solution where it may be moved or translocated to other areas of the soil. Areas that have lost iron typically develop characteristic gray or reddish-gray colors and are known as redox depletions.

If a soil reverts to an aerobic state, iron that is in solution will oxidize and become concentrated in patches as soft masses and along root channels or other pores. These areas of oxidized iron are called redox concentrations. Since water movement in these saturated or inundated soils can be multidirectional, redox depletions and concentrations can occur anywhere in the soil and have irregular shapes and sizes. Soils that are saturated and contain ferrous iron at the time of sampling may change color upon exposure to the air, as ferrous iron is rapidly converted to ferric iron in the presence of oxygen. Such soils are said to have a reduced matrix (Vepraskas, 1994). Redox concentrations, depletions, and reduced matrices are collectively referred to as redoximorphic features.

While indicators related to iron (Fe) or manganese (Mn) depletions and concentrations are most common in hydric soils, they cannot form in soils with parent materials that are low in Mn or Fe content. Soils that formed in such materials may have low-chroma colors that are not related to saturation and reduction. Such soils may exhibit other hydric soil morphologic features that form through the accumulation of organic matter.

Sulfate Reduction

Sulfur is one of the least thermodynamically favorable alternative electron acceptors to chemically reduce under anaerobic conditions (McBride, 1994). As a result, a reduction of sulfur occurs in portions of the landscape that experience prolonged periods of persistent saturation, flooding, or ponding. When these conditions are met, microbial respiration induces the conversion of sulfate (SO_4^{2-}) to sulfide (S^{2-}). The resultant S^{2-} can rapidly react to form hydrogen sulfide gas (H_2S), or in the presence of reduced iron, can precipitate amorphous iron monosulfide (FeS) and other compounds. The formation and diffusion of H_2S gas results in a “rotten egg” odor, which can be used to identify hydric soils as described in field indicator A4, Hydrogen Sulfide. Iron monosulfide (FeS) concentrations form as dark-gray or black precipitates that coat soil pore linings and ped faces (adapted from Vaughan et al., 2016). These morphological features are documented using multiple rapid field tests that distinguish FeS from other dark-colored materials in soil (e.g., organic matter, manganese oxides). Hydric soils are present when FeS is observed near the soil surface, as described in field indicator A18, Iron Monosulfide.

Organic Matter Accumulation

Soil microbes use carbon compounds that occur in organic matter as an energy source. The rate at which soil microbes use organic carbon, however, is considerably lower in a saturated and anaerobic environment than under aerobic conditions. Therefore, in saturated soils, partially decomposed organic matter may accumulate. The result in wetlands is often the development of thick organic surface horizons, such as peat or muck, or dark organic-rich mineral surface layers.

Determining the Texture of Soil Materials High in Organic Carbon

Soil materials fall into three categories based upon the organic carbon content: organic soil, mucky mineral soil, and mineral soil. In lieu of laboratory data, the following field estimation method can be used to categorize soil material that is wet or nearly saturated with water. This method may be inconclusive with loamy or clayey mineral soils. Gently rub the wet soil material between forefinger and thumb. If upon the first or second rub the material feels gritty, it is mineral soil material. If after the second rub the material feels greasy, it is either mucky mineral or organic soil material. Gently rub the material two or three more times. If after these additional rubs it feels gritty or plastic, it is mucky mineral soil material; if it still feels greasy, it is organic soil material. If the material is organic soil material, a further division should be made. Organic soil materials are classified as muck, mucky peat, or peat. Differentiating criteria are based on the percentage of visible fibers observable with a hand lens in an undisturbed state and after rubbing between thumb and fingers 10 times. Muck, mucky peat, and peat correspond to the textures sapric, hemic, and fibric. If there is a conflict between unrubbed and rubbed fiber content, rubbed content is used. Live roots are disregarded in this test. Other methods of determining the organic soil matter category, such as applying the von Post humification scale (von Post, 1926), can also be used.

Cautions

A soil that is drained or protected (for instance, by dikes or levees) meets the definition of a hydric soil if the upper part formed under anaerobic conditions in an unaltered state. Drained or protected hydric soils generally have one or more of the indicators. Not all areas that have hydric soils qualify as wetlands. For example, a soil that formed under anaerobic conditions but no longer has wetland hydrology nor supports hydrophytic vegetation still meets the definition of a hydric soil. However, the area will not meet the requirements of a federal wetland determined by the three-factor approach (presence of hydric soils, wetland hydrology, and hydrophytic vegetation).

There are hydric soils with morphologies that are difficult to interpret. These include soils with black, gray, or red parent materials; soils with high pH or salts; soils high or low in organic matter content; recently developed hydric soils; and soils high in iron inputs. In these cases, the current published indicators do not always function to identify a hydric soil. As long as the soil meets the definition of a hydric soil, the lack of an indicator does not preclude the soil from being hydric.

The indicators were developed mostly to identify the boundary of hydric soil areas and generally work best on the margins. Additionally, indicators are designed to leverage the most readily observable redoximorphic features, which are more likely to occur in soils that cycle between anaerobic (reduced) and aerobic (oxidized) conditions. It is important to acknowledge that portions of an area under near-constant saturation may not display an indicator. Therefore, a prudent investigator might transect across the wetland towards the upland position to locate the wetland boundary.

Morphological features of hydric soils indicate that saturation and anaerobic conditions have existed under either contemporary or former hydrologic regimes. Where soil morphology seems inconsistent with the landscape, vegetation, or observable hydrology, it is recommended to consult with an experienced soil or wetland scientist to determine whether the soil is hydric.

General Guidance for Using the Indicators

Observe and Document the Site

Before making any decision about the presence or absence of hydric soils, the overall site and how it interacts with the soil should be considered. The steps below, while not required to identify a hydric soil, can help to explain why a hydric soil is or is not present. Always look at the landscape features of the immediate site and compare them to the surrounding areas. Try to contrast the features of wet and dry sites that are in close proximity. When observing slope features, look first at the area immediately around the sampling point. For example, a nearly level bench or depression at the sampling point may be more important to the wetness of the site than the overall landform on which the bench or depression occurs. Understanding how water moves across the site helps to clarify the reasons for the presence or absence of hydric soil indicators.

Observe and Document the Soil

To observe and document a hydric soil, first remove from the soil surface any woody material larger than 2 cm in cross section that cannot be crushed or shredded when rubbed. Do not remove the organic surface layers of the soil, which generally consist of plant remains in various stages of decomposition. Dig a hole and describe the soil profile. In general, the hole should be dug to the depth needed to document an indicator or to confirm the absence of indicators. For most soils, the recommended excavation depth is approximately 50 cm (20 inches) from the soil surface, although a shallower soil pit may suffice for some indicators (e.g., A2, Histic Epipedon). Use the completed profile description to determine which hydric soil indicators have been met.

The accumulation of organic matter in these soils may mask redoximorphic features in the surface layers. For soils with thick, dark surface layers, deeper examination may be required when field indicators are not observed at a depth of 50 cm (20 inches) or less from the soil surface. Examination to a depth of 1 m (40 inches) or more may be needed to determine whether the soils meet the requirements of indicator A12, Thick Dark Surface. A soil auger or probe may be useful for sampling soil materials below a depth of 50 cm (20 inches).

Whenever possible, excavate the soil deep enough to determine if there are layers or materials present that might restrict soil drainage. This determination will help to indicate why the soil may or may not be hydric. After a sufficient number of exploratory excavations have been made to determine the soil hydrologic relationships at the site, subsequent excavations can be limited to an adequate depth for identifying hydric soil indicators. Consider taking photographs of both the soil and the overall site, including a clearly marked measurement scale in pictures of soil profiles.

When applying the indicators, the depth at which measurements begin differs based on the type of soil material encountered and regional differences in soils and climate. For indicators A1, A2, A3, S2, and S3 in all LRRs, measurements should start at the soil surface. For all indicators in R, W, X, and Y and for indicators F6 and F7 in all LRRs, all measurements should start at the top of the uppermost mineral layer. For all other indicators, except those in LRRs R, W, X, and Y and indicators F6 and F7, measurements should start at the top of the uppermost muck or mineral layer (fig. 2).

All colors noted in this guide refer to moist Munsell colors (X-Rite, 2009). Dry soils should be moistened until the color no longer changes, and wet soils should be allowed to dry until they no longer glisten (fig. 3). Care should be taken to avoid over-moistening dry soil.

Soil chromas specified in the indicators do not have decimal points; however, intermediate colors do occur. Colors should not be rounded to make the chroma meet the requirements of an indicator. A soil matrix with chroma between 2 and 3 should be described as having chroma of 2+. It would not meet any indicator that requires chroma of 2 or less.

In contrast, the color value should be rounded to the nearest color chip when using the indicators. For example, a color in between a value of 3 and 4 should be rounded and not excluded from meeting either F3, Depleted Matrix or F6, Redox Dark Surface, because the color occurs between color chips. If the value is closer to 3, then F6 or some other dark surface indicator should be considered. If it is closer to 4, then F3 or some

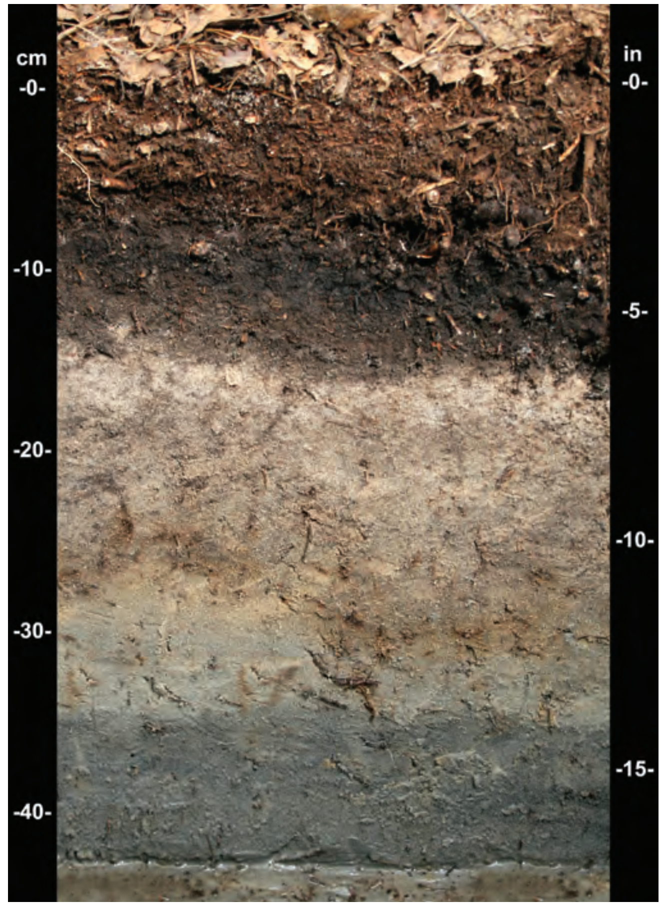

Figure 2.—The soil profile above consists of an 8 cm layer of peat and/or mucky peat underlain by a 1 cm layer of muck. The remaining soil layers are sandy soil material. In LRRs R, W, X, and Y, observations would begin below the peat, mucky peat, and muck layers (9 cm). When using Indicators S2 or S3, observations would start at the actual soil surface (0 cm). In all remaining LRRs, observations would begin at the muck surface (8 cm).

other redoximorphic feature indicator should be considered.

Always examine soil matrix colors in the field immediately after sampling. Ferrous iron in the soil can oxidize rapidly, resulting in the development of colors with higher chroma or redder hue. Soils that are saturated at the time of sampling may contain reduced iron and/or manganese that cannot be detected by the eye. Under saturated conditions, redox concentrations may be absent or difficult to see, particularly in dark-colored soils. It may be necessary to let the

Figure 3.—The left portion of this ped shows moist soil colors, and the right portion shows dry soil colors. Moist colors are to be used when hydric soils are identified. The moist colors in this picture would meet the requirements for indicator F6, Redox Dark Surface, but the dry colors would not meet these requirements.

soil dry (for 5 to 30 minutes or more) to a moist state before the iron or manganese oxidizes and the redoximorphic features become visible.

Pay particular attention to changes in microtopography over short distances. Small changes in elevation may result in repetitive sequences of hydric/nonhydric soil mosaics, making the delineation of individual areas of hydric and nonhydric soils difficult. Procedures have been developed to address mosaic scenar scenarios (USACE, 2012). The shape of the local landform can greatly affect the movement of water through the landscape. Significant changes in parent material or lithologic discontinuities in the soil can also affect the hydrologic properties of the soil.

Indicators that have requirements that allow a chroma of more than 2 can also have a chroma of more than 2 above the layer or layers meeting the requirement of the indicator. Indicators that require a chroma of 2 or less only permit a chroma of more than 2 within a zone thinner than 15 cm (6 inches) above it, and the remainder of the material above the indicator must have a chroma of 2 or less (fig. 4).

Hydric soil indicators were developed to find the hydric soil boundary. Many of the features used to identify a soil as a hydric soil are better expressed at the wetland boundary and may not be evident as you move to the center of the wetland. As wetlands dry out, manganese and iron diffuse to the boundary so that redoximorphic concentrations are more abundant near the boundary and may be absent in the middle of a wetland.

Field indicators are best expressed at the boundary of a wetland. The interior of a wetland

Figure 4.—The lower portion of this soil profile meets the color and depth requirements of indicator F3, Depleted Matrix; however, the upper portion of the profile contains a layer with chroma of more than 2 that is more than 15 cm (6 inches) thick. As a result, the requirements of indicator F3, Depleted Matrix, are not met.

may become depleted in manganese and iron or, if currently saturated, any manganese or iron could remain in solution and thus not be visible. In this case, the soil will lack any redoximorphic indicators. However, if you lack an indicator in the obvious interior of a wetland, you should transect out toward the boundary to see if an indicator is more evident toward the wetland boundary.

Soil Texture and the Indicators

Hydric soil indicators occur in three groups. Indicators for “All Soils” are used for any soil layers regardless of texture (A indicators). Indicators listed under “Sandy Soils,” (S indicators), as well as any language that refers to sandy layers or materials, refer to soil materials with USDA textures of loamy fine sand or coarser. Indicators listed under “Loamy and Clayey Soils,” (F indicators), as well as any language that refers to loamy or clayey materials or layers, are used for soil materials with textures of loamy very fine sand and finer. Both sandy layers and loamy or clayey layers can occur in the same soil profile. If this occurs, you should look for sandy (S) indicators in the sandy layers and loamy and clayey (F) indicators in the loamy and clayey material.

It is permissible to combine certain hydric soil indicators if all requirements of the indicators are met except minimum thickness. The most restrictive requirements for layer thickness in any indicators used must be met. Therefore, a soil is hydric if its layers meet the requirements of both S and F indicators, except thickness, such that when both layers are combined, the more restrictive indicator thickness requirement is met.

For example, if you meet all the requirements of one indicator except it requires a minimum thickness of 10 cm (4 inches) and all the requirements of another indicator in a separate layer and it requires a minimum thickness of 15 cm (6 inches), the cumulative thickness of the two layers must be at least 15 cm (6 inches).

Not all indicators are possible candidates for combination. For example, indicator F2, Loamy Gleyed Matrix, has no thickness requirement and is not a candidate for combination.

To Comment on the Indicators

The indicators are revised and updated as field data are collected to improve our understanding of hydric soil processes. Revisions, additions, and other comments regarding field observations of hydric soil conditions that cannot be documented using the presently recognized hydric soil indicators are welcome. Any suggestions for modifications must be approved by the NTCHS. Guidelines for requesting changes to field indicators are as follows:

1. To propose a new indicator or revision to an existing indicator, the following documentation is required as a minimum to accompany all requests for additions and changes to existing hydric soil indicators for consideration into future versions of the “Field Indicators of Hydric Soils in the United States”:
   a. Detailed descriptions of at least three pedons that document the addition or change and detailed descriptions of the neighboring nonhydric pedons.
   b. Detailed vegetative documentation recording the specific plant community at each of the six pedon locations summarizing any contrasting patterns between the proposed upland and hydric positions.
   c. Saturation/inundation data and oxidation-reduction potential (Eh) data for a duration that captures the saturation cycle (dry-wet-dry) of at least one of the hydric pedons and one of the nonhydric pedons. Precipitation and in-situ soil-water pH data from the same sites should also be provided (fig. 5). Data are to be collected according to the Hydric Soil Technical Standard (Berkowitz et al., 2021).
2. To add or delete a test indicator, the following documentation is required to accompany all requests for adding or deleting a test indicator in “Field Indicators of Hydric Soils in the United States”:

Figure 5.—Proper installation and monitoring of equipment as described in the Hydric Soil Technical Standard are required to collect data regarding proposed additions, deletions, or other changes to the hydric soil indicators.

a. Detailed descriptions of at least three hydric pedons that document the test indicator and detailed descriptions of three neighboring nonhydric pedons.

b. Detailed vegetative documentation recording the specific plant community at each of the six pedon locations, summarizing any contrasting patterns between the proposed upland and hydric positions.

c. All requests involving a and b above require a short written description that identifies the problem, explains the rationale for the request, and provides the following:

- A person responsible and point of contact (email and postal addresses and phone number)
- A timeline for supporting data and final report to be delivered to NTCHS
- A timeline requested for final NTCHS decision and partners involved in the project
- Requests, plans, and data should be sent to the current Chair of the National Technical Committee for Hydric Soils.

Figure 6.—Map of USDA land resource regions and major land resource areas in the conterminous United States (USDA NRCS, 2022).

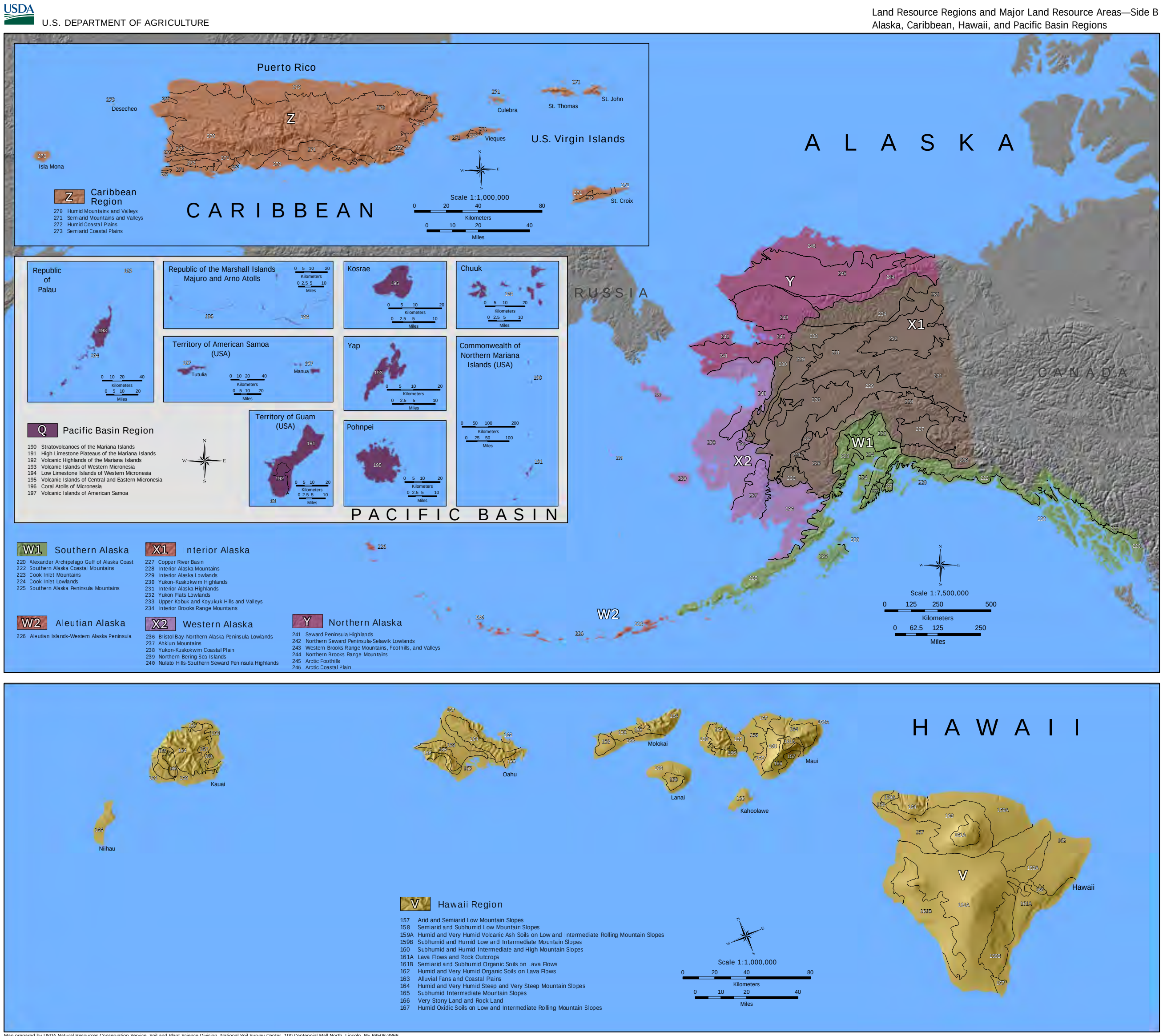

Figure 7.—Map of USDA land resource regions and major land resource areas in the noncontrminous United States (USDA NRCS, 2022).

Field Indicators of Hydric Soils

The indicator descriptions are structured as follows:

1. Alphanumeric listing (A, S, or F indicators)
2. Short name
3. Applicable land resource regions (LRRs in italic)
4. Requirements of the field indicator
5. User notes

For example, A2 is the alphanumeric listing for the second indicator for “All Soils”; “Histic Epipedon” is the short name; “For use in all LRRs” indicates the applicable regions; and “a histic epipedon underlain by mineral soil material with chroma of 2 or less” is the requirement of the indicator. Any accompanying user notes that follow the indicator provide useful tips or context to the indicator guidance.

All Soils

“All Soils” refers to soil layers with any USDA soil texture.

All mineral layers above any of the layers meeting the requirements of any A indicator, except for indicators A16 and A18, have a dominant chroma of 2 or less, or the thickness of the layers with a dominant chroma of more than 2 is less than 15 cm (6 inches). In addition, nodules and concretions are not considered to be redox concentrations for the application of the indicators.

A1.—Histosol or Histel. *For use in all LRRs*. Classifies as a Histosol (except Folist) or as a Histel (except Folistel).

User Notes: In a Histosol, organic soil material is typically 40 cm (16 inches) or more of the upper 80 cm (32 inches) (fig. 8). Organic soil materials have organic carbon content (by weight) of 12 percent or more. These materials include muck (sapric soil material), mucky peat (hemic soil material), and peat (fibric soil material). See “Keys to Soil Taxonomy” (Soil Survey Staff, 2022) for a complete definition.

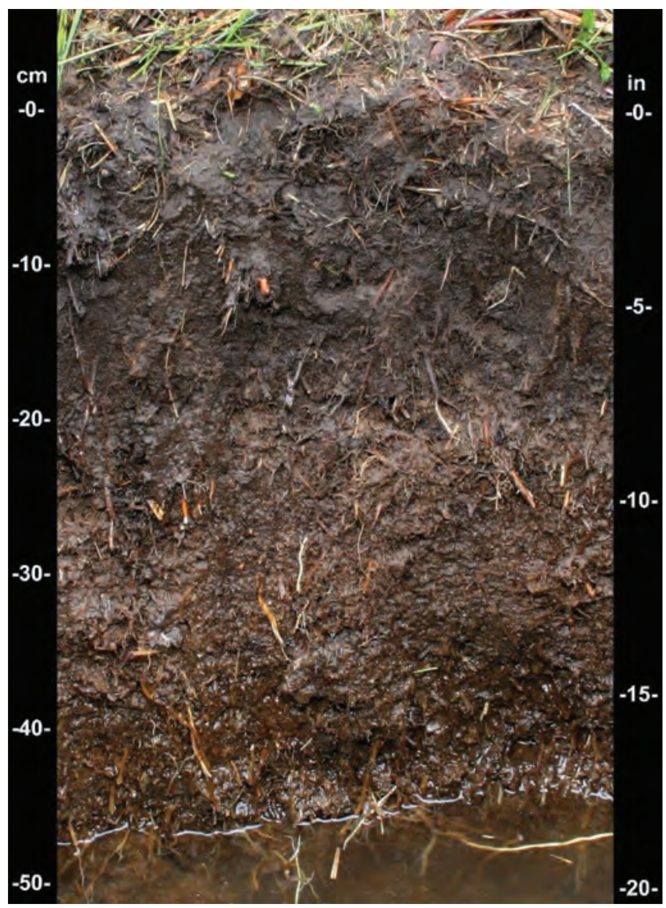

Figure 8.—Indicator A1, Histosol or Histel. This soil has more than 40 cm of organic soil material starting at the soil surface.

A2.—Histic Epipedon. *For use in all LRRs.* A histic epipedon underlain by mineral soil material with chroma of 2 or less.

User Notes: Most histic epipedons are composed of surface horizons with organic soil material 20 cm (8 inches) or more thick (fig. 9). Aquic conditions or artificial drainage is required. See “Keys to Soil Taxonomy” (Soil Survey Staff, 2022) for a complete definition.

A3.—Black Histic. *For use in all LRRs.* A layer of peat, mucky peat, or muck 20 cm (8 inches) or more thick starting at a depth of 15 cm (6 inches) or less from the soil surface with a hue of 10YR or yellower, value of 3 or less, and chroma of 1 or less and underlain by mineral soil material with chroma of 2 or less.

User Notes: Unlike indicator A2, this indicator does not require proof of aquic conditions or artificial drainage (see fig. 9).

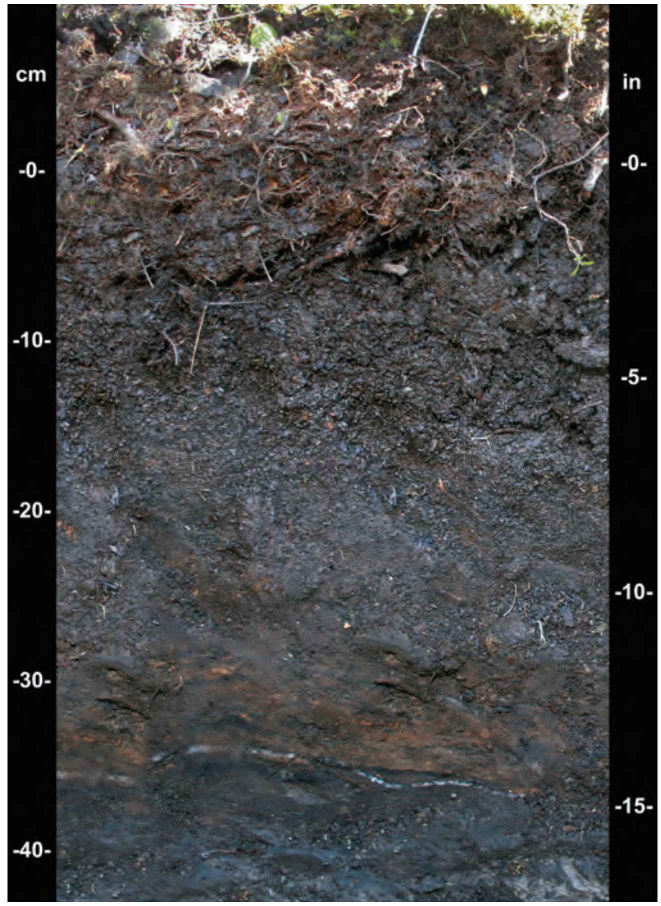

Figure 9.—Indicators A2, Histic Epipedon, and A3, Black Histic. This soil meets the depth criterion of A2 and the color and depth criteria of A3. The black color, a requirement of A3, results from the accumulation of organic matter when the soil is saturated and anaerobic.

A4.—Hydrogen Sulfide. *For use in all LRRs.* A hydrogen sulfide odor starting at a depth of 30 cm (12 inches) or less from the soil surface.

User Notes: This “rotten egg smell” indicates that sulfate-sulfur has been chemically reduced to hydrogen sulfide gas, which indicates the soil is anaerobic (fig. 10).

A5.—Stratified Layers. *For use in LRRs C, F, K, L, M, N, O, P, R, S, T, and U; for testing in LRRs Q, V, and Z.* Several stratified layers starting at a depth of 15 cm (6 inches) or less from the soil surface. At least one of the layers has value of 3 or less and chroma of 1 or less, or it is muck, mucky peat, peat, or a mucky modified mineral texture. The remaining layers in the upper 15 cm (6 inches) have chroma of 2 or less. For any sandy material that constitutes the layer with value of 3 or less and chroma of 1 or less, at least 70 percent of the visible soil particles must be masked with organic material when viewed through a 10x or 15x hand lens.

User Notes: Use of this indicator may require assistance from a trained soil scientist with local experience. A stratified layer is depositional and not pedogenic. An undisturbed sample must be observed. Individual strata are dominantly less than 2.5 cm (1 inch) thick. A hand lens is an excellent tool to aid in the identification of this indicator. Many alluvial soils have stratified layers at greater depths than allowed in the requirements of the indicator; these soils do not meet the requirements of this indicator.

Figure 10.—Indicator A4, Hydrogen Sulfide, is most likely to occur in salt marshes and other very wet ecosystems.

Many alluvial soils have stratified layers at the required depths but do not have chroma of 2 or less; these do not meet the requirements of this indicator. The stratified layers occur in any soil texture (fig. 11). In sandy textures observed without a hand lens, the masked sand particles appear to be closer to 100 percent masked with organic material when moist. Masked sand grains can disappear quickly if a soil has been drained or disturbed.

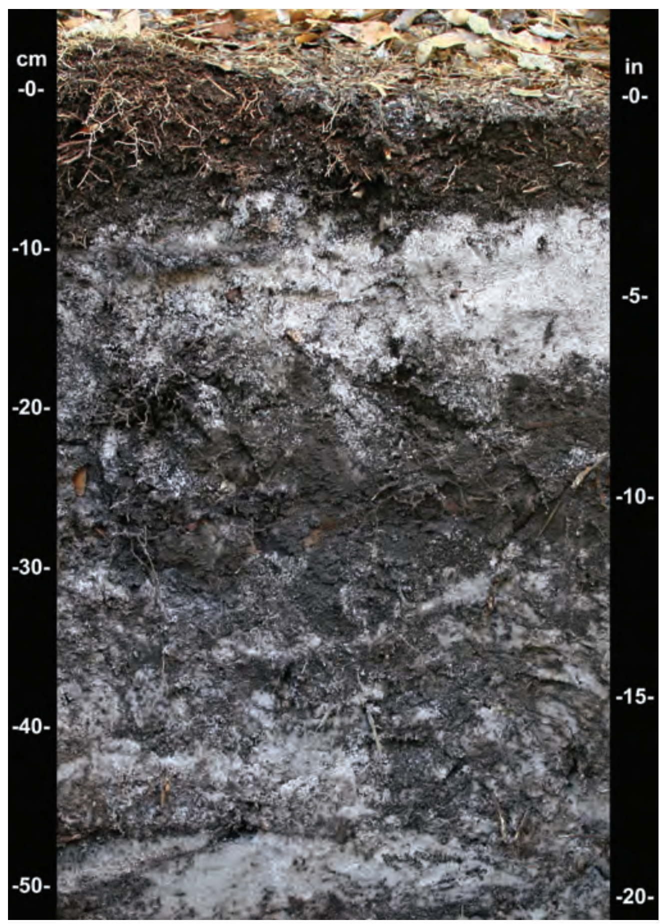

Figure 11.—Indicator A5, Stratified Layers, in sandy material. This soil also meets the requirements of indicator A6, Organic Bodies.

A6.—Organic Bodies. *For use in LRRs P (except for MLRA 136), T, U, and Z.* Presence of 2 percent or more organic bodies of muck or a mucky modified mineral texture, starting at a depth of 15 cm (6 inches) or less from the soil surface.

User Notes: Organic bodies typically occur at the tips of fine roots. In order to meet the Organic Bodies indicator, the organic carbon content in organic bodies must meet the requirements of muck or mucky modified textures. The size of the organic body is not specifically defined, but the bodies are commonly 1 to 3 cm (0.5 to 1 inch) in diameter (fig. 12).

Many organic bodies do not have the required content of organic carbon and as a result do not meet this indicator. For example, organic bodies of mucky peat (hemic material) and/or peat (fibric

Figure 12.—Indicator A6, Organic Bodies. An individual organic body generally is about 1 to 3 cm in size but could be smaller than 1 cm.

material) do not meet the requirements of this indicator nor does material consisting of partially decomposed root tissue. The Organic Bodies indicator includes the indicator previously named "accretions" (Florida Soil Survey Staff, 1992).

A7.—5 cm Mucky Mineral. *For use in LRRs P (except for MLRA 136), T, U, and Z.* A layer of mucky modified mineral soil material 5 cm (2 inches) or more thick, starting at a depth of 15 cm (6 inches) or less from the soil surface (fig. 13).

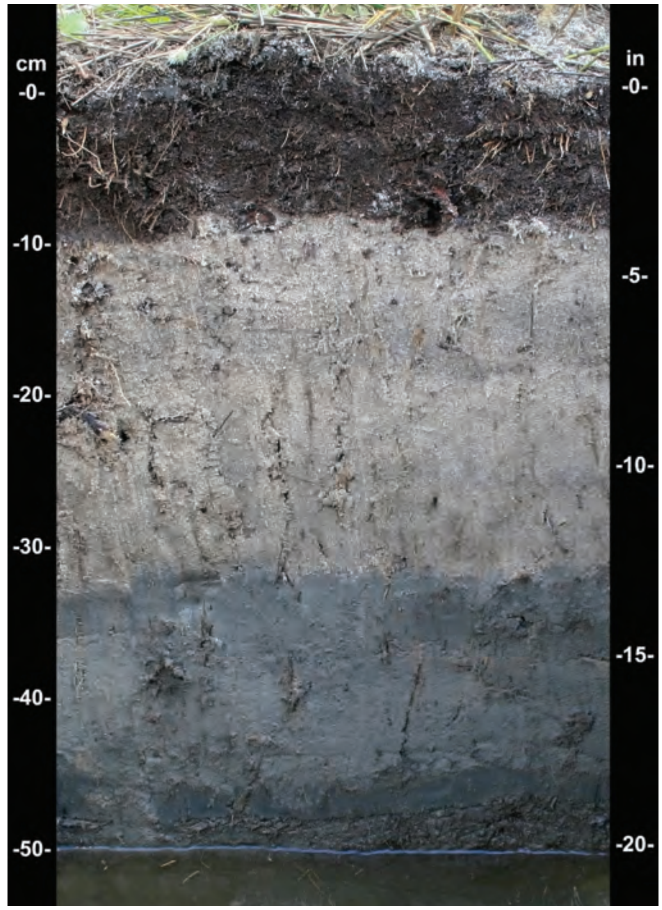

Figure 13.—Indicator A7, 5 cm Mucky Mineral. This soil has more than 5 cm of mucky sand, starting at the surface.

User Notes: "Mucky" is a USDA texture modifier for mineral soils. The content of organic carbon ranges from 5 to 12 percent.

A8.—Muck Presence. *For use in LRRs Q, U, V, and Z.* A layer of muck with value of 3 or less and chroma of 1 or less, starting at a depth of 15 cm (6 inches) or less from the soil surface.

User Notes: The presence of muck of any thickness at a depth of 15 cm (6 inches) or less is the only requirement. Normally, this expression of anaerobiosis is at the soil surface; however, it may occur at any depth 15 cm (6 inches) or less. Muck is sapric soil material with a minimum content of 12 percent organic carbon. Organic soil material is called muck if virtually all of the material has undergone sufficient decomposition to prevent the identification of plant parts. Mucky peat (hemic material) and/or peat (fibric material) do not qualify. Generally, muck is black and has a "greasy" feel; sand grains should not be evident.

A9.—1 cm Muck. *For use in LRRs D, F, G, H, P (except for MLRA 136), and T; for testing in LRRs C, I, J, and O.* A layer of muck 1 cm (0.5 inch) or more thick with value of 3 or less and chroma of 1 or less, starting at a depth of 15 cm (6 inches) or less from the soil surface.

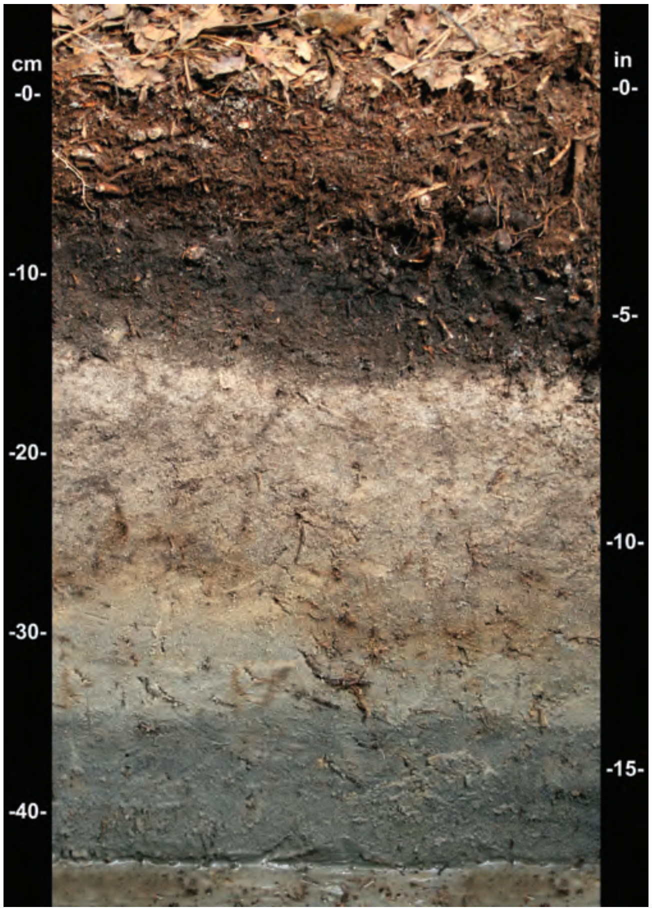

Figure 14.—Indicator A9, 1 cm Muck. This soil has more than 1 cm of muck, starting at 8 cm on the left measuring tape. Different LRRs may use the presence of muck or 2 cm of muck as an indicator of a hydric soil.

User Notes: Unlike indicator A8, Muck Presence, this indicator has a minimum thickness requirement of 1 cm (fig. 14).

Normally, this expression of anaerobiosis is at the soil surface; however, it may occur at any depth of 15 cm (6 inches) or less. Muck is sapric soil material with a minimum content of 12 percent organic carbon. Organic soil material is called muck if virtually all of the material has undergone sufficient decomposition to limit the recognition of plant parts. Mucky peat (hemic material) and/or peat (fibric material) do not qualify. Generally, muck is black and has a “greasy” feel; sand grains should not be evident.

A10.—2 cm Muck. *For use in LRRs M and N; for testing in LRRs A, B, E, K, L, and S (except for MLRA 148).* A layer of muck 2 cm (0.75 inch) or more thick with value of 3 or less and chroma of 1 or less, starting at a depth of 15 cm (6 inches) or less from the soil surface.

User Notes: This indicator requires a minimum muck thickness of 2 cm. Normally, this expression of anaerobiosis is at the soil surface; however, it may occur at any depth of 15 cm (6 inches) or less. Muck is sapric soil material with a minimum content of 12 percent organic carbon. Organic soil material is called muck if virtually all of the material has undergone sufficient decomposition to limit the recognition of plant parts. Mucky peat (hemic material) and/or peat (fibric material) do not qualify. Generally, muck is black and has a “greasy” feel; sand grains should not be evident.

A11.—Depleted Below Dark Surface. *For use in all LRRs except for W, X, and Y; for testing in LRRs W, X, and Y.* A layer with a depleted or gleyed matrix that has 60 percent or more chroma of 2 or less, starting at a depth of 30 cm (12 inches) or less from the soil surface and having a minimum thickness of either

1. 15 cm (6 inches), or
2. 5 cm (2 inches) if the 5 cm consists of fragmental soil material.

Organic, loamy, or clayey layer(s) above the depleted or gleyed matrix must have value of 3 or less and chroma of 2 or less starting at a depth of less than 15 cm (6 inches) from the soil surface and extend to the depleted or gleyed matrix. Any loamy fine sand and coarser material above the depleted matrix must have value of 3 or less and chroma of 1 or less starting at a depth of 15 cm (6 inches) or less from the soil surface and extend to the depleted or gleyed matrix. When viewed through a 10x or 15x hand lens, at least 70 percent of the visible sand particles must be masked with organic material.

User Notes: The depleted matrix can occur in either sandy soil layers or loamy and clayey soil layers. This indicator often occurs in Mollisols but also applies to soils with umbric epipedons and dark-colored ochric epipedons (figs. 15 and 16). For soils with dark-colored epipedons more than 30 cm (12 inches) thick, use indicator A12. A depleted matrix requires value of 4 or more and chroma of 2 or less.

Redox concentrations, including soft iron-manganese masses and/or pore linings, 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 the soil layer has 2 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings. In sandy textures observed without a hand lens, the masked sand particles appear to be closer to 100 percent masked with organic material when moist. Masked sand grains can disappear quickly if a soil has been drained or disturbed.

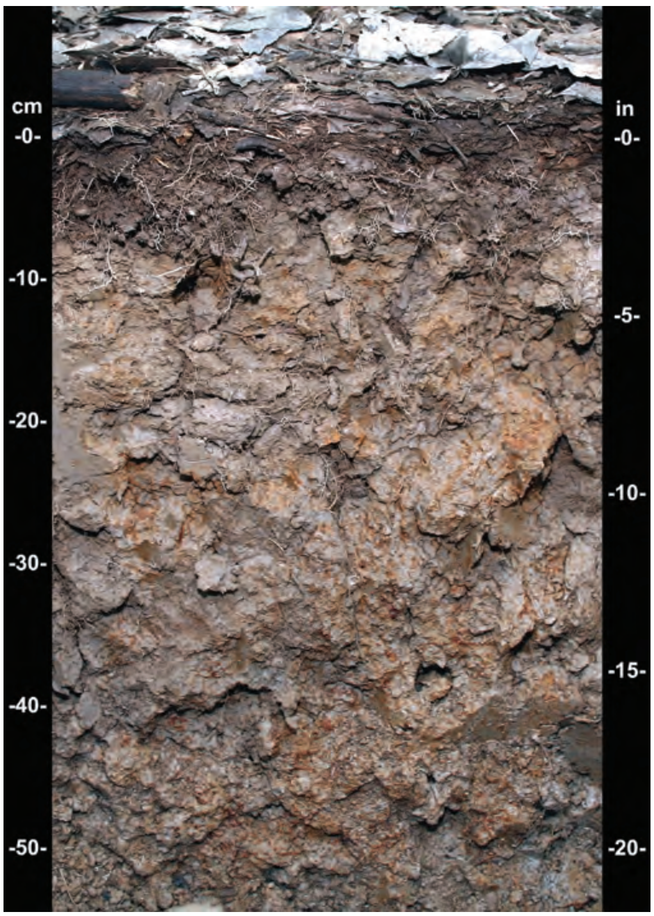

Figure 15.—Indicator A11, Depleted Below Dark Surface. This soil has a thin, dark surface horizon that meets the requirements of indicator A11. Because a depleted matrix below the surface horizon starts at a depth of 15 cm or less from the soil surface and is at least 5 cm thick, the soil also meets the requirements of indicator F3, Depleted Matrix.

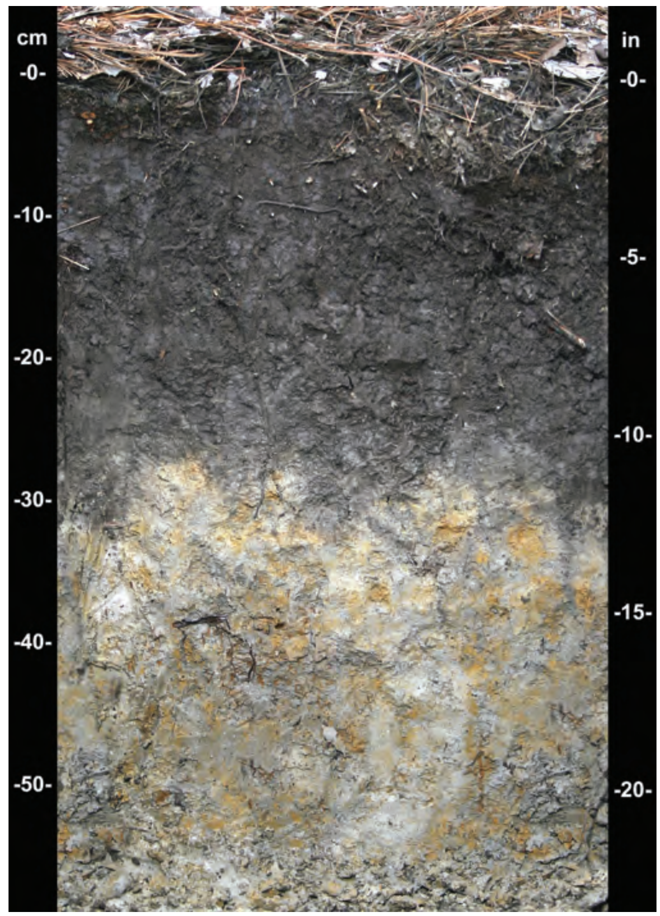

Figure 16.—Indicator A11, Depleted Below Dark Surface. This soil has a thick, dark surface horizon that meets the requirements of indicator A11. Unlike the soil profile in fig. 15, which has a depleted matrix starting around 8 cm below the dark surface horizon, this soil has a depleted matrix that starts at a depth of about 29 cm, which is too deep to meet the requirements of indicator F3, Depleted Matrix. Indicator A11 allows a deeper depleted matrix than indicator F3.

A12.—Thick Dark Surface. *For use in all LRRs.* A layer 15 cm (6 inches) or more thick with a depleted or gleyed matrix that has 60 percent or more chroma of 2 or less starting at a depth of more than 30 cm (12 inches) from the soil surface. The layer(s) above the depleted or gleyed matrix and starting at a depth of less than 15 cm (6 inches) from the soil surface must have value of 2.5 or less and chroma of 1 or less to a depth of 30 cm (12 inches) or more and a value of 3 or less and chroma of 1 or less in any remaining layers above the depleted or gleyed matrix. In any loamy fine sand and coarser material above the depleted or gleyed matrix, at least 70 percent of the particles must be masked with organic material when viewed through a 10x or 15x hand lens.

User Notes: The depleted matrix can occur in either sandy soil layers or loamy and clayey soil layers. This indicator applies to soils that have a very dark layer of 30 cm (12 inches) or more thick and then can get a little less dark in any remaining layers directly above a depleted or gleyed matrix (fig. 17). This indicator is most often associated with overthickened soils in concave landscape positions. A depleted matrix requires a value of 4 or more and chroma of 2 or less. Redox concentrations, including soft iron-manganese masses and/or pore linings, are required in soils with matrix colors of 4/1, 4/2, or 5/2. A, E, and calcic horizons may be mistaken for a depleted matrix because they may have low chromas and high values. These horizons are excluded from the concept of a depleted matrix unless they have 2 percent or more distinct or prominent concentrations occurring as soft masses or pore linings. In sandy textures observed without a hand lens, the masked sand particles appear to be closer to 100 percent masked with organic material when moist. Masked sand grains can disappear quickly if a soil has been drained or disturbed.

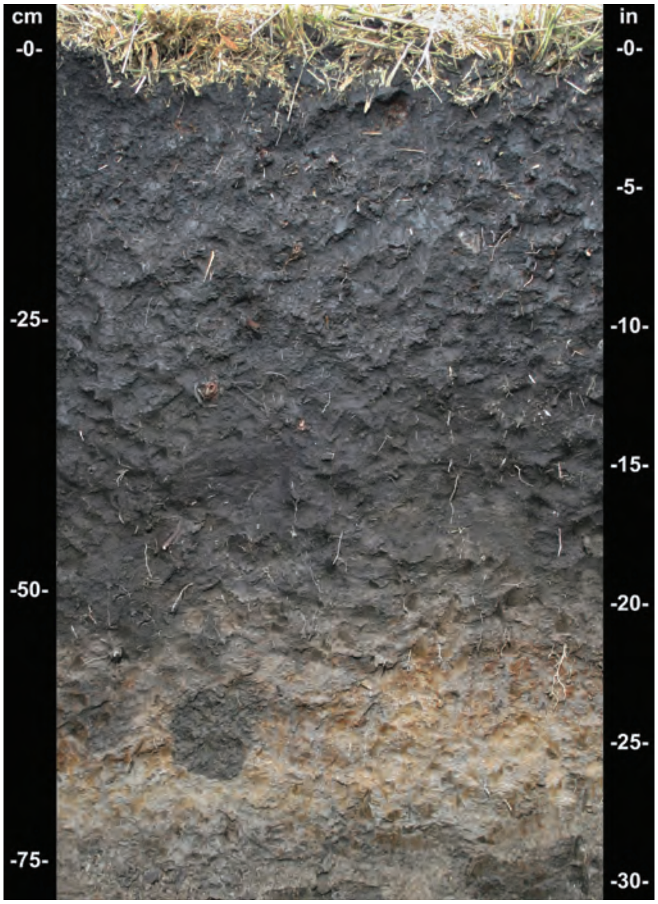

Figure 17.—Indicator A12, Thick Dark Surface. Observations deeper in the profile are needed to determine whether a soil meets the requirements of this indicator. In this soil, depth to the depleted matrix is about 55 cm.

A13.—Alaska Gleyed. *For use in LRRs W, X, and Y.* A mineral layer with more than 50 percent gleyed matrix. The layer starts at a depth of 30 cm (12 inches) or less from the mineral surface and is underlain at a depth 1.5 m (60 inches) or less from the soil surface by soil material with hue of 5Y or redder in the same type of parent material.

User Notes: The indicator has two requirements (fig. 18). First, one or more of the specified gley colors occur at 30 cm (12 inches) or less from the soil surface. These must be the colors on the pages of the “Munsell Soil Color Book” (X-Rite, 2009) that show gley colors, not simply gray colors. Second, below these gley colors, the color of similar soil material is 5Y or redder (2.5Y, 10YR, 7.5YR, etc.). The presence of the truly gley colors indicates that the soil has undergone reduction.

Figure 18.—Indicator A13, Alaska Gleyed. The bluish band at a depth of about 20 cm indicates the presence of reduced soil material. The material below 20 cm reflects both the color of the parent material and soil weathering under aerobic conditions.

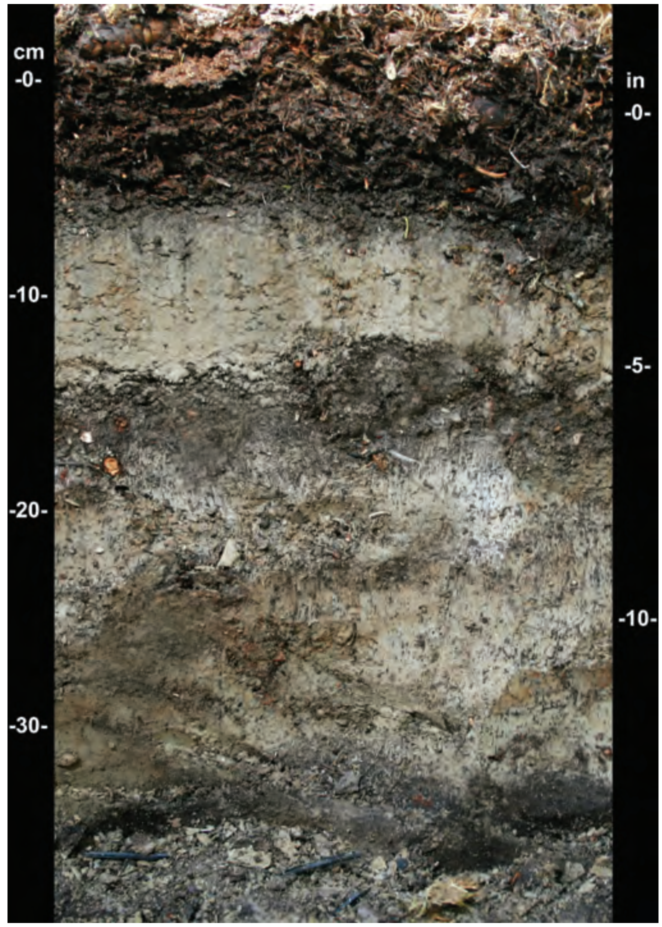

Figure 19.—Indicator A14, Alaska Redox. The matrix color meets the requirements of a gleyed matrix. Reddish orange redox concentrations occur along the pores and channels of living roots.

The requirement for 5Y or redder colors lower in the profile ensures that the gley colors are not simply the basic color of the parent material. Some tidal sediments, lacustrine sediments, loess, and glacial tills have base colors that appear as gley. This indicator proves that the near-surface gley colors are the result of anaerobic conditions. When comparing the near-surface and underlying colors, make sure that both are the same type of soil material. Many soils in Alaska consist of two or more types of material (e.g., silty loess overlying gravelly glacial till or sand and gravel river deposits).

A14.—Alaska Redox. *For use in LRRs W, X, and Y.* A mineral layer that has dominant hue of 5Y with chroma of 3 or less or a gleyed matrix of 10 percent or more distinct or prominent redox concentrations occurring as pore linings with value and chroma of 4 or more. The layer occurs at a depth of 30 cm (12 inches) or less from the soil surface.

User Notes: In a soil layer that has been reduced, one of the first areas where oxygen will be reintroduced is along pores and the channels of live roots (fig. 19). As oxidation occurs in these areas, characteristic reddish orange redox concentrations (with value and chroma of 4 or more) will be apparent along the pores and linings. These will stand out in contrast to the matrix color of the overall soil layer. First, determine if the dominant color(s) of the soil layer match the chroma 3 or less or gley colors indicated. Then, break open pieces of the soil and look for reddish orange redox concentrations along pores and root linings. The occurrence of these concentrations indicates that the soil has been reduced during periods of saturation and is now oxidizing in a drier state.

A15.—Alaska Gleyed Pores. *For use in LRRs W, X, and Y.* A mineral layer of 10 percent or more gleyed matrix colors along root channels or other pores and that starts at a depth of 30 cm (12 inches) or less from the soil surface. The matrix has a dominant hue of 5Y or redder.

User Notes: In a soil layer that is becoming anaerobic, reduced conditions will first occur where the soil microbes have an ample supply of organic carbon. Colder soils, such as those in Alaska, normally have a low content of organic carbon, so the microbes will congregate along the channels containing dead roots. Gley colors will first appear along these channels (fig. 20). In a soil layer that is not already dominated by gley colors, break open pieces of the soil and look closely at the root channels. Many of these will be very thin or fine. See if you can observe thin coatings along the channels that match the

Figure 20.—Indicator A15, Alaska Gleyed Pores. Gleyed colors are along root channels. Reduction occurs first along root channels, where organic carbon is concentrated.

gley colors listed in the indicator. If they occur, they indicate that the soil experiences anaerobic conditions.

A16.—Coast Prairie Redox. *For use in MLRA 150A of LRR T; for testing in LRR S (except for MLRA 149B).* A layer starting at a depth of 15 cm (6 inches) or less from the soil surface that is 10 cm (4 inches) or more thick and has a matrix chroma of 3 or less with 2 percent or more distinct or prominent redox concentrations occurring as soft masses and/or pore linings.

User Notes: These hydric soils occur mainly on depressional landforms and portions of the intermound landforms on the Lissie Formation. Redox concentrations occur mainly as iron-dominated pore linings. Common or many redox concentrations are required. Matrix colors with chroma 3 are allowed because they may be the color of stripped sand grains or because few or common sand-sized reddish chert particles occur and may prevent obtaining chroma of 2 or less.

A17.—Mesic Spodic. *For use in MLRA 144A and 145 of LRR R and in MLRA 149B of LRR S.* A layer that is 5 cm (2 inches) or more thick, that starts at a depth of 15 cm (6 inches) or less from the mineral soil surface, that has value of 3 or less and chroma of 2 or less, and that is directly underlain by either

1. one or more layers of spodic materials that have a combined thickness of 8 cm (3 inches) or more, that start at a depth of 30 cm (12 inches) or less from the mineral soil surface, and that have a value and chroma 3 or less; or

2. one or more layers that have a combined thickness of 5 cm (2 inches) or more, that start at a depth of 30 cm (12 inches) or less from the mineral soil surface, that have a value of 4 or more and chroma of 2 or less, and that are directly underlain by one or more layers that have a combined thickness of 8 cm (3 inches) or more, that are spodic materials, and that have a value and chroma of 3 or less.

User Notes: This indicator is used to identify wet soils that have spodic materials or that meet the definition of Spodosols. The layer or layers described above that have value of 4 or more and chroma of 2 or less are typically described as E or Eg horizons. The layer or layers that are 8 cm (3 inches) or more thick, that have value and chroma of 3 or less, and that meet the definition of spodic materials (that is, have an illuvial accumulation of amorphous materials consisting of organic carbon and aluminum with or without Fe) are typically described as Bh, Bhs, or Bhsm horizons. These Bh, Bhs, or Bhsm horizons typically have several color patterns, cementation, or both.

A18.—Iron Monosulfide. *For use in all LRRs.* Positive identification of dark-gray or black iron monosulfide concentrations with value of 4 or less and chroma of 2 or less, starting at a depth of 25 cm (10 inches) or less from the soil surface.

User Notes: Positive identification of this indicator requires a minimum of two separate observations of iron monosulfide (FeS) concentrations in the soil occurring as stains, coatings, soft masses, or pore linings. Care should be taken to observe the occurrence of FeS immediately following excavation as these compounds can oxidize rapidly with exposure to the atmosphere. The presence of FeS concentrations is confirmed by documenting dark-gray or black colored areas within the soil matrix and its subsequent degradation using either: (A) oxidation following exposure to the atmosphere or with application of an oxidizing agent such as dilute hydrogen peroxide, both of which result in an increase in Munsell value of 1 or more; or (B), the evolution of hydrogen sulfide gas following application of dilute hydrochloric acid. See the "Glossary" for a description of methods to identify FeS (fig. 21).

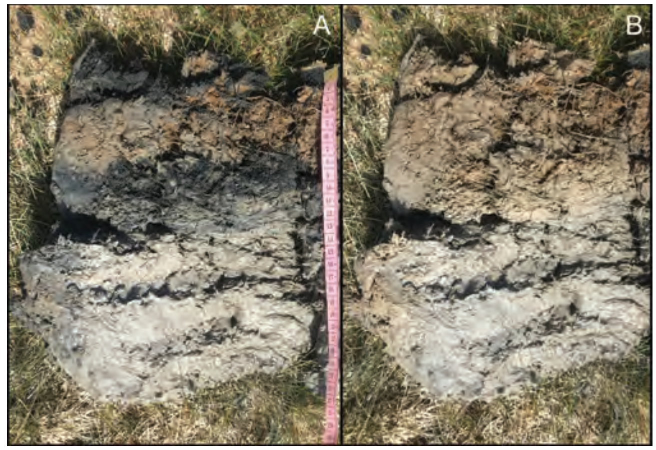

Figure 21.—Indicator A18, Iron Monosulfide, in loamy/clayey material. This soil has concentrations of black-colored iron monosulfide (FeS) in the upper 25 cm under moist to wet conditions (A). Concentrations of FeS were confirmed in this soil via the application of dilute (3%) hydrogen peroxide to induce rapid oxidation, resulting in a distinct color change (i.e., an increase in Munsell value of 1 or more) (B).

Sandy Soils

"Sandy Soils" have layers that have a USDA texture of loamy fine sand and coarser. All mineral layers above any of the layers meeting the requirements of any S indicator, except for indicators S6 and S11, have a dominant chroma of 2 or less, or the thickness of the layer(s) with a dominant chroma of more than 2 is less than 15 cm (6 inches). In addition, nodules and concretions are not considered to be redox concentrations. Use the following S indicators for soils with mineral layers that are sandy.

S1.—Sandy Mucky Mineral. *For use in all LRRs except T, U, W, X, Y, and Z and all but MLRA 136 of P.* A layer of mucky modified sandy soil material 5 cm (2 inches) or more thick starting at a depth of 15 cm (6 inches) or less from the soil surface.

User Notes: "Mucky" is a USDA texture modifier for mineral soils. The content of organic carbon ranges from 5 to12 percent.

S2.—2.5 cm Mucky Peat or Peat. *For use in LRRs G and H.* A layer of mucky peat or peat 2.5 cm (1 inch) or more thick with value of 4 or less and chroma of 3 or less, starting at a depth of 15 cm (6 inches) or less from the soil surface, and underlain by sandy soil material.

User Notes: Mucky peat (hemic soil material) and peat (fibric soil material) have a minimum organic carbon content of 12 percent. Organic soil material is called peat if virtually all of the plant remains are sufficiently intact to permit identification of plant remains. Mucky peat is at an intermediate stage of decomposition between peat and highly decomposed muck. To ascertain if mucky peat and/or peat are present, determine the percentage of rubbed fibers.

S3.—5 cm Mucky Peat or Peat. *For use in LRRs F and M; for testing in LRRs K, L, and R.* A layer of mucky peat or peat 5 cm (2 inches) or more thick with value of 3 or less and chroma of 2 or less, starting at a depth of 15 cm (6 inches) or less from the soil surface, and underlain by sandy soil material.

User Notes: Mucky peat (hemic soil material) and peat (fibric soil material) have a minimum organic carbon content of 12 percent. Organic soil material is called peat if virtually all of the plant remains are sufficiently intact to permit identification of plant remains. Mucky peat is at an intermediate stage of decomposition between peat and highly decomposed muck. To ascertain if mucky peat and/or peat are present, determine the percentage of rubbed fibers.

S4.—Sandy Gleyed Matrix. *For use in all LRRs, except for W, X, and Y.* A gleyed matrix that occupies 60 percent or more of a layer starting at a depth of 15 cm (6 inches) or less from the soil surface.

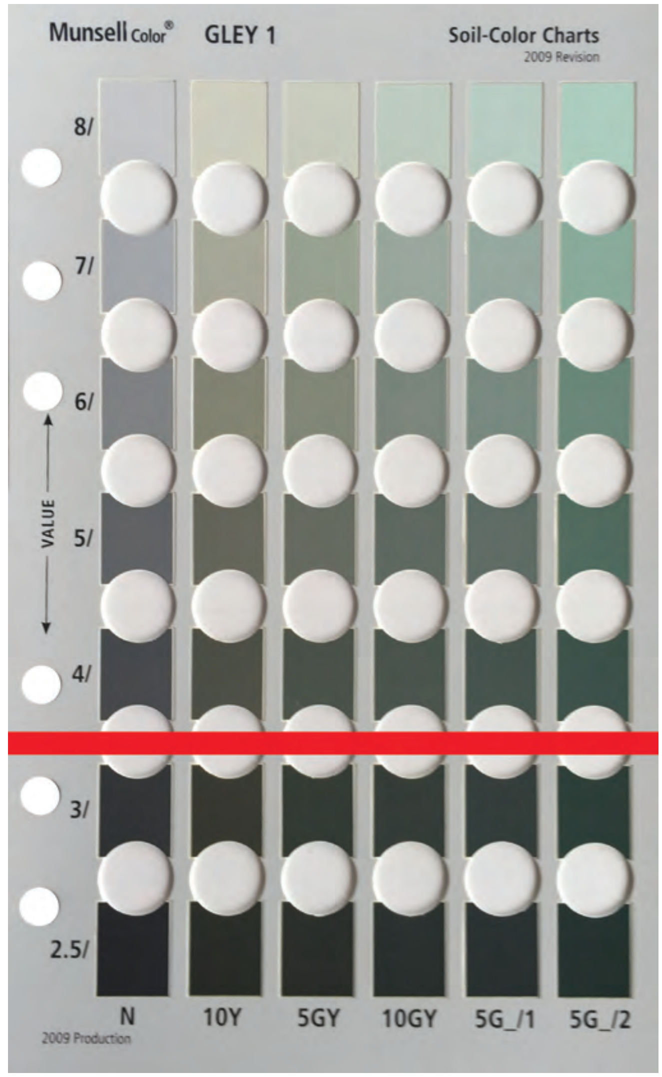

Figure 22.— Gleyed colors, for the purpose of the indicators, are colors found on the gleyed pages of the "Munsell Soil Color Book." They must also be a value of 4 or more or above the red line in this figure. Background image from the "Munsell Soil Color Charts" reprinted courtesy of Munsell Color Services Lab, a part of X-Rite, Inc. (X-Rite, 2009).

User Notes: Gley colors are not synonymous with gray colors (fig. 22). They are the colors on the gley color pages in the "Munsell Soil Color Book" (X-Rite, 2009) that have hue of N, 10Y, 5GY, 10GY, 5G, 10G, 5BG, 10BG, 5B, 10B, or 5PB and value of 4 or more. For this indicator, the gleyed matrix only has to be present at a depth of 15 cm (6 inches) or less from the surface; there is no thickness requirement for the layer.

S5.—Sandy Redox. *For use in all LRRs, except for Q, V, W, X, and Y.* A layer starting at a depth of

15 cm (6 inches) or less from the soil surface that is 10 cm (4 inches) or more thick and has a matrix with 60 percent or more chroma of 2 or less and 2 or more percent distinct or prominent redox concentrations occurring as soft masses and/or pore linings.

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 the concept of redox concentrations are iron-manganese bodies occurring as soft masses with diffuse boundaries. Common (2 to less than 20 percent) or many (20 percent or more) redox concentrations are required. If the soil is saturated at the time of sampling, it may be necessary to let it dry to a moist condition for redox features to become visible (figs. 23 and 24). This is a very common indicator of hydric soils and is often used to identify the hydric and nonhydric soil boundary in sandy soil layers.

S6.—Stripped Matrix. *For use in all LRRs, except for V, W, X, and Y.* A layer starting at a depth of 15 cm (6 inches) or less from the soil surface in which iron-manganese oxides and/or organic matter have been stripped from the matrix and the primary base color of the soil material has been exposed. The stripped areas and translocated oxides and/or organic matter form a faintly contrasting pattern of two or more colors with diffuse boundaries. The stripped zones are 10 percent or more of the volume and are rounded.

User Notes: This indicator includes the indicator previously named "polychromatic matrix" as well as the term "streaking." Common or many areas of stripped (unmasked) soil materials are required. The stripped areas are typically 1 to 3 cm (0.5 to 1 inch) in size but may be larger or smaller (fig. 25). Commonly, the stripped areas have a value of 5 or more and chroma of 2 or less and the unstripped areas have chroma of 3 and/or 4. The matrix may not have the material with chroma of 3 and/or 4. The mobilization and translocation of oxides and organic matter is the

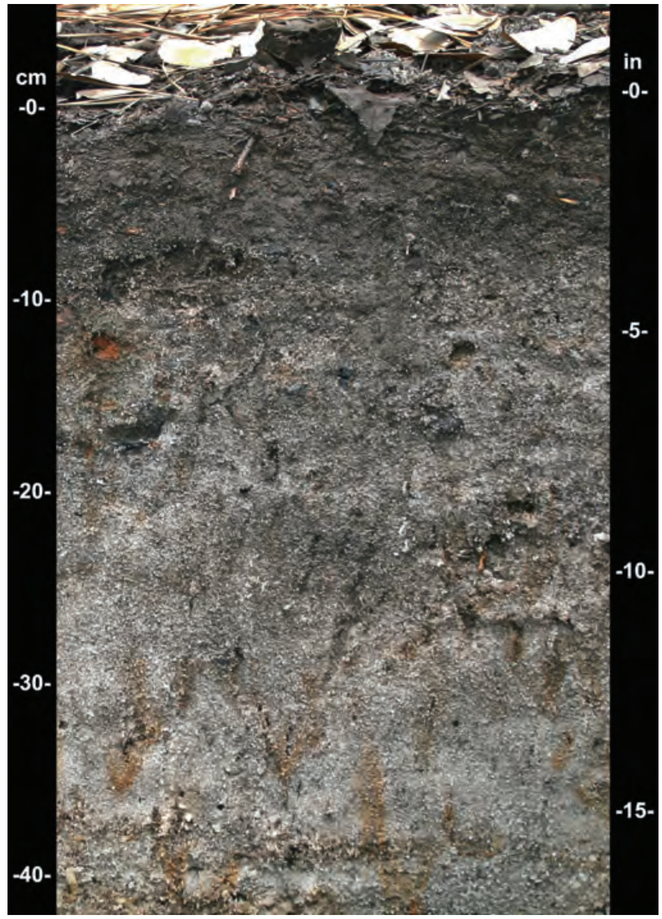

Figure 23.—Indicator S5, Sandy Redox. This soil meets the requirements of indicator S5, having a matrix chroma of 2 or less and at least 2 percent redox concentrations starting at a depth of about 10 cm.

Figure 24.—Indicator S5, Sandy Redox. A close-up of the layer in figure 23 that has chroma of 2 or less and at least 2 percent redox concentrations.

Figure 25.—Indicator S6, Stripped Matrix. This indicator requires diffuse splotchy patterns with rounded areas stripped of organic matter or iron as exemplified in this photo of a horizontal cross-section of a profile.

important process and should result in a splotchy pattern of masked and unmasked soil areas. This may be a difficult pattern to recognize and is more evident when a horizontal slice is observed. Assistance from an experienced soil or wetland scientist can aid in identifying this indicator.

S7.—Dark Surface. *For use in LRRs K, L, M, N, P, Q, R, S, T, U, V, and Z.* A layer 10 cm (4 inches) or more thick, starting at a depth of 15 cm (6 inches) or less from the soil surface, with a matrix value of 3 or less and chroma of 1 or less. At least 70 percent of the visible soil particles must be masked with organic material when viewed through a 10x or 15x hand lens. The matrix color of the layer directly below the dark layer must have the same colors as described above or any color with a chroma of 2 or less.

User Notes: An undisturbed sample must be observed (fig. 26). Many wet soils have a ratio of about 50 percent soil particles that are masked with organic matter and about 50 percent unmasked soil particles, giving the soils a salt-and-pepper appearance. Where the organic matter coverage is less than 70 percent, the Dark Surface indicator does not occur. Observed without a hand lens, the masked sand particles

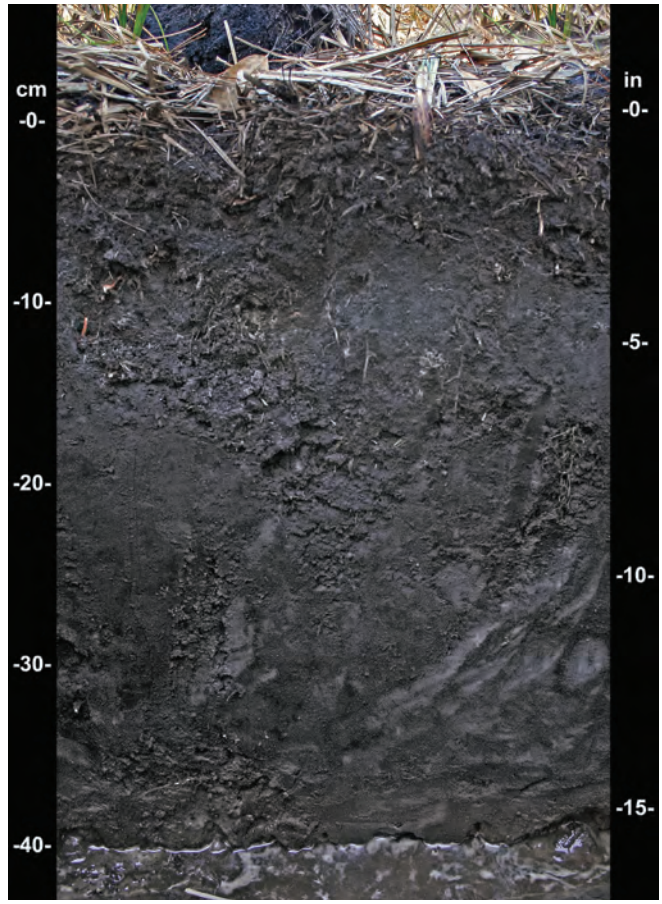

Figure 26.—Indicator S7, Dark Surface. This soil has value of 3 or less and chroma of 1 or less from the soil surface to a depth of 10 cm. Directly below 10 cm, it is the same color, meeting the requirement of having chroma of 2 or less.

appear to be closer to 100 percent masked with organic material when moist. Masked sand grains can disappear quickly if a soil has been drained or disturbed.

S8.—Polyvalue Below Surface. *For use in LRRs R, S, T, and U; for testing in LRRs K and L.* A layer with a value of 3 or less and chroma of 1 or less starting at a depth of 15 cm (6 inches) or less from the soil surface. At least 70 percent of the visible soil particles must be masked with organic material when viewed through a 10x or 15x hand lens. Directly below this layer, 5 percent or more of the soil volume has a value of 3 or less and chroma of 1 or less, and the remainder of the soil volume has value of 4 or more and chroma of 1 or less to a depth of 30 cm (12 inches) or to the spodic horizon.

User Notes: This indicator applies to soils with a very dark gray or black surface or near-surface layer that is typically less than 10 cm (4 inches) thick but has no thickness requirement and is underlain by a layer in which organic matter has been differentially distributed within the soils by water movement (fig. 27). The mobilization and translocation of organic matter result in splotchy coated and uncoated soil. Observed without a hand lens, the masked sand particles appear to be closer to 100 percent masked with organic material when moist. Masked sand grains can disappear quickly if a soil has been drained or disturbed.

Figure 27.—Indicator S8, Polyvalue Below Surface. The diffuse splotchy pattern of black (value of 3 or less and chroma of 1 or less) and gray (value of 4 or more and chroma of 1 or less) below a black surface horizon is evidence of organic matter that has been mobilized and translocated. This soil also meets the requirements of indicator S5, Sandy Redox.

S9.—Thin Dark Surface. *For use in LRRs R, S, T, and U; for testing in LRRs K and L.* A layer 5 cm (2 inches) or more thick, starting at a depth of 15 cm (6 inches) or less from the soil surface, with value of 3 or less and chroma of 1 or less. At least 70 percent of the visible soil particles must be masked with organic material when viewed through a 10x or 15x hand lens. This layer is underlain by a layer or layers with value of 4 or less and chroma of 1 or less to a depth of 30 cm or a spodic horizon.

User Notes: This indicator applies to soils with a very dark gray or black near-surface layer that is 5 cm (2 inches) or more thick and is underlain by a layer in which organic matter has been carried downward by flowing water (fig. 28). The mobilization and translocation of organic matter result in an even distribution of organic matter in the eluvial (E) horizon. The chroma of 1 or less is critical because it limits application of this indicator to only those soils that are depleted of iron. This indicator commonly occurs in hydric Spodosols, but a spodic horizon is not required. Observed without a hand lens, the masked sand particles appear to be closer to 100 percent masked with organic material when moist. Masked sand grains can disappear quickly if a soil has been drained or disturbed.

S11.—High Chroma Sands. *For use along shorelines and near shore regions of the Great Lakes in LRRs K and L.* In coastal zones and dune-and-swale complexes, a layer 5 cm (2 inches) or more thick starting at a depth of 10 cm (4 inches) or less from the soil surface with chroma of 4 or less and 2 percent or more distinct or prominent redox concentrations.

User Notes: Along the shorelines of the Great Lakes within LRRs L and K, some wetlands exhibit the presence of high chroma sands (often chroma 3 to 4). These high-chroma, sandy soils occur at the landward edge of coastal marshes or in interdunal landscape positions of dune-and-swale complexes. These soils exhibit redox

Figure 28.—Indicator S9, Thin Dark Surface. A dark surface horizon about 5 cm thick overlies a thin layer with value of 4 or less and chroma of 1 or less. Directly below the second layer is a spodic horizon, starting at a depth of about 7 cm.

concentrations as pore linings, soft masses, or both starting at a depth of 10 cm (4 inches) or less from the soil surface. In adjacent upland areas, redox concentrations are absent or are only observed at a depth of more than 10 cm (4 inches) from the soil surface. It may be helpful to involve a soil scientist to identify soils that qualify for this indicator.

S12.—Barrier Islands 1 cm Muck. *For use in MLRA 153B and 153D of LRR T.* In the swale portion of dune-and-swale complexes of barrier islands, a layer of muck 1 cm (0.5 inch) or more thick with value of 3 or less and chroma of 2 or less and starting at a depth of 15 cm (6 inches) or less from the soil surface.

User Notes: This indicator is similar to A9 but allows chroma of more than 1 but not more than 2. The indicator is limited to dune-and-swale complexes on barrier islands.

Loamy and Clayey Soils

"Loamy and Clayey Soils" have layers with USDA textures of loamy very fine sand and finer. All mineral layers above any of the layers meeting the requirements of any F-indicator(s) except for indicators F8, F12, F19, F20, and F21 have a dominant chroma of 2 or less, or the thickness of the layer(s) with a dominant chroma of more than 2 is less than 15 cm (6 inches). (See figure 4.) Also, except for indicator F16, nodules and concretions are not considered to be redox concentrations. Use the following F indicators for mineral layers that are loamy and clayey.

F1.—Loamy Mucky Mineral. *For use in all LRRs, except for N, Q, R, S, V, W, X, and Y, those using A7 (LRRs P, T, U, and Z), and MLRA 1 of LRR A.* A layer of mucky modified loamy or clayey soil material 10 cm (4 inches) or more thick starting at a depth of 15 cm (6 inches) or less from the soil surface.

User Notes: "Mucky" is a USDA texture modifier for mineral soils. The content of organic carbon ranges from 5 to 12 percent.

F2.—Loamy Gleyed Matrix. *For use in all LRRs, except for W, X, and Y.* A gleyed matrix that occupies 60 percent or more of a layer starting at a depth of 30 cm (12 inches) or less from the soil surface (fig. 29).

User Notes: Gley colors are not synonymous with gray colors. They are the colors on the gley color pages of the "Munsell Soil Color Book" (X-Rite, 2009) that have hue of N, 10Y, 5GY, 10GY, 5G, 10G, 5BG, 10BG, 5B, 10B, or 5PB and value of 4 or more. The gleyed matrix only has to be present at a depth of 30 cm (12 inches) or less from the soil surface, and there is no thickness requirement for the layer.

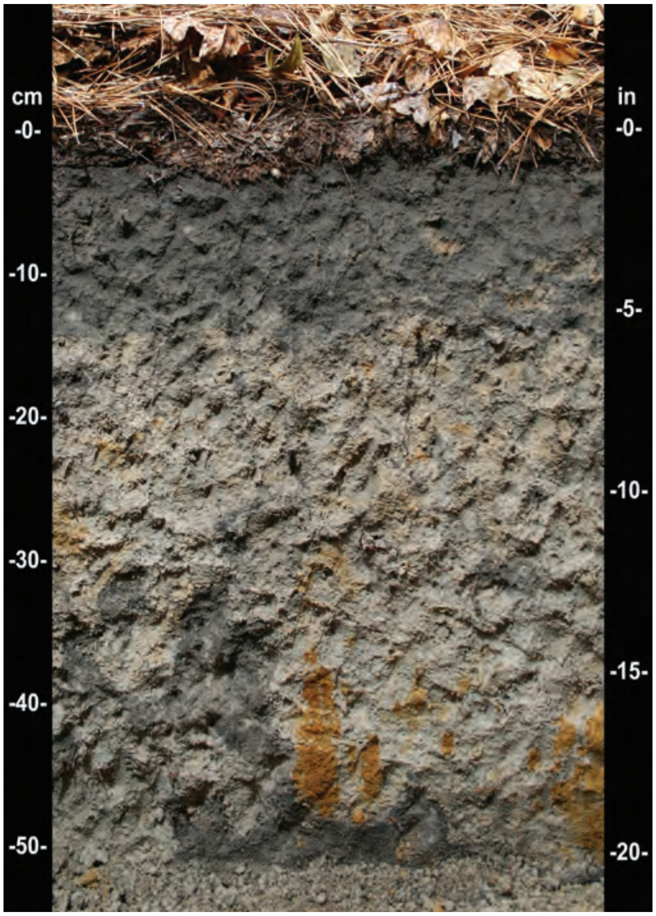

Figure 29.—Indicator F2, Loamy Gleyed Matrix. The gleyed matrix begins at the soil surface and extends to a depth of about 14 cm.

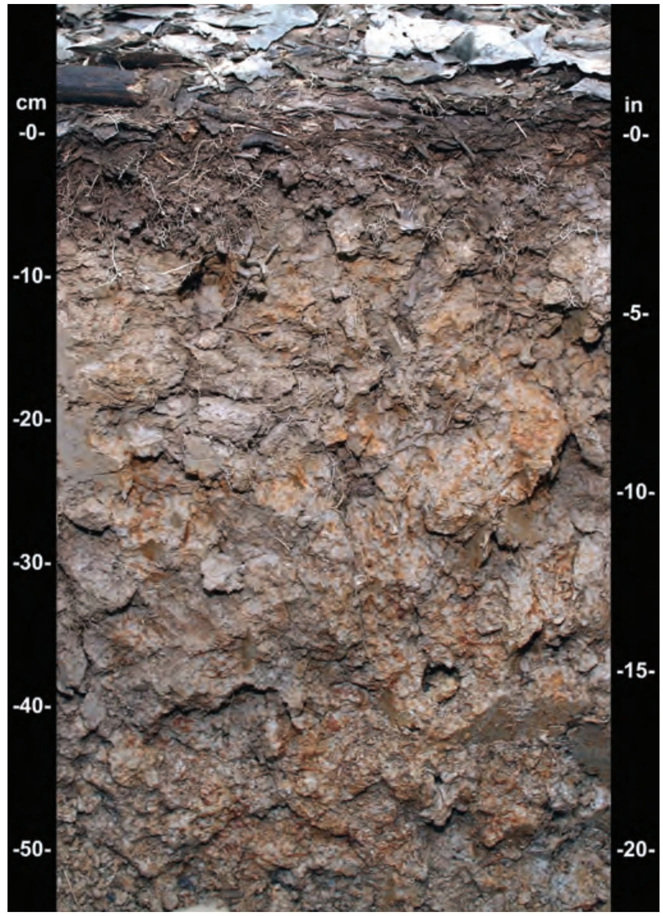

Figure 30.—Indicator F3, Depleted Matrix. This soil has value of 4 or more and chroma of 2 or less and redox concentrations starting at a depth of 8 cm. Since the depleted matrix starts at a depth of 10 cm or less from the soil surface, the minimum thickness requirement is only 5 cm to meet the requirements of indicator F3, Depleted Matrix.

F3.—Depleted Matrix. *For use in all LRRs, except W, X, and Y; for testing in LRRs W, X, and Y.* A layer that has a depleted matrix with 60 percent or more chroma of 2 or less and that has a minimum thickness of either

1. 5 cm (2 inches), starting at a depth of 10 cm (4 inches) or less from the soil surface, or
2. 15 cm (6 inches), starting at a depth of 25 cm (10 inches) or less from the soil surface.

User Notes: This is a very common indicator used to delineate wetland soils in many regions and landscape positions. A depleted matrix requires a value of 4 or more and chroma of 2 or less (fig. 30). Redox concentrations, including soft iron-manganese masses and/or pore linings, 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 the layer has 2 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings. The low-chroma matrix must be the result of wetness and not a weathering or parent material feature.

F6.—Redox Dark Surface. *For use in all LRRs, except W, X, and Y; for testing in LRRs W, X, and Y.* A layer that is 10 cm (4 inches) or more thick, starting at a depth of 20 cm (8 inches) or less from the mineral soil surface, and has

1. matrix value of 3 or less and chroma of 1 or less and 2 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings, or
2. matrix value of 3 or less and chroma of 2 or less and 5 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings.

User Notes: This is a very common indicator used to delineate wetland soils that have a dark surface layer. Redox concentrations in mineral soils with a high content of organic matter and a dark surface layer are commonly small and difficult to see (figs. 31, 32, and 33). The organic matter masks some or all of the concentrations that may be present. Careful examination is required to see what commonly brownish redox concentrations in the darkened materials are. If the soil is saturated at the time of sampling, it may be necessary to let it dry at least to a moist condition for redox features to become visible.

Figure 31.—Indicator F6, Redox Dark Surface. A soil that meets the requirements of indicator F6 must have a dark surface layer with value of 3 or less and chroma of 2 or less and redox concentrations in the dark layer.

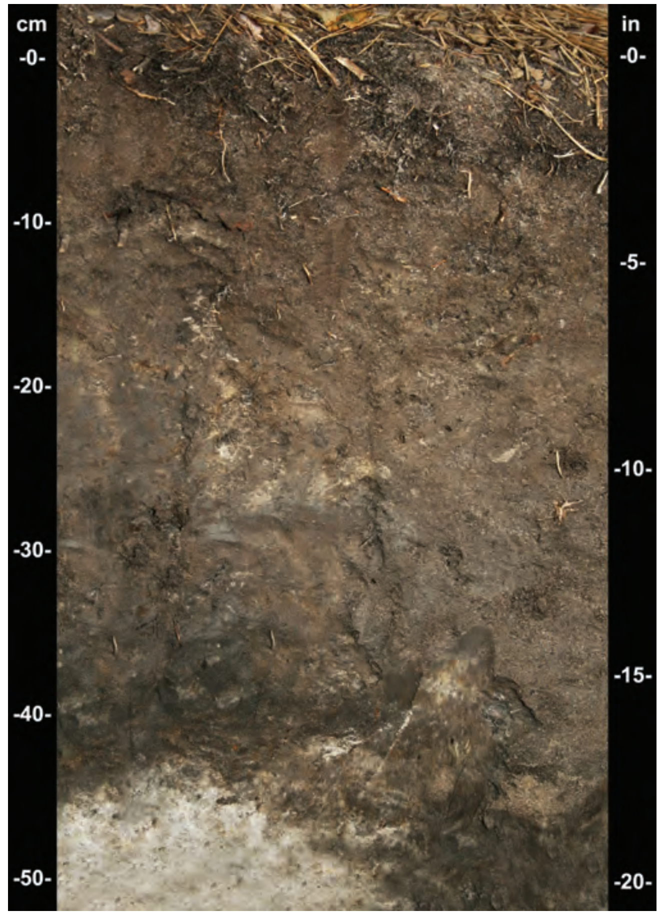

Figure 32.—Indicators F6, Redox Dark Surface, and F7, Depleted Dark Surface. A soil that meets the requirements of indicator F7 commonly also meets the requirements of indicator F6. If the dark surface layer has depletions, it most likely also has concentrations.

Figure 33.—Indicators F6, Redox Dark Surface, and F7, Depleted Dark Surface. An example of both depletions and concentrations in a dark matrix.

Typically, unless the soil is ponded with saturation only occurring near the surface, the material below the indicator will have a depleted or gleyed matrix. Soils that are subject to ponding or have a shallow, perched layer of saturation may have any color below the dark surface. It is recommended that delineators evaluate the hydrologic source and examine and describe the layer below the dark-colored surface layer when applying this indicator. This indicator is easily human-induced if a plow pan or other human-made confining layer is present. In these cases, the human-induced feature may have caused the development of a hydric soil. Removal of the feature that is causing the perching of water can eliminate the source of water causing anaerobic conditions to occur; therefore, the soil is no longer actively forming as a hydric soil.

F7.—Depleted Dark Surface. *For use in all LRRs except W, X, and Y; for testing in LRRs W, X, and Y.* Redox depletions with value of 5 or more and chroma of 2 or less in a layer that is 10 cm (4 inches) or more thick, starting at a depth of 20 cm (8 inches) or less from the mineral soil surface, and has

1. matrix value of 3 or less and chroma of 1 or less and 10 percent or more redox depletions, or
2. matrix value of 3 or less and chroma of 2 or less and 20 percent or more redox depletions.

User Notes: Care should be taken not to mistake mixing of an E or calcic horizon into the surface layer for depletions. The pieces of E and calcic horizons are not redox depletions. Knowledge of local conditions is helpful in areas where E and/or calcic horizons may be present. In soils that are wet because of subsurface saturation, the layer directly below the dark surface layer will typically have a depleted or gleyed matrix. Redox depletions should have associated redox concentrations (see figs. 32 and 33) that occur as Fe pore linings or masses within the depletion(s) or surrounding the depletion(s).

F8.—Redox Depressions. *For use in all LRRs except W, X, and Y; for testing in LRRs W, X, and Y.* In closed depressions subject to ponding, 5 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings in a layer that is 5 cm (2 inches) or more thick and starts at 10 cm (4 inches) or less from the soil surface.

User Notes: This indicator occurs on depressional landforms, such as vernal pools, playa lakes, rainwater basins, Grady ponds, Carolina Bays, and potholes (figs. 34 and 35). This indicator is also common in backwater depressions of flood plains such as swamps or sloughs. It does not occur in solitary microdepressions (approximately 1 m scale) or on convex or planar slope shape positions.

F10.—Marl. *For use in LRR K, L, and U.* A layer of marl with value of 5 or more and chroma of 2 or less starting at a depth of 10 cm (4 inches) or less from the soil surface (fig. 36).

User Notes: Marl is a limnic material deposited in water by precipitation of calcium carbonate by algae as defined in “Soil Taxonomy” (Soil Survey Staff, 1999). It has a Munsell value of 5 or more and reacts with dilute hydrochloric acid to evolve carbon dioxide. Marl is not the carbonatic substrate material associated with limestone bedrock. Some soils have materials with all of the properties of marl, except for the required Munsell value. These soils are hydric if the required value is present at a depth of 10 cm (4 inches) or less from the soil surface. Normally, this indicator occurs at the soil surface. There is no thickness requirement to meet this indicator.

F11.—Depleted Ochric. *For use in MLRA 151 of LRR T.* A layer 10 cm (4 inches) or more thick in which 60 percent or more of the matrix has value of 4 or more and chroma of 1 or less. The layer starts at a depth 15 cm (6 inches) or less from the soil surface.

User Notes: This indicator is applicable in deltaic accreting areas along the Mississippi River.

F12.—Iron-Manganese Masses. *For use in LRRs N, O, P, and T; for testing in LRRs D, K, L, M, and R.* On flood plains, a layer 10 cm (4 inches) or more thick with 40 percent or more

Figure 34.—Indicator F8, Redox Depressions. F8 requires only 5 percent redox concentrations in the upper part of the soil and has no matrix color requirement.

Figure 35.—Indicator F8, Redox Depressions. Indicator F8 requires that the soil be in a closed depression subject to ponding. This soil is in a backwater depression on a flood plain.

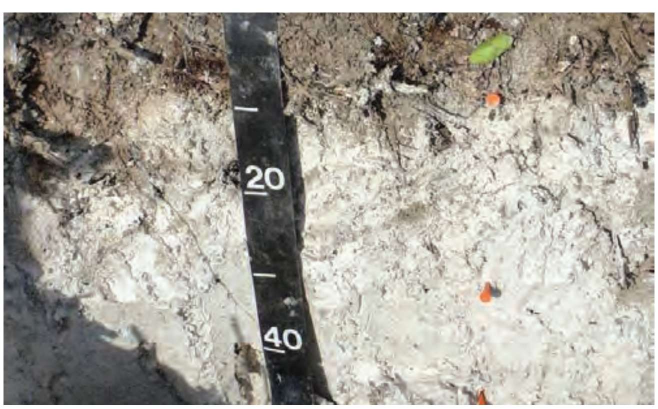

Figure 36.—Indicator F10, Marl. In this profile, marl begins at a depth of 10 cm or less from the soil surface. The scale is in cm.

chroma of 2 or less and 2 percent or more distinct or prominent redox concentrations occurring as soft iron-manganese masses with diffuse boundaries. The layer starts at a depth of 20 cm (8 inches) or less from the soil surface. Iron-manganese masses have value and chroma of 3 or less. Most commonly, they are black. The thickness requirement is waived if the layer is the mineral soil surface layer.

User Notes: These iron-manganese masses generally are small (2 to 5 mm in size) and have value and chroma of 3 or less (fig. 37). They can be dominated by manganese and therefore have a color approaching black. The low matrix chroma must be the result of wetness and not be a weathering or parent material feature. Iron-manganese masses should not be confused with the larger and redder iron nodules associated with plinthite or with concretions that have sharp boundaries. This indicator occurs on flood plains along rivers, such as the Apalachicola, Congaree, Mobile, Savannah, and Tennessee Rivers.

F13.—Umbric Surface. *For use in LRRs P, T, and U and MLRA 122 of LRR N.* A layer 25 cm (10 inches) or more thick, starting at a depth of 15 cm (6 inches) or less from the soil surface, in which the upper 15 cm (6 inches) has value of 3 or less and chroma of 1 or less and in which the

Figure 37.—Indicator F12, Iron-Manganese Masses. Although this indicator requires only 40 percent value of 4 or more and chroma of 2 or less, at least 2 percent iron-manganese masses is needed. These masses are indicated by black splotches in this photo.

lower 10 cm (4 inches) has the same colors as those described above or any other color that has chroma of 2 or less.

User Notes: The thickness requirements may be slightly less than those for an umbric epipedon (fig. 38).

F16.—High Plains Depressions. *For use in MLRAs 72 and 73 of LRR H; for testing in other MLRAs of LRR H.* In closed depressions that are subject to ponding, a mineral soil that has chroma of 1 or less to a depth of 35 cm (13.5 inches) or more from the soil surface and a layer of 10 cm (4 inches) or more thick starting at a depth of 25 cm

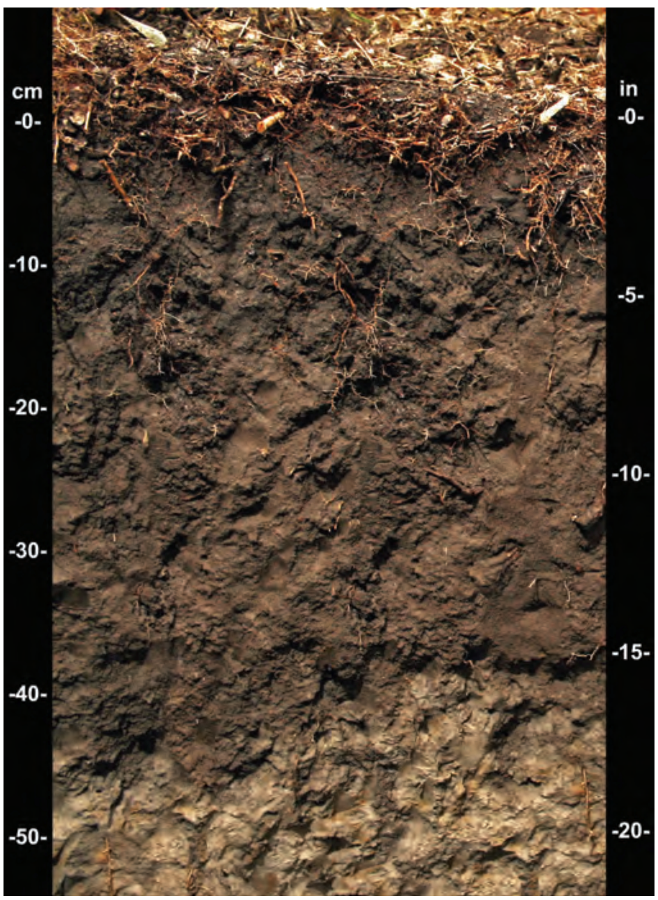

Figure 38.—Indicator F13, Umbric Surface. This soil has an umbric surface horizon about 44 cm thick. It meets the requirements not only of indicator F13 but also of indicators A7, 5 cm Mucky Mineral, and A12, Thick Dark Surface.

(10 inches) or less from the mineral soil surface that has either

1. one percent or more redox concentrations occurring as nodules or concretions, or
2. redox concentrations occurring as nodules or concretions with distinct or prominent corona (halo).

User Notes: This indicator is applicable in closed depressions in western Kansas, southwestern Nebraska, eastern Colorado, and southeastern Wyoming. It occurs in such soils as those of the Ness and Pleasant series. The matrix color of the 35-cm (13.5-inch) layer must have chroma of 1 or less; chroma-2 matrix colors are excluded; value generally is 3. The nodules and concretions are rounded, are hard or very hard, range in size from less than 1 mm to 3 mm, and most commonly are black or reddish black. The corona generally is reddish brown, strong brown, or yellowish brown. The nodules and concretions can be removed from the soil, and the corona will occur as coatings on the concentration or will remain attached to the soil matrix. Use of 10x to 15x magnification aids in the identification of these features.

F17.—Delta Ochric. *For use in MLRA 151 of LRR T.* A layer 10 cm (4 inches) or more thick in which 60 percent or more of the matrix has value of 4 or more and chroma of 2 or less and there are no redox concentrations. This layer starts at a depth of 20 cm (8 inches) or less from the soil surface.

User Notes: This indicator is applicable in accreting areas of the Mississippi River Delta.

F18.—Reduced Vertic. *For use in MLRA 150 of LRR T; for testing in all LRRs with Vertisols and Vertic intergrades.* In Vertisols and Vertic intergrades, a positive reaction to alpha-alpha-dipyridyl that:

1. is the dominant (60 percent or more) condition of a layer 10 cm (4 inches) or more thick starting at a depth of 30 cm (12 inches) or less; or 5 cm (2 inches) or more thick starting

at a depth 15 cm (6 inches) or less from the muck or mineral surface,

2. occurs for 7 or more continuous days and 28 cumulative days, and
3. occurs during a normal or drier season and month.

User Notes: The time requirements for this indicator were identified from research in MLRA 150A in LRR T (Gulf Coast Prairies). These requirements or slightly modified time requirements may be used to identify wetland Vertisols and Vertic intergrades in other parts of the Nation. These soils generally have thick, dark surface horizons, but indicators A11, A12, and F6 commonly are not evident, possibly because of masking of redoximorphic features by organic carbon. These soils are a special case of the “Problem Soils with Thick, Dark A Horizons” listed in the “Corps of Engineers Wetlands Delineation Manual“ (Environmental Laboratory, 1987).

F19.—Piedmont Flood Plain Soils. *For use in MLRAs 148 and 149A of LRR S; for testing on flood plains subject to piedmont deposition throughout LRRs P, S, and T.* On flood plains, a mineral layer 15 cm (6 inches) or more thick, starting at a depth of 25 cm (10 inches) or less from the soil surface, with a matrix (60 percent or more of the volume) chroma of less than 4 and 20 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings.

User Notes: This indicator is for use or testing on flood plains in the mid-Atlantic and southern parts of the Piedmont province and in areas where sediments derived from the Piedmont are being deposited on flood plains on the Coastal Plain (fig. 39). This indicator does not apply to stream terraces, which are associated with a historic stream level and are representative of an abandoned flood plain. While these soils are found on flood plains, flooding may be rare, and groundwater is often the source of hydrology.

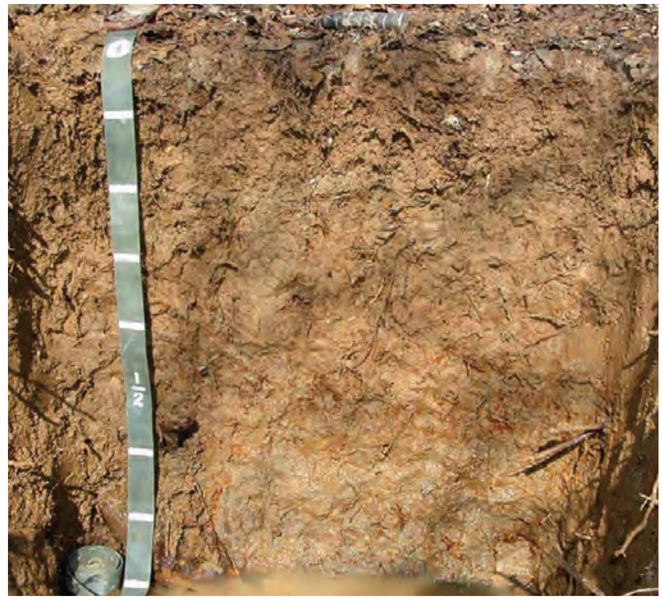

Figure 39.—Indicator F19, Piedmont Flood Plain Soils. This indicator is restricted to active flood plains. It does not require a matrix color with chroma of 2 or less.

F20.—Anomalous Bright Loamy Soils. *For use in MLRA 149A of LRR S and MLRAs 153C and 153D of LRR T; for testing in MLRA 153B of LRR T.* Within 200 m (656 feet) from estuarine marshes or water and at a depth 1 m (3.28 feet) or less of mean high water, a mineral layer 10 cm (4 inches) or more thick, starting at a depth of 20 cm (8 inches) or less from the soil surface, with a matrix (60 percent or more of the volume) chroma of less than 5 and 10 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings and/or depletions.

User Notes: These soils are expected to occur on linear or convex landforms that are adjacent to estuarine marshes or water (fig. 40).

F21.—Red Parent Material. *For use in MLRA 127 of LRR N; MLRA 145 of LRR R; and MLRAs 147 and 148 of LRR S; for testing in all soils derived from red parent materials.* A layer derived from red parent materials (see “Glossary”) that is 10 cm (4 inches) or more thick, starting at a depth of 25 cm (10 Inches) or less from the soil surface with a hue of 7.5YR or redder. The matrix has a value and chroma of more than 2 to less than or equal to 4. The layer must contain 10 or more percent depletions and/or distinct or prominent concentrations occurring as soft masses or pore

Figure 40.—Indicator F20, Anomalous Bright Loamy Soils. This indicator is restricted to areas near estuarine marshes or water. It does not require a matrix color with chroma of 2 or less.

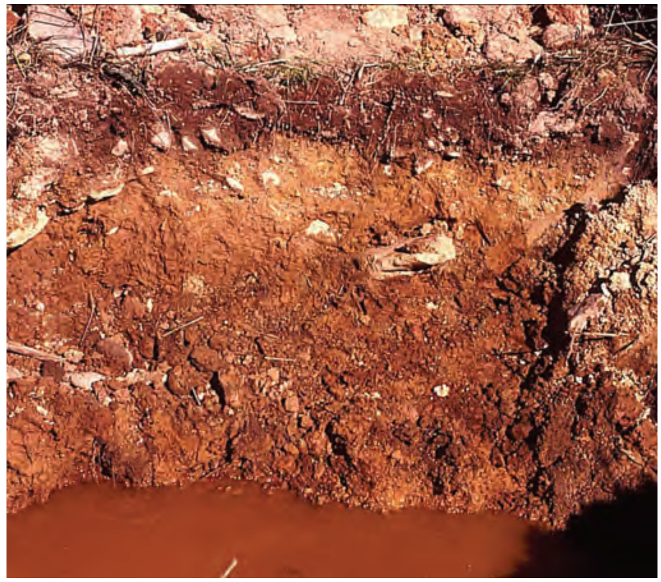

Figure 41.—Indicator F21, Red Parent Material. This indicator should be used only in areas of red parent material that are resistant to reduction. Not all red soils formed in red parent material.

linings. Redox depletions should differ in color by having

1. a minimum difference of one value higher and one chroma lower than the matrix, or
2. value of 4 or more and chroma of 2 or less than the matrix (fig. 41).

User Notes: This indicator was developed for use in areas of red parent material, such as residuum in the Piedmont Province Triassic Lowlands section or the Paleozoic “red beds” of the Appalachian Mountains, and in alluvium or colluvium derived from these materials. This indicator may occur along the Red River (Arkansas and Louisiana). In glaciated areas, the indicator may form in glacial till, outwash, deltaic sediments, or glaciolacustrine sediments derived from similar parent materials in the area. Soils potentially derived from red parent materials should be evaluated to determine the Color Change Propensity Index (CPPI) and be shown to have CCPI values below 30 (Rabenhorst and Parikh, 2000). In landscapes where mixing or stratification of parent materials occur, it cannot be assumed that sediment overlying red parent material is derived solely from that parent material. The total percentage of all redox concentrations and redox depletions must add up to at least 10 percent to meet the threshold for this indicator. This indicator is typically found at the boundary between hydric and non-hydric soils. Other, more common indicators may be found on the interior (fig. 42). Mack et al. (2019) provides maps of soils and geologic features associated with red parent materials. It may be helpful to involve a soil scientist familiar with these soils to identify those soils that qualify for this indicator.

Figure 42.—Indicator F3, Depleted Matrix, in red parent material. If a soil that formed in red parent material stays wet and anaerobic long enough, it may develop the indicator F3.

F22.—Very Shallow Dark Surface. *For use in MLRA 138 and west Florida portions of MLRA 152A of LRR T and MLRA 154 of LRR U; for testing in all other MLRAs and LRRs.* In depressions and flood plains subject to frequent ponding and/or flooding, one of the following must be observed:

1. If bedrock occurs between 15 cm (6 inches) and 25 cm (10 inches) of the soil surface, a layer of 15 cm (6 inches) or more thick starting at a depth 10 cm (4 inches) or less from the soil surface with value of 2.5 or less and chroma 1 or less, and the remaining soil to bedrock must have the same colors as above or any other color that has chroma of 2 or less; or

2. If bedrock occurs at a depth of 15 cm (6 inches) or less from the soil surface, more than half of the soil thickness must have value of 2.5 or less and chroma 1 or less, and the remaining soil to bedrock must have the same color as above or any other color that has a chroma of 2 or less.

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Glossary

As defined in this Glossary, terms marked with an asterisk (*) have definitions that are slightly different from the definitions in the referenced materials. The definitions in the Glossary are intended to assist users of this document and are not intended to add to or replace definitions in the referenced materials.

A horizon. A mineral soil horizon that formed at the surface or below an O horizon where organic material is accumulating. See “Soil Taxonomy” (Soil Survey Staff, 1999) for a complete definition.

Accreting areas. Landscape positions in which soil material accumulates through deposition from higher elevations or upstream positions more rapidly than the rate at which soil material is being lost through erosion.

Anaerobic. A condition in which molecular oxygen is virtually absent from the soil.

Anaerobiosis. Microbiological activity under anaerobic conditions.

Aquic conditions. Conditions in the soil represented by depth of saturation, occurrence of reduction, and redoximorphic features. See “Soil Taxonomy” (Soil Survey Staff, 1999) for a complete definition.

***Artificial drainage.** The use of human efforts and devices to remove free water from the soil surface or from the soil profile (fig 43). The hydrology may also be modified by levees and dams, which keep water from entering a site (fig. 44).

Calcic horizon. An illuvial horizon in which carbonates have accumulated to a significant extent. See “Soil Taxonomy” (Soil Survey Staff, 1999) for a complete definition.

Calcium carbonate. Calcium carbonate has the chemical formula of $CaCO_3$. It effervesces when treated with cold hydrochloric acid.

Closed depressions. Low-lying areas that are surrounded by higher ground and have no natural outlet for surface drainage.

Figure 43.—Artificial drainage does not alter the hydric status of a soil.

Figure 44.—Profile on right is from a drained wetland adjacent to a ditch. Profile on 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.

Common. When referring to redox concentrations, redox depletions, or both, “common” represents 2 to 20 percent of the observed surface.

Concave landscapes. Landscapes in which the surface curves downward.

Concretions. Firm to extremely firm, irregularly shaped bodies with sharp to diffuse boundaries. When broken in half, concretions have concentric layers. See Vepraskas (1994) for a complete discussion.

***Depleted matrix.** For mineral soil layers, 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. 45). 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:

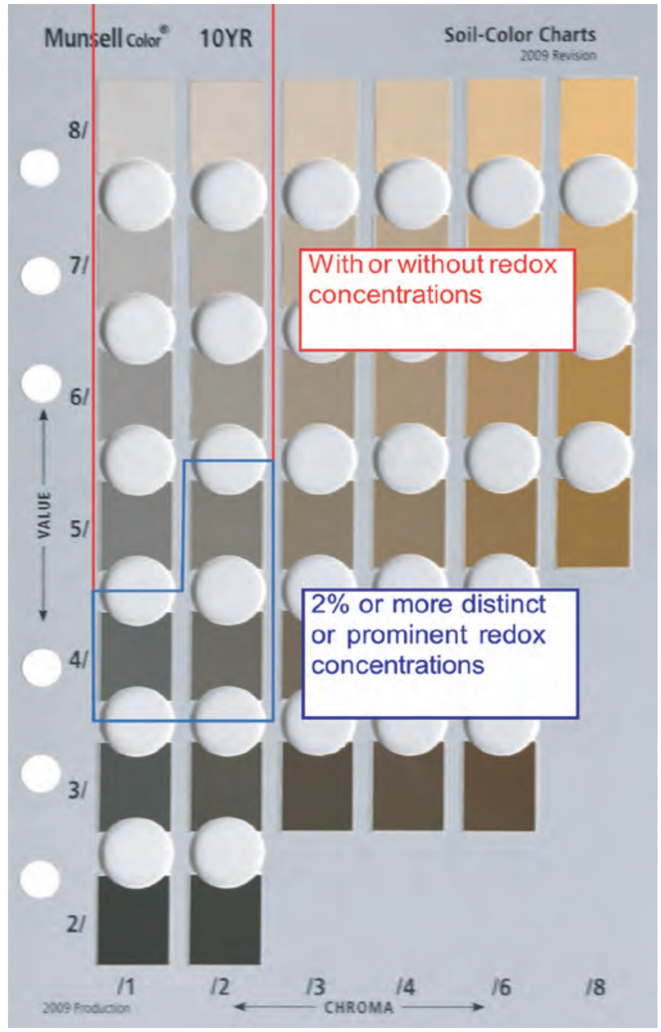

Figure 45.—Illustration of values and chromas that require 2 percent or more distinct or prominent redox concentrations and those that do not, for hue 10YR, to meet the definition of a depleted matrix. Due to inaccurate color reproduction, do not use this page to determine soil colors in the field. Background image from the Munsell Soil Color Charts reprinted courtesy of Munsell Color Services Lab, a part of X-Rite, Inc. (X-Rite, 2009).

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, chroma of 2, and 2 percent or more distinct or prominent redox concentrations occurring as soft masses and/or pore linings; or
4. Matrix value of 4, a chroma of 1, and 2 percent or more distinct or prominent redox concentrations occurring as soft masses and/or pore linings (fig. 46).

Diffuse boundary. Used to describe redoximorphic features that grade gradually from one color to another (fig. 47). The color grade is more than 2 mm wide.

Figure 46.—A depleted matrix with value of 4 or more and chroma of 2 or less. Redox concentrations occur as soft masses and pore linings.

Figure 47.—Iron concentration with a diffuse boundary exhibited by bright colors in the center of the concentration and a lighter color away from the center.

Distinct. Readily seen but contrasting only moderately with the color to which compared. The contrast is distinct for the following:

1. Delta hue equal to 0, then
   a. delta value of 2 or less and delta chroma of more than 1 to less than 4, or
   b. delta value of more than 2 to less than 4 and delta chroma of less than 4.

2. Delta hue equal to 1, then
   a. delta value of 1 or less and delta chroma of more than 1 to less than 3, or
   b. delta value of more than 1 to less than 3 and delta chroma of less than 3.

3. Delta hue equal to 2, then
   a. delta value equal to 0 and delta chroma of more than 0 to less than 2, or
   b. delta value of more than 0 to less than 2 and delta chroma of less than 2.

Exception: if the compared colors have both a value of 3 or less and a chroma 2 or less, then the color contrast is faint regardless of hue difference (fig. 48).

For a more detailed explanation of how to determine color contrast, see “Soil Survey Technical Note 430-SS-2” on “Soil Color Contrast” (Soil Survey Staff, 2023).

E horizon. A mineral horizon in which the dominant process is loss of silicate clay, iron, and/or aluminum, leaving a concentration of sand and silt particles (fig. 49). See “Soil Taxonomy” (Soil Survey Staff, 1999) for a complete definition.

Epipedon. A horizon that has developed at the soil surface. See “Soil Taxonomy” (Soil Survey Staff, 1999) for a complete definition.

Faint. Evident only on close examination. The contrast is faint if

1. delta hue equal to 0, then delta value of 2 or less and delta chroma of 1 or less, or
2. delta hue equal to 1, then delta value of 1 or less and delta chroma of 1 or less, or

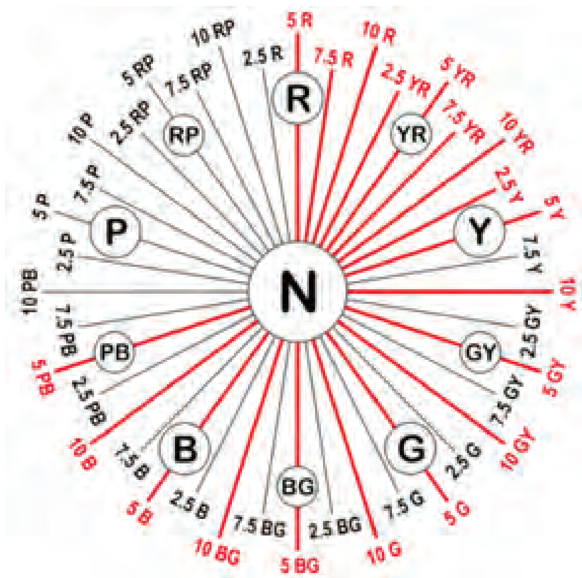

Figure 48.—Relationships among the hues of the Munsell Color System. Solid lines represent hues contained in the "Munsell Soil Color Charts" (X-Rite, 2009). Dotted lines represent all other possible 2.5-unit steps. Moving from one hue line to the adjacent hue line represents a delta hue of 1 (2.5 units). Moving from hue N to any other hue the delta hue is 1. Adapted from the "Soil Survey Manual" (Soil Survey Staff, 2017).

3. delta hue equal to 2, then delta value equal to 0 and delta chroma equal to 0, or
4. any delta hue if both colors have a value of 3 or less and chroma of 2 or less (table 1).

Table 1: Upper Threshold for Faint

Δ Hue	**Δ Value**	**Δ Chroma**
0	2 or less	1 or less
1	1 or less	1 or less
2	0	0
Δ Hue	**If Value**	**If Chroma**
Any	3 or less	2 or less

Any feature above the upper threshold for faint features would be considered either distinct or prominent. If an indicator requires distinct or prominent features, then the features at or below the faint threshold are not considered.

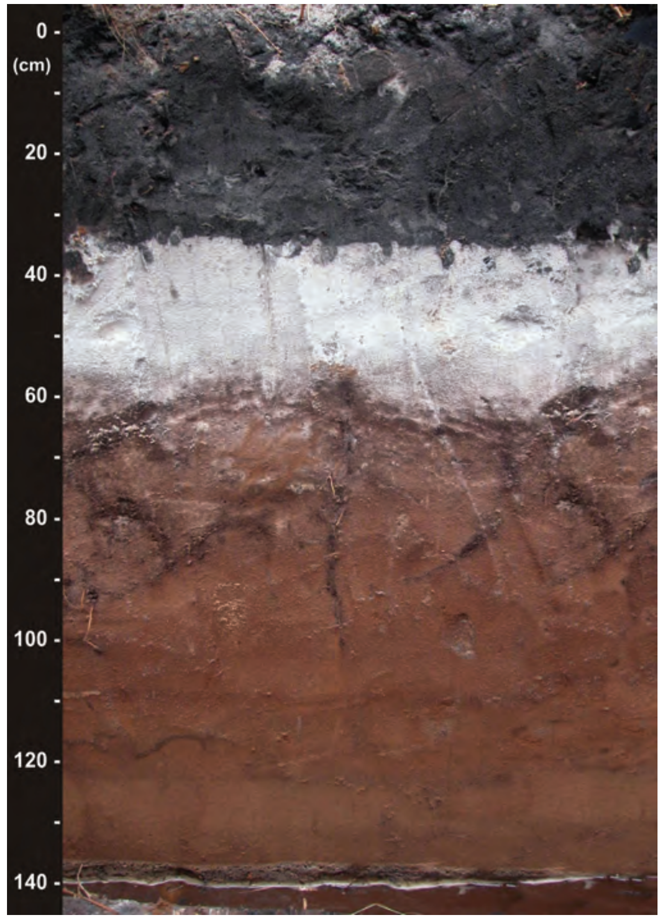

Figure 49.—A soil profile with an albic (white) E horizon between depths of about 35 and 60 cm. The white color results from loss of iron through weathering.

Fe-Mn concretions. Firm to extremely firm, irregularly shaped bodies with sharp to diffuse boundaries. When broken in half, concretions have concentric layers. See Vepraskas (1994) for a complete discussion.

Fe-Mn nodules. Firm to extremely firm, irregularly shaped bodies with sharp to diffuse boundaries. When broken in half, nodules do not have visibly organized internal structure. See Vepraskas (1994) for a complete discussion.

Few. When referring to redox concentrations, redox depletions, or both, "few" represents less than 2 percent of the area in an exposed face of a soil profile.

Fibric. See “Peat.”

Flooded. A condition in which the soil surface is temporarily covered with flowing water from any source, such as streams overflowing their banks, runoff from adjacent or surrounding slopes, inflow from high tides, or any combination of sources.

Flood plain. The nearly level plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the stream.

Fragmental soil material. Soil material that consists of 90 percent or more rock fragments. Less than 10 percent of the soil consists of particles 2 mm or smaller.

Frequently flooded or ponded. A frequency class in which flooding or ponding is likely to occur often under usual weather conditions (a chance of more than 50 percent in any year or more than 50 times in 100 years).

Glauconitic. Refers to a mineral aggregate that contains a micaceous mineral resulting in a characteristic green color, e.g., glauconitic shale or clay (fig. 50).

***g.** A horizon suffix indicating that the horizon is gray because of wetness but not necessarily that it is gleyed. All gleyed matrices (defined below) should have the suffix “g”; however, not all horizons with the “g” suffix are gleyed. For example, a horizon with the color 10YR 6/2 that is at least seasonally wet, with or without other redoximorphic features, should have the “g” suffix.

***Gleyed matrix.** Soils with a gleyed matrix have the following combinations of hue, value, and chroma (the soils are not glauconitic):

1. 10Y, 5GY, 10GY, 10G, 5BG, 10BG, 5B, 10B, or 5PB with value of 4 or more and chroma of 1; or
2. 5G with value of 4 or more and chroma of 1 or 2; or
3. N with value of 4 or more; or

Figure 50.—Glauconitic soils typically have gleyed, green, or black matrices and can have mottles of weathered sulfides that can be mistaken for redox concentrations. If the weathered sulfides in this glauconitic soil were mistaken for redox concentrations, this nonhydric soil would appear to meet the requirements of indicator F6, Redox Dark Surface.

4. in some places the gleyed matrix may change color upon exposure to air. (See “Reduced matrix”). This phenomenon is included in the concept of gleyed matrix (figs. 50, 51, and 52).

***Hemic.** See “Mucky peat.”

Histels. Organic soils that overlie permafrost and show evidence of cryoturbation. See “Soil Taxonomy” (Soil Survey Staff, 1999) for a complete definition.

Histic epipedon. A thick (20- to 60-cm, or 8- to 24-inch) organic soil horizon that is saturated with water at some period of the year (unless the soil is artificially drained) and that is at or near the surface of a mineral soil.

Histosols. Organic soils that have organic soil materials in more than half of the upper 80 cm (32 inches) or that have organic materials of any thickness if they overlie rock or fragmental materials that have interstices filled with organic

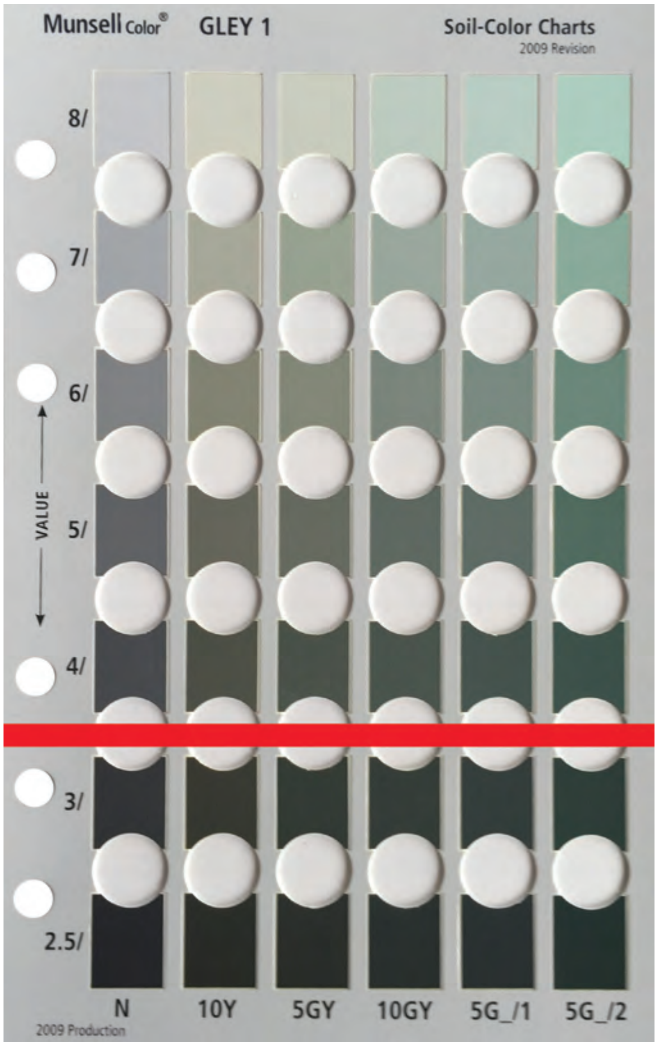

Figure 51.—A gleyed matrix must have the colors on one of the Gley color pages in the “Munsell Soil Color Book” (X-Rite, 2009). Values are 4 or more (above the red line).

soil materials. See “Soil Taxonomy” (Soil Survey Staff, 1999) for a complete definition.

Horizon. A layer, approximately parallel to the surface of the soil, distinguishable from adjacent layers by a distinctive set of properties produced by soil-forming processes. See “Soil Taxonomy” (Soil Survey Staff, 1999) for a complete definition.

Hydric soil definition. A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (“Changes in Hydric Soils of the United States, 60 Fed. Reg. 10349,” 1995).

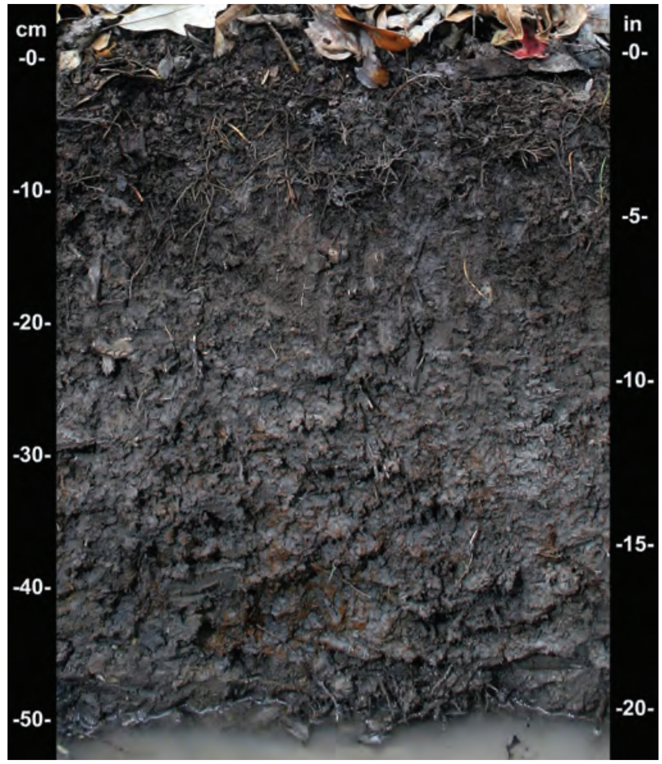

Figure 52.—The gleyed matrix in this soil starts at a depth of about 15 cm. The matrix color has value of 4 or more and is shown on one of the pages showing gleyed colors in the “Munsell Soil Color Book” (X-Rite, 2009).

Hydrogen sulfide odor. The odor of H_2S. It is similar to the smell of rotten eggs.

Iron monosulfide (FeS). Dark-gray or black precipitates with matrix of 4 or less and chroma of 2 or less occurring in the soil as stains, coatings, soft masses, or pore linings (Duball et al., 2020). These compounds rapidly oxidize when exposed to the atmosphere resulting in a 1 or more unit increase in Munsell value. Proper identification of FeS is critical to differentiate it from other dark soil materials such as organic matter and manganese oxides. The flowchart (fig. 53) should be employed to identify FeS features.

Layer(s). A horizon, subhorizon, or combination of contiguous horizons or subhorizons sharing the properties required by the indicator.

Lithologic discontinuity. Occurs in a soil that has developed in more than one type of parent material. Commonly determined by a significant

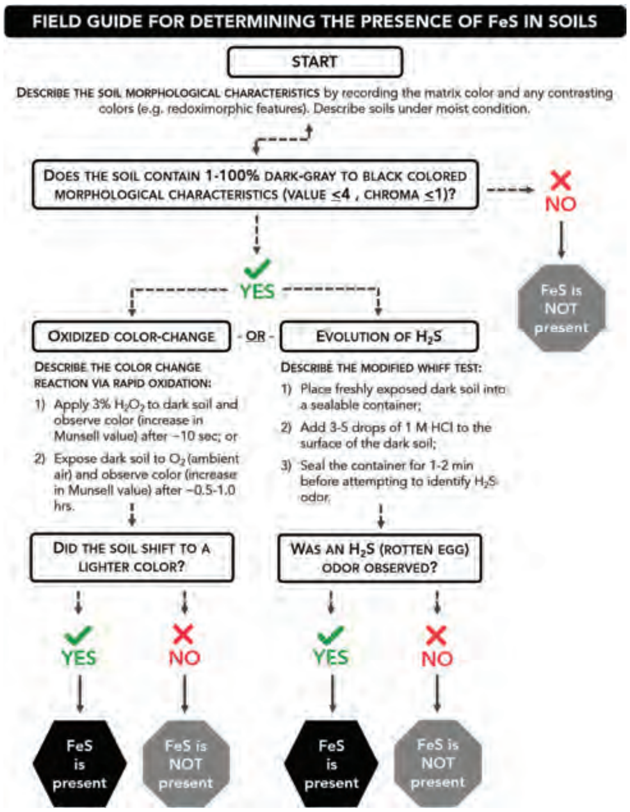

Figure 53.— Use to identify iron monosulfides (Duball et al., 2020).

change in particle-size distribution, mineralogy, etc., that indicates a difference in material from which the horizons formed.

LRR. Land resource region. LRRs are geographic areas characterized by a particular pattern of soils, climate, water resources, and land use. Each LRR is assigned a different letter of the alphabet (A-Z). LRRs are defined in "U.S.Department of Agriculture Handbook 296" (USDA, NRCS, 2022).

Many. When referring to redox concentrations, redox depletions, or both, "many" represents greater than 20 percent of the observed surface.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions. See "Soil Taxonomy" (Soil Survey Staff, 1999) for a complete definition.

***Masked.** Through redoximorphic processes, the color of soil particles is hidden by organic material, silicate clay, iron, aluminum, or some combination of these.

Matrix. The dominant soil volume that is continuous in appearance. When three colors occur, such as when a matrix, depletions, and concentrations are present, the matrix may represent less than 50 percent of the total soil volume.

MLRA. Major land resource area. MLRAs are geographically associated divisions of land resource regions. MLRAs are defined in "U.S. Department of Agriculture Handbook 296" (USDA, NRCS, 2022).

Mollic epipedon. A mineral surface horizon that is relatively thick, dark colored, and humus rich and has high base saturation (fig. 54). See "Soil Taxonomy" (Soil Survey Staff, 1999) for a complete definition.

Mollisols. Mineral soils that have a mollic epipedon. See "Soil Taxonomy" (Soil Survey Staff, 1999) for a complete definition.

Muck. Sapric organic soil material in which virtually all of the organic material is so decomposed that identification of plant forms is not possible. Use only with organic horizons (of any thickness) of mineral and organic soils that are saturated for 30 or more cumulative days in normal years or are artificially drained.

***Mucky modified mineral soil material.** A USDA soil texture modifier, e.g., mucky sand. Mucky modified mineral soil material has between 5 and 12 percent organic carbon. Where the organic component is peat (fibric material) or mucky peat (hemic material), mucky mineral soil material does not occur.

Mucky peat. Hemic organic material, which is characterized by decomposition that is intermediate between that of peat (fibric material) and that of muck (sapric material). Use only with organic horizons (of any thickness) of mineral and organic soils that are saturated for 30 or more

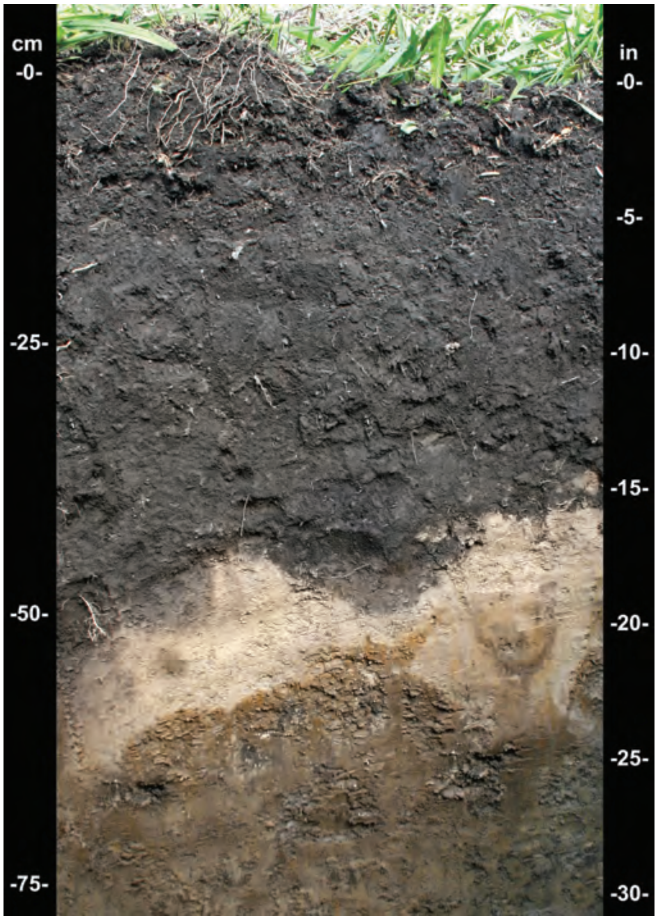

Figure 54.— A soil with a mollic epipedon, which is a thick, black surface horizon that has high base saturation. Soils that have a mollic epipedon are classified as Mollisols.

cumulative days in normal years or are artificially drained.

Nodules. Firm to extremely firm, irregularly shaped bodies with sharp to diffuse boundaries. When broken in half, nodules do not have visibly organized internal structure. See Vepraskas (1994) for a complete discussion.

NRCS. USDA, Natural Resources Conservation Service (formerly Soil Conservation Service).

NTCHS. National Technical Committee for Hydric Soils.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Organic soil material. Soil material that has 12 percent or more (by weight) organic carbon. Terms used in lieu of texture for organic materials of soil horizons saturated for 30 or more cumulative days in normal years, or artificially drained, include muck (Oa), mucky peat (Oe), and peat (Oi).

Peat. Fibric organic soil material. The plant forms can be identified in virtually all of the organic material. Use only with organic horizons (of any thickness) of mineral and organic soils that are saturated for 30 or more cumulative days in normal years or are artificially drained. Peat has three-fourths or more fibers after rubbing.

Ped. A unit of soil structure such as a block, column, granule, plate, or prism, formed by natural processes (in contrast with a clod, which is formed artificially).

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. See “Soil Taxonomy” (Soil Survey Staff, 1999) for a complete discussion.

Figure 55.—A redox concentration occurring as a pore lining.

Ponding. Standing water in a closed depression that is removed only by percolation, evaporation, or transpiration. The ponding lasts for more than 7 days.

Pore linings. Zones of accumulation that may be either coatings on a ped or pore surface or impregnations of the matrix adjacent to the pore or ped (fig. 55). See Vepraskas (1994) for a complete discussion.

Prominent. Contrasts strongly in color. Color contrasts more contrasting than faint and distinct are prominent.

Red parent material. The parent material with a natural inherent reddish color attributable to the presence of iron oxides, typically hematite (Elless and Rabenhorst, 1994; Elless et al., 1996), occurring as coatings on and occluded within mineral grains. Soils that formed in red parent material have conditions that greatly retard the development and extent of the redoximorphic features that normally occur under prolonged aquic conditions. They typically have a Color Change Propensity Index (CCPI) of less than 30 (Rabenhorst and Parikh, 2000). Most commonly, the material consists of dark red, consolidated Mesozoic or Paleozoic sedimentary rocks, such as shale, siltstone, and sandstone, or alluvial materials derived from such rocks. Assistance from a local soil scientist may be needed to determine where red parent material occurs.

Figure 56.—Redox concentrations occurring as soft masses and pore linings. The image also shows a redox depletion along a root channel.

Redox concentrations. Bodies of apparent accumulation of Fe-Mn oxides (figs. 55 and 56). Redox concentrations include soft masses, pore linings, nodules, and concretions. For the purposes of the indicators, nodules and concretions are excluded from the concept of redox concentrations unless otherwise specified by specific indicators. See Vepraskas (1994) for a complete discussion.

Redox depletions. Bodies of low chroma (2 or less) having value of 4 or more where Fe-Mn oxides have been stripped or where both Fe-Mn oxides and clay have been stripped (fig. 56). See Vepraskas (1994) for a complete discussion.

Redoximorphic features. Features formed by the processes of reduction, translocation, and/or oxidation of Fe and Mn oxides (figs. 55 and 56); formerly called mottles and low-chroma colors. See Vepraskas (1994) for a complete discussion.

Reduced matrix. A soil matrix that has low chroma and high value, but in which the color changes in hue or chroma when the soil is exposed to air. See Vepraskas (1994) for a complete discussion.

***Reduction.** For the purpose of the indicators, reduction occurs when the redox potential (Eh) is below the ferric-ferrous iron threshold as adjusted for pH. In hydric soils, this is the point when the transformation of ferric iron (Fe^{3+}) to ferrous iron (Fe^{2+}) occurs.

Relict features. Soil morphological features that reflect past hydrologic conditions of saturation and anaerobiosis. See Vepraskas (1994) for a complete discussion.

***Sapric.** See “Muck.”

Saturation. Wetness characterized by zero or positive pressure of the soil water. Almost all of the soil pores are filled with water.

Sharp boundary. Used to describe redoximorphic features that grade sharply from one color to another. The color grade is commonly less than 0.1 mm wide.

Soft masses. Noncemented redox concentrations, frequently within the soil matrix, that are of various shapes and cannot be removed as discrete units (see fig. 56).

Soil pH. A measure of the acidity or alkalinity in the soil.

Soil texture. The relative proportions, by weight, of sand, silt, and clay particles less than 2 mm in size in the soil material.

Spodic horizon. A mineral soil horizon that is characterized by the illuvial accumulation of amorphous materials consisting of aluminum and organic carbon with or without iron (figs. 57 and 58). The spodic horizon has a minimum thickness, a minimum quantity of oxalate extractable carbon plus aluminum, and/or specific color requirements.

Stream terrace. Flat-topped landforms in a stream valley that flank and are parallel to the stream channel, originally formed by previous stream level, and representing the abandoned flood plain, stream bed, or valley floor produced during a past state of fluvial erosion or deposition (i.e., currently very rarely or never flooded; inactive cut and fill and/or scour and fill processes). Stream terraces may occur singularly or as a series. Erosional surfaces cut into bedrock and thinly mantled with stream deposits (alluvium) are called “strath terraces.” Remnants of constructional valley floors thickly mantled with alluvium are called “alluvial terraces.”

Umbric epipedon. A thick, dark mineral surface horizon with base saturation of less than 50 percent. See “Soil Taxonomy” (Soil Survey Staff, 1999) for a complete definition.

Figure 57.—A wet Spodosol with a splotchy gray and black eluvial horizon above a reddish brown spodic horizon.

Figure 58.—Even in wet Spodosols, the spodic horizon may be bright colored. If iron occurs in the horizon, redox concentrations may be evident in the bright spodic material. Some spodic horizons, however, do not have iron.

Vertisol. A mineral soil with 30 percent or more clay in all layers. These soils expand and shrink, depending on moisture content, and have slickensides or wedge-shaped peds. See "Soil Taxonomy" (Soil Survey Staff, 1999) for a complete definition.

Wetland. An area that has hydrophytic vegetation, hydric soils, and wetland hydrology, as per the "National Food Security Act Manual" (USDA NRCS, 2010) and the "1987 Corps of Engineers Wetlands Delineation Manual" (Environmental Laboratory, 1987).

Appendices

Appendix 1: Approved Indicators by Land Resource Regions (LRRs) and Certain Major Land Resource Areas (MLRAs)

LRR	Indicators
A	A1, A2, A3, A4, A11, A12, A18, S1, S4, S5, S6, F1 (except for MLRA 1), F2, F3, F6, F7, F8
B	A1, A2, A3, A4, A11, A12, A18, S1, S4, S5, S6, F1, F2, F3, F6, F7, F8
C	A1, A2, A3, A4, A5, A11, A12, A18, S1, S4, S5, S6, F1, F2, F3, F6, F7, F8
D	A1, A2, A3, A4, A9, A11, A12, A18, S1, S4, S5, S6, F1, F2, F3, F6, F7, F8
E	A1, A2, A3, A4, A11, A12, A18, S1, S4, S5, S6, F1, F2, F3, F6, F7, F8
F	A1, A2, A3, A4, A5, A9, A11, A12, A18, S1, S3, S4, S5, S6, F1, F2, F3, F6, F7, F8
G	A1, A2, A3, A4, A9, A11, A12, A18, S1, S2, S4, S5, S6, F1, F2, F3, F6, F7, F8
H	A1, A2, A3, A4, A9, A11, A12, A18, S1, S2, S4, S5, S6, F1, F2, F3, F6, F7, F8, F16 (MLRAs 72 and 73)
I	A1, A2, A3, A4, A11, A12, A18, S1, S4, S5, S6, F1, F2, F3, F6, F7, F8
J	A1, A2, A3, A4, A11, A12, A18, S1, S4, S5, S6, F1, F2, F3, F6, F7, F8
K	A1, A2, A3, A4, A5, A11, A12, A18, S1, S4, S5, S6, S7, S11, F1, F2, F3, F6, F7, F8, F10
L	A1, A2, A3, A4, A5, A11, A12, A18, S1, S4, S5, S6, S7, S11, F1, F2, F3, F6, F7, F8, F10
M	A1, A2, A3, A4, A5, A10, A11, A12, A18, S1, S3, S4, S5, S6, S7, F1, F2, F3, F6, F7, F8
N	A1, A2, A3, A4, A5, A10, A11, A12, A18, S1, S4, S5, S6, S7, F2, F3, F6, F7, F8, F12, F13 (MLRA 122), F21 (MLRA 127)
O	A1, A2, A3, A4, A5, A11, A12, A18, S1, S4, S5, S6, F1, F2, F3, F6, F7, F8, F12
P	A1, A2, A3, A4, A5, A6 (except MLRA 136), A7 (except for MLRA 136), A9 (except for MLRA 136), A11, A12, A18, S1 (except MLRA 136), S4, S5, S6, S7(MLRA 136), F2, F3, F6, F7, F8, F12, F13, F22 (MLRA 138 and West Florida portion of 152A)
Q	A1, A2, A3, A4, A8, A11, A12, A18, S1, S4, S6, S7, F2, F3, F6, F7, F8
R	A1, A2, A3, A4, A5, A11, A12, A17 (MLRA 144A and 145), A18, S1, S4, S5, S6, S7, S8, S9, F2, F3, F6, F7, F8, F21 (MLRA 145)
S	A1, A2, A3, A4, A5, A11, A12, A17 (MLRA 149B), A18, S1, S4, S5, S6, S7, S8, S9, F2, F3, F6, F7, F8, F19 (MLRAs 148 and 149A), F20 (MLRA 149A), F21 (MLRA 147 and 148)
T	A1, A2, A3, A4, A5, A6, A7, A9, A11, A12, A16 (MLRA 150A), A18, S4, S5, S6, S7, S8, S9, S12 (MLRA 153B and 153D), F2, F3, F6, F7, F8, F11 (MLRA 151), F12, F13, F17 (MLRA 151), F18 (MLRA150), F20 (MLRAs 153C and 153D), F22 (MLRA 138 and west Florida portion of 152A)
U	A1, A2, A3, A4, A5, A6, A7, A8, A11, A12, A18, S4, S5, S6, S7, S8, S9, F2, F3, F6, F7, F8, F10, F13, F22 (MLRA 154)
V	A1, A2, A3, A4, A8, A11, A12, A18, S1, S4, S7, F2, F3, F6, F7, F8
W	A1, A2, A3, A4, A12, A13, A14, A15, A18
X	A1, A2, A3, A4, A12, A13, A14, A15, A18
Y	A1, A2, A3, A4, A12, A13, A14, A15, A18
Z	A1, A2, A3, A4, A6, A7, A8, A11, A12, A18, S4, S5, S6, S7, F2, F3, F6, F7, F8

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

Appendix 3: Indicators that Have Been Deleted or Are No Longer Approved for Use

S10. Alaska Gleyed.—This indicator is now indicator A13 (Alaska Gleyed).

F4. Depleted Below Dark Surface.—This indicator is now indicator A11 (Depleted Below Dark Surface).

F5. Thick Dark Surface.—This indicator is now indicator A12 (Thick Dark Surface).

F9. Vernal Pools.—This indicator has been deleted and its concepts are included in Field Indicator F3 (Depleted Matrix).

F14. Alaska Redox Gleyed.—This indicator is now indicator A14 (Alaska Redox).

F15. Alaska Gleyed Pores.—This indicator is now indicator A15 (Alaska Gleyed Pores).

TA1. Playa Rim Stratified Layers.—This test indicator has been deleted.

TA2. Structureless Muck.—This test indicator has been deleted.

TA3. Coast Prairie Redox.—This test indicator has been approved for use and is now A16 (Coast Prairie Redox).

TS1. Iron Staining.—This test indicator has been deleted.

TS2. Thick Sandy Dark Surface.—This test indicator has been deleted. Its concepts have been approved for use and are now included with indicator A12 (Thick Dark Surface).

TS3. Dark Surface 2.—This test indicator has been deleted. It is now the same as indicator S7 (Dark Surface).

TS4. Sandy Neutral Surface.—This test indicator has been deleted. Most of its concepts have been approved for use and are now included in indicator A11 (Depleted Below Dark Surface).

TS5. Chroma 3 Sandy Redox.—This test indicator has been deleted. It has been approved for use as indicator A16 (Coast Prairie Redox).

TF1. ? cm Mucky Peat or Peat.—This test indicator has been deleted.

TF2. Red Parent Material.—This test indicator has been deleted. Its concept has been approved for use as indicator F21 (Red Parent Material).

TF3. Alaska Concretions.—This test indicator has been deleted.

TF4. 2.5Y/5Y Below Dark Surface.—This test indicator has been deleted.

TF5. 2.5Y/5Y Below Thick Dark Surface.—This test indicator has been deleted.

TF6. Calcic Dark Surface.—This test indicator has been deleted.

TF7. Thick Dark Surface 2/1.—This test indicator has been deleted. Its concepts have been approved for use and are now included in indicator A12 (Thick Dark Surface).

TF8. Redox Spring Seeps.—This test indicator has been deleted.

TF9. Delta Ochric.—This test indicator has been approved for use and is now indicator F17 (Delta Ochric).

TF10. Alluvial Depleted Matrix.—This test indicator has been deleted.

TF11. Reduced Vertic.—This test indicator has been approved for use and is now indicator F18 (Reduced Vertic).

TF12. Very Shallow Dark Surface.—This test indicator has been approved for use and is now indicator F22 (Very Shallow Dark Surface).