

## FIELD INDICATORS OF HYDRIC SOILS IN HAWAII AND THE PACIFIC BASIN

Unless otherwise indicated, all mineral layers above any of the hydric soil indicators have dominant chroma of 2 or less, or the layer(s) with dominant chroma of more than 2 is less than 15 cm. (6 in.) thick. In addition, unless otherwise stated, nodules and concretions are not considered to be redox concentrations for the purposes of this document.

### ALL SOILS

All soils refer to soils with any USDA soil texture. Use the following hydric soil indicators regardless of texture:

**A1. Histosol.** For use in all LRRs. Classifies as a Histosol, except Folists. A histosol has 40 cm. (16 in.) or more of the upper 80 cm. (32 in.) as organic soil material. Organic soil material has an organic carbon content (by weight) of 12 to 18 percent, or more, dependent upon the clay content of the soil. These materials include muck (sapric soil material), mucky peat (hemic soil material), or peat (fibric soil material).

**A2. Histic Epipedon.** For use in all LRRs except W, X, and Y. A Histic epipedon.

Most histic epipedons are surface horizons 20 cm.(8 in.) or more thick of organic soil material. Aquic conditions or artificial drainage are required. See Keys to Soil Taxonomy, page 3 (Soil Survey Staff, 1994). Slightly lower organic carbon contents are allowed in plowed soils (See Keys to Soil Taxonomy, page 4).

**A3. Black Histic.** For use in all LRRs except W, X, and Y, where being tested. A layer of peat, mucky peat, or muck 20 cm. (8 in.) or more thick starting within the upper 15 cm (6 in.) having hue 10YR or yellower and value 3 or less and chroma 1 or less. Unlike indicator A2 (above) use of this indicator does not require proof of aquic conditions or artificial drainage.

**A4. Hydrogen Sulfide.** For use in all LRRs. A hydrogen sulfide odor within 30 cm. (12 in.) of the surface. Hydrogen Sulfide User Notes: This "rotten egg smell" indicates that sulfate-sulfur has been reduced and therefore the soil is anaerobic. In most hydric soils, sulfidic odor is only present when the soil is saturated and anaerobic.

**A8. Muck Presence.** For use in LRRs U and V. Presence of a layer of muck with value 3 or less and chroma 1 or less within 15 cm (6 in) of the soil surface. The presence of muck of any thickness within 15 cm (6 in.) is the only requirement. Muck is sapric soil material with at least 12 or 18 percent organic carbon. Organic soil material is called muck (sapric soil material) if virtually all of the material has undergone sufficient decomposition to limit recognition of the plant parts. Hemic (mucky peat) and fibric (peat) soil materials do not qualify. To determine if muck is present, first remove loose leaves, needles, bark, and other easily identified plant remains. This is sometimes called a leaf/root mat. Then, examine for decomposed organic soil material. Generally muck is black and has a "greasy" feel, sand grains should not be evident. The presence of a leaf or root mat is not indicative of hydric soils or upland soils; it indicates that the vegetation present produces a large amount of biomass. Hydric soil indicator determinations are made below the leaf or root mat; however, root mats that meet the definition of hemic or fibric soil material are included in the decision making process for Mucky Peat, Peat, Organic Bodies, or Histic Indicators.

### SANDY SOILS

Sandy soils refer to those soils with a USDA texture of loamy fine sand and coarser. Unless otherwise indicated, all mineral layers above any of the indicators have dominant chroma 2 or less, or the layer with dominant chroma of more than 2 is less than 15 cm (6 inches) thick. In addition, unless otherwise indicated, nodules and concentrations are not considered to be redox concentrations.

**S1. Sandy Mucky Mineral.** For use in all LRRs except W, X, and Y. A mucky modified mineral surface layer 5 cm. (2 in.) or more thick, starting within 15 cm (6 in) of the soil surface. "Mucky" is a USDA texture modifier for mineral soils. The organic carbon content is at least 5 and ranges as high as 14 percent. The percentage requirement is dependent upon the clay content of the soil; the higher the clay content, the higher the organic carbon requirement. An example is mucky fine sand, which has at least 5 percent organic carbon but not more than about 12 percent organic carbon. In sand soils a quick field test for mucky is: place one unbroken ped of soil between thumb and fingers; rub twice only, if you can neither see or feel sand grains it is likely mucky.

**S4. Sandy Gleyed Matrix.** For use in all LRRs except W, X, and Y. A gleyed matrix which occupies 60% or more of a layer within 15 cm. (6 in.) of the soil surface. Gley colors are not synonymous with gray colors. Gley colors are those colors that are found on the gley page (Kollmorgen Instruments Corporation, 1994). They have hue N, 10Y, 5GY, 10GY, 5G, 10G, 5BG, 10BG, 5B, 10B, or 5PB with value 4 or more. The gleyed matrix only has to be present within 15 cm. (6 in.) of the surface. Soils with gleyed matrices are saturated for significant duration; this is why no thickness of the layer is required.

**S7. Dark Surface.** For use in LRRs N, P, R, S, T, U, and V and Z. A surface layer 10 cm. (4 in.) or more thick within the upper 15 cm. (6 in.) with matrix value 3 or less and chroma 1 or less. At least 70% of the visible soil particles must be covered, to represent the matrix color, this is determined on individual soil particles covered or masked with organic material. The matrix color of the layer immediately below the dark surface must have chroma 2 or less. The organic carbon content of this indicator is slightly less than required for "mucky. An undisturbed sample must be observed. A 10X or 15X hand lens is an excellent tool to help aid this decision. Many wet soils have a ratio of about 50 percent soil particles, which are covered or coated with organic matter, and about 50 percent uncoated or uncovered soil particles, giving the soil a salt and pepper appearance.

## LOAMY AND CLAYEY SOILS

Loamy and clayey soils refer to those soils with USDA textures of loamy very fine sand and finer. Unless otherwise indicated, all mineral layers above any of the indicators have dominant chroma 2 or less, or the layer with dominant chroma of more than 2 is less than 15 cm (6 inches) thick. In addition, unless otherwise indicated, nodules and concentrations are not considered to be redox concentrations.

**F2. Loamy Gleyed Matrix.** For use in all LRRs except W, X, and Y. A gleyed matrix which occupies 60% or more of a layer within 30 cm. (12 in.) of the soil surface. Gley colors are not synonymous with gray colors. Gley colors are those colors that are found on the gley pages (Kollmorgen Instruments Corporation, 1994). They have hue N, 10Y, 5GY, 10GY, 5G, 10G, 5BG, 10BG, 5B, 10B, or 5PB with value 4 or more. The gleyed matrix only has to be present within 30 cm. (12 in.) of the surface. Soils with gleyed matrices are saturated for significant duration, this is why no thickness of the layer is required.

**F3. Depleted Matrix.** For use in all LRRs except W, X, and Y. A layer at least 15 cm. (6 in.) thick with a depleted matrix that has 60% or more chroma 2 or less starting within 25 cm. (10 in.) of the surface. The minimum thickness requirement is 5 cm (2 in) if the depleted matrix is within the upper 15 cm (6 in) of the soil. Redox concentrations include iron and manganese soft masses and/or pore linings in soils with matrix colors of 4/1, 4/2, and 5/2. The low chroma matrix must be due to wetness and not a relict or parent material feature. The thickness requirement is waved if the depleted matrix is the mineral surface layer.

**F4. Depleted Below Dark Surface.** For use in all LRRs except W, X, and Y, where they are being tested. A layer at least 15 cm (6 in.) thick with a depleted matrix that has 60% or more chroma 2 or less starting within 30 cm. (12 in.) of the surface. The layer(s) above the depleted matrix have value 3 or less and chroma 2 or less. This indicator often occurs in Mollisols but also applies to soils with umbric epipedons and dark colored ochric epipedons. This indicator is most often associated with soils in depressional landscape positions. For soils with dark colored epipedons greater than 30 cm. (12 in.) thick use Indicator F5.

**F5. Thick Dark Surface.** For use in all LRRs except P, T, U, W, X, and Y. Testing in W, X, and Y. A layer at least 15 cm. (6 in.) thick with a depleted matrix that has 60% or more chroma 2 or less (or a gleyed matrix) starting below 30 cm. (12 in.) of the surface. The layer(s) above the depleted or gleyed matrix have hue N and value 3 or less to a depth of 30 cm. (12 in.) and value 3 or less and chroma 1 or hue of N in the remainder of the epipedon. The soil has a black or very dark gray surface layer 30 cm. (12 in.) or more thick. The dark colored subsoil has value of 3 or less, chroma 1 or less. Below the dark colored epipedon is a depleted matrix or gleyed matrix. This indicator is most often associated with overthickened soils in concave landscape positions. Redox concentrations including iron/manganese soft masses and/or pore linings are required in soils with matrix colors of 4/1, 4/2, and 5/2.

**F6. Redox Dark Surface.** For use in all LRRs except W, X, and Y, where being tested. A layer at least 10 cm. (4 in.) thick entirely within the upper 30 cm. (12 in.) of the mineral soil that has: a. matrix value 3 or less and chroma 1 or less and 2% or more distinct or prominent redox concentrations as soft masses or pore linings, or b. matrix value 3 or less and chroma 2 or less and 5% or more distinct or prominent redox concentrations as soft masses or pore linings. Redox concentrations in high organic matter mineral soils with dark surfaces are often difficult to see. The organic matter "masks" some or all of the concentrations that may be present. Careful examination is required in order to see what are often brownish "mottles" in the darkened materials. In some instances, drying of the samples makes the concentrations (if present) easier to see. Dried colors, if used, need to have matrix chromas of 1 or 2 and the redox concentrations need to be distinct or prominent. In soils which are wet due to a subsurface water table, the layer immediately below the dark epipedon should have a depleted or gleyed matrix. Soils which are wet due to ponding or shallow perched water tables may not always have a depleted/gleyed matrix below the dark surface. It is recommended to evaluate the hydrologic source and to examine and describe the layer below the dark colored epipedon when applying this indicator.

**F7. Depleted Dark Surface.** For use in all LRRs except W, X, and Y, where being tested. Redox depletions with value 5 or more and chroma 2 or less, in a layer at least 10 cm. (4 in.) thick entirely within the upper 30 cm. (12 in.) of the mineral soil that has: a. matrix value 3 or less and chroma 1 or less and 10% or more redox depletions, or b. matrix value 3 or less and chroma 2 or less and 20% or more redox depletions. Care should be taken not to mistake mixing of an E or calcic horizon into the surface layer as depletions. The "pieces" of E and calcic horizons are not redox depletions. Knowledge of local conditions is required in areas where E and/or calcic horizons may be present. In soils which are wet due to a subsurface water table, the layer immediately below the dark surface should have a depleted or gleyed matrix. Redox depletions should have associated "microsites" of redox concentrations. The concentrations may occur as pore linings within the depletion(s) or surround the depletion(s).

**F8. Redox Depressions.** For use in all LRRs except W, X, and Y, where being tested. In closed depressions subject to ponding, 5% or more distinct or prominent redox concentrations as soft masses or pore linings in a layer 5 cm. (2 in.) or more thick within the upper 15 cm. (6 in.) For these landscape positions there is no restriction on matrix value and chroma. This indicator occurs on landforms such as: vernal pools, playa lakes, rainwater basins, "Grady" ponds, and potholes: not for micro-depressions on convex or plane landscapes.

**TF2. Red Parent Material.(testing).** In Parent material with a matrix hue of 7.5YR or redder, a layer at least 10 cm (4 in) thick with a matrix value of 4 or more and chroma 4 or less and 2% or more redox depletions and/or redox concentrations as soft masses and/or pore linings. The layer is entirely within 12 in of the soil surface. The minimum thickness requirement is 5 cm (2 in) if the layer is the mineral surface layer. Redox features most noticeable in red materials include redox depletions and soft manganese masses which are black or dark reddish black.