

Section 8

Guidelines for Wetland Delineation

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PART 1. INTRODUCTION

The purpose of this section of the manual is to provide guidance in identifying wetlands and delineating their boundaries with non-wetlands for implementation of the Washington Forest Practice Rules. *This manual is intended to be used only for forest practices.*

Wetland Definition

For the purposes of the Forest Practice Rules, “wetland” means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, such as swamps, bogs, fens, and similar areas. This includes wetlands created, restored, or enhanced as part of a mitigation procedure. This does not include constructed wetlands or the following surface waters of the state intentionally constructed from wetland sites: Irrigation and drainage ditches, grass lined swales, canals, agricultural detention facilities, farm ponds, and landscape amenities.”

Explicit in this definition is the consideration of three environmental parameters: hydrology, soil, and vegetation. Observable evidence of all three parameters normally is present in wetlands.

As referred to in the definition of wetlands, “constructed wetlands” means those wetlands voluntarily developed by the landowner. Constructed wetlands do not include wetlands created, restored, or enhanced as part of a mitigation procedure or wetlands inadvertently created as a result of current or past practices including but not limited to: road construction, landing construction, railroad construction or surface mining.

Approaches

Two approaches are provided in **Part 4** for identifying and delineating wetlands depending on the complexity of the site in question and on the availability, quality, and quantity of existing data:

Approximate Determination of Wetland Boundaries is used for delineating:

- forested wetlands greater than 3 acres within a harvest area
- classifying the type of wetland which is within or adjacent to the proposal
- determination of acres of Type A and B wetlands
- Forested wetlands in association with an RMZ
- Approximate determination uses maps, aerial photographs, and other information if adequate data of this nature exists. Not all wetlands are visible on aerial photos or can be located using existing map products. Field visits may be necessary.

Accurate Delineation of Wetland Boundaries is used to determine those portions of any wetland where road construction that could result in filling or draining more than 0.1 acre.

This approach requires actually visiting the site and provides a basic method for identifying the presence of wetlands and delineating their boundaries. The same basic method is reiterated as needed as the size or complexity of the site in question increases.

Either approach may be used when determining the innermost boundary of WMZ of Type A and B wetlands. The innermost boundary of a WMZ for Type A and B wetlands can also be determined by locating the point on the wetland edge where the crown cover changes from less than 30% to greater than 30%. This is generally the drip line of the conifer trees at the edge of the wetland.

When the presence of a bog is suspected, Part 5 of this section, Bog Identification, should be consulted. The practitioner may want to request assistance from Department of Natural Resources (DNR) or Department of Ecology (DOE) wetlands specialists to verify bog identification. Occasionally, the practitioner may encounter a disturbed Area wetland defined as an area in which one or more of the parameters (vegetation, soil, and/or hydrology) have been sufficiently altered by recent human activities or natural events to preclude the presence of wetland indicators of the parameter. Likewise, the practitioner may encounter one of whose certain wetland type and/or conditions termed Problem Area wetlands in which finding or interpreting indicators of one of more parameters is difficult. In either of these situations, it is suggested that the practitioner request assistance from DNR or DOE wetland specialists to complete delineation.

PART 2. TECHNICAL CRITERIA THAT IDENTIFY WETLANDS

Areas are determined to be wetlands if they satisfy (directly or indirectly) the minimum criteria standards for each of three parameters (hydrology, soils, *and* vegetation). “Criteria” are observations that in and of themselves are sufficiently conclusive to satisfy that a parameter is indicative of a wetland rather than non-wetland condition. The criteria are described specifically in Appendix A. If any one of the features described in Appendix A can be observed for each of all three parameters, it is mandatory that the site be called a wetland. In many cases, it will not be possible to observe features on a site that *directly* satisfy the criteria. However, other observable features - known as “field indicators” - may be used, and like circumstantial evidence, may make the case for wetland *indirectly*. Such interpretation of circumstantial evidence, or field indicators, is allowed within bounds of good professional judgment. Field indicators are discussed in Part 3.

Although vegetation is the most easily observed parameter, sole reliance on vegetation as the determinant of wetlands can be misleading. Many plant species tolerate a broad range of conditions enabling them to live successfully in both wetlands and non-wetlands, and hydrophytic vegetation may persist for decades following alteration of hydrology that renders a site a non-wetland. The criteria for hydrophytic vegetation is as follows:

If, under normal circumstances, more than 50 percent of the dominant species totaled from all vegetation strata are Obligate Wetland (OBL) Facultative Wetland (FACW) or Facultative (FAC).

Likewise, soils can be strong indicators of whether or not a site is a wetland when it is in an undrained landscape or in a hydrologically unaltered condition. While soils are excellent long-term integrators of all the ecological influences on a site including relative wetness, on hydrologically altered sites, they generally retain the morphological characteristics revealing their origin (i.e. having developed over geologic time in a wetland or in a non-wetland) long after site hydrology has been totally reversed.

The criteria for **hydric soils** is as follows:

Unless drained or protected from inundation:

1. All Histosols (peats and mucks) except Folists or;
2. Soils in Aquic suborder, Aquic subgroups, Allbolls suborder, Salorthids great group, Pell great groups of Vertisols, Pachic subgroups, or Cumulic subgroups that are:
 - a. "Somewhat poorly drained" and have a frequently occurring water table at less than 0.5 foot (ft.) from the surface for a significant period (usually more than 2 weeks) during the growing season or;
 - b. "Poorly" or "Very Poorly" drained and have either:
 - i. a frequently occurring water table at less than 0.5 ft. from the surface for a significant period (usually more than 2 weeks) during the growing season if textures are coarse sand, sand, or fine sand in all layers within 20 inches (in.) Or; for other soils;
 - ii. a frequently occurring water table at less than 1.0 ft. from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is equal to or greater than 6.0 in./hour (hr.) in all layers within 20 inches (in.) Or;
 - iii. a frequently occurring water table at less than 1.5 ft. from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is less than 6.0 in./hr. in any layer within 20 in. or;
3. Soils that are frequently ponded for "long duration" or "very long duration" during the growing season or;
4. Soils that are frequently flooded for "long duration" or "very long duration" during the growing season.

On the other hand, if enough data exists, determination of whether or not a site is a wetland could be made based on hydrology alone irrespective of vegetation or soils.

The criteria for **wetland hydrology** is as follows:

The area is inundated either permanently or periodically to a depth at which emergent vegetation interfaces with open water, or the soil has a frequently occurring high water table that remains within 12 inches of the surface for more than 14 consecutive days during the growing season of the prevalent vegetation.

In the vast majority of circumstances, however, adequate data to make a decision based on hydrology alone almost never occurs. Further, direct evidence of the relative degree of site wetness may be ephemeral. What can be done is a direct assessment of site physical and geomorphic characteristics adequate to indicate whether or not site hydrology is likely to have been altered substantively either by human or natural causes. (Substantive alteration means that the site has become either wetter or drier than it had been during the periods over which both its plant community and soils developed.) If such an assessment indicates no substantive removal of site hydrology, and both vegetation and soils, indicate wetland conditions, the site should be determined a wetland.

The combined use of evidence for all three parameters (hydrology, soils, and vegetation) will enhance the technical accuracy, consistency, and credibility of wetland determinations.

Generally, in Washington's forested regions, the determination of whether or not a site is a wetland can be based on observation of criteria and/or field indicators. Part 3 shows a simplified approach for identifying wetlands. Part 5 identifies bogs and low-nutrient fens. Special considerations necessary for identifying and delineating Disturbed and Problem Areas are outlined in Appendices B and C respectively.

NOTE: In interpreting the results of a wetland determination, conclusions based on the observation of criteria features (as listed in Appendix A) supersede those based on the observation of field indicators (as described in Part 3). Before an area is designated as a wetland, a reasonable hypothesis explaining the source of water for this specific site should be determined. The hypothesis should take into account the effectiveness of any possible drainage that has occurred. Further, the hypothesis should make more sense based on available observations than would the alternative hypothesis (i.e. that the same observations lead to the conclusion that wetland hydrology is not present). The water which enables a site to be a wetland is usually the result of one or combination of the following sources: 1) flooding (headwater, backwater, and/or tidal); 2) precipitation (including snowmelt) and runoff (resulting in ponding and/or perched water tables); and/or, 3) groundwater, in the form of seasonal high water tables (apparent and/or artesian).

PART 3. FIELD INDICATORS USED TO SATISFY THE TECHNICAL CRITERIA

Wetlands are identified and delineated based on three environmental parameters: hydrology, vegetation, and soil. The presence of one or more of the observations listed in this section are considered positive "field indicators" that indirectly satisfy the wetland criteria for the appropriate parameter. *At least one positive indicator for each of the three parameters must be present in order to determine that a site is a wetland.* The field indicators for each parameter typically used to make wetland determinations are listed in each of the following sections:

Wetland Hydrology

Field Indicators listed in order of descending reliability:

- a. Recorded hydrologic data including stream, lake, or tidal gauge data, flood predictions, and historical flood records;
- b. Aerial photography records showing flooding or ponding;
- c. Visual observation that the site is inundated;
- d. Visual observation of the water table within 12 inches of the soil surface;
- e. Rusty colored mineral staining in channels or halos (Oxidized rhizospheres) surrounding *living* roots or underground stems;
- f. Watermarks;
- g. Drift lines;
- h. Waterborne sediment deposits (including encrusted filamentous algae);
- i. Drainage patterns relative to site geomorphology (e.g. a closed basin with no outlet or with an elevation controlled outlet);
- j. Judgment-tempered observations of undrained condition.*

*Wetland systems controlled only by seasonal high groundwater generally lack surface indicators of wetland hydrology such as those listed. However, these systems can be dominated by OBL, FACW, and/or FAC plant species and have undrained hydric soils. In such systems, the delineator may, after considering the seasonal fluctuation pattern in depth to the water table, conclude that the hydrology criterion is satisfied if there is no observable indication that the hydrology has been substantively modified by either man-made (e.g. ditching, tile-draining, diking) or natural processes (e.g. chronic incision by a stream lowering its base level and reducing its ability to flood or saturate adjacent areas). Thus, the inability to observe high water table during the season of the year when it should be at its low point (e.g. summer, early fall) does not suggest that wetland hydrology is absent. Conversely, the inability to observe high water table during the time of year when it should be near the surface (e.g. winter, early spring) suggests that wetland hydrology may not be present. Such interpretations must be done in light of precipitation patterns and groundwater recharge capabilities for the system in question.

Hydric Soils

Field Indicators listed *in order of descending reliability*:

Non-Sandy Soils

1. The soil is an organic soil (i.e. a Histosol like a peat or a muck);
2. The soil is a mineral soil but it has a peat or muck layer (i.e. a "Histic Epipedon") 8 to 16 inches thick. (Note: Thick surface layers of aerated organic matter, or "duff", do not qualify.);
3. Sulfidic material (evidenced by the odor of rotten eggs) is present in the upper 12 inches of the soil profile;
4. An aquic or peraquic moisture regime is present as evidenced by long term observation of hydrology patterns on or in the surface layers of the soil;
5. Direct observation of reducing conditions in the soil. (Note: This is done by such means as periodically conducting chemical testing for the presence of ferrous iron or measuring the redox potential.);
6. Observation as specified for soils with aquic moisture regimes in Soil Taxonomy (SCS 1975, Soils Survey Staff 1990) of soil profile color (hydromorphic) characteristics in the

horizon(s) immediately below the dark A-horizon (A₁ or A_p) or within 10 inches of the surface, whichever is nearer, including but not limited to the following:

- a. A gleyed matrix (i.e. a predominance of certain gray, greenish, or bluish color as compared with the Munsell Soil Color (1990) “Color Page for Gley”);
 - b. A matrix chroma of 2 or less in mottled soils or as specified for the given soil taxa in Soil Taxonomy (SCS 1975, Soil Survey Staff 1990);
 - c. A matrix chroma of 1 or less in unmottled soils or as specified for the given soil taxa in Soil Taxonomy (SCS 1975, Soil Survey Staff 1990);
7. The presence of many, large iron or manganese concretions in the surface 6 inches of the soil.

Sandy Soils

1. In sandy soil, there is an organic surface layer 3 or more inches thick;
2. In sandy soil, there is a near surface organic pan (spodic horizon—i.e. that keys out as an Aquod in the most recent version of Soil Taxonomy);
3. In sandy soil, there is streaking or staining in the subsurface by organic matter;
4. Data indicate that the water table is less than 6 inches from the surface for more than 14 consecutive days during the growing season.

NOTE: Colors are determined by comparison in the field with Munsell Soil Color Charts (Munsell Color 1990), which standardize the reporting of color by documenting the major aspects of color, Hue, Value, and Chroma as a three-part code. If in question, the color characteristics used for determining whether or not an observed soil is hydric should be as specified within the most recent revision of Soil Taxonomy (SCS 1975, Soil Survey Staff 1990) for the soil taxa listed in the Hydric Soils Criteria portion of Appendix A.

Hydrophytic Vegetation

Field Indicators listed *in order of descending reliability*:

1. More than 50 percent of the dominant* plant species all strata are considered wetland plants. That is, they are classified as Obligate Wetland (OBL), Facultative Wetland (FACW), and/or Facultative (FAC);
2. A plant community of any species composition if it occurs in an undrained organic (peat or muck) soil.

* [For guidance on choosing “dominant” plant species, see Hydrophytic Vegetation Criteria” in Appendix A.]

PART 4. METHODS FOR IDENTIFICATION OF WETLANDS AND DELINEATION OF THEIR BOUNDARIES

There are two primary products of wetland delineation:

1. A map showing the location of wetlands on a site; and
2. Documentation supporting why the boundaries are justified as shown on the map. Sometimes an additional product is needed: the location of the wetland boundary having been marked (by flagging, stakes or other means) in the field.

Prior to making a wetland determination, obtain any available information on the vegetation, soil, and hydrology of the site in question. Potential sources of information include but are not limited to the following:

- Topographic maps
- County Soil Survey Reports
- National Wetland Inventory Maps
- Hydric Soils of Washington
- National Hydric Soils List
- County Hydric Soil Map Unit List
- National Insurance Agency Flood Maps
- Local Wetland Maps
- Land Use and Land Cover Maps
- Aerial Photographs (particularly false color infrared)
- Satellite imagery
- National List of Plant species that Occur in Wetlands
- Regional List of Plants that Occur in Wetlands
- National Wetland Plant Data Base
- Gauge Data (stream, lake, or tidal)
- SCS Soil Drainage Guides
- Environmental Impact Assessments and Statements
- Published Reports
- Agency Experts (i.e. specialists designated within DNR, DOE, etc.)
- Local Expertise (e.g. Universities, consultants and others)
- Site-specific Plans and Engineering Designs (e.g. state projects or developers).
- *Recognizing Wetlands*, Bigley and Hull, DNR FLM Contribution No. 500, January 1993.

Decide whether information for each parameter is sufficient to enable a determination without a site visit.

Three methods for wetland determinations are described in the following pages and in the Appendices:

1. Approximate Determination of Wetland Boundaries (no site visit is conducted);
2. Accurate Delineation of Wetland Boundaries (site visit required); and
3. Methods for Disturbed Areas (an onsite method used when an area has been altered recently to the point that one or more of the parameters cannot be interpreted).

Approximate Determination of Wetland Boundaries

To determine the probability of the presence of a wetland prior to an actual site visit or when no site visit is possible examine all data available. If data are not adequate to evaluate all three parameters, a site visit will be necessary. If one or more of the parameters has been altered to the extent that it cannot be interpreted, it will be necessary to use the section on *Methods for Disturbed Areas* (MDA) listed in Appendix B. Likewise, if the site meets one of the landscape conditions listed in Appendix C, use the guidance in the *Problem Areas* section (Appendix C) in conjunction with the method below to determine if the site is a wetland.

Develop a series of overlay maps at the same scale. Overlay information for each of the following points of observation:

- Soil Survey maps showing map units dominated by soils listed as hydric;
- Soil Survey maps showing map units dominated by soils with hydric inclusions;

- National Wetland Inventory Maps showing wetlands;
- Other maps showing wetlands;
- Aerial photography (particularly color infrared) showing wetness signatures;
- Contour maps showing level to almost level ground adjacent to streams or in valley bottoms;
- Other data demonstrating wetness characteristic as described in Parts 2 and 3 that are capable of being depicted to scale on a map overlay.

Each successive layer of information imparts a degree of confidence that wetlands exist on the site in question. While this approach is crude, the more layers that overlap, the higher the confidence level that wetlands are present. Even one layer of information is adequate to spur closer consideration. *Since the landowner is ultimately responsible for compliance with wetland regulations, great caution should be used in proceeding with work at a location that has not received an onsite investigation.*

Accurate Delineation of Wetland Boundaries

A site visit is required. When a site visit is possible or necessary, the following approach can be used:

1. Determine if the area has been altered to the extent that vegetation, soils, or hydrology cannot be interpreted. If the site is altered, go to the *Disturbed Area Method* (Appendix B).
2. Determine if the site meets one of the landscape conditions listed in Appendix C; if so, use the guidance in the *Problem Areas* section (Appendix C) in conjunction with the method below to determine if the site is a wetland.
3. If the hydrology, soils, and vegetation on the site all can be interpreted and the site is not one of the types listed as a Problem Area, subdivide the site into units with similar plant communities, topographic features and/or other natural features. In each landscape unit, find a location that is most typical of the entire unit and record observations that confirm the presence or absence of criteria of field indicators for each of the three parameters. Combine this with any other data available for the site, then go to 1 (a), follow the key, and determine if the landscape unit is wetland or nonwetland. Conclusions are indicated in **bold** type as **Wetlands** or **Nonwetlands**.

	Question	Resp	Action
1.	(a) Hydrology not substantially altered (i.e. site is not effectively drained).	Yes No	Go to 1
	(b) Field indicator of wetland hydrology Present	Yes No	Go to MDA Go to 2 (a) Nonwetland
2.	(a) Soils present are peats or mucks (i.e. Histosols).	Yes No	Go to 2 (b) Go to 3 (a)
	(b) Plants (of any kind) are present.	Yes No	Wetland Go to MDA
3.	(a) <u>Soil present is undisturbed.</u>	Yes No	Go to (b) Go to MDA
	(b) <u>Indicator of hydric soil present.</u>	Yes No	Go to 4 (a) Nonwetland
4.	(a) Plants are present. (Identify plant community type(s). Delineator must know dominant plant species of each type)	Yes No	Go to 4(b) Go to MDA
	(b) (Identify plant community type(s). Delineator must know dominant plant species of each type.) Dominant plant species > 50 percent OBL, FACW, and/or FAC.	Yes No	Wetland Nonwetland

It is suggested that the delineator assemble the data that enabled the distinction between wetland and nonwetland into a brief report with a statement explaining how the distinction was made and why. Record the position of the wetland boundary on a map or aerial photograph.

PART 5. BOG IDENTIFICATION

Bogs and nutrient poor fens are distinct wetland types that are very sensitive to disturbance. Bogs and fens form when organic material accumulates in a wetland setting faster than it decomposes. These systems, however, form extremely slowly, with the organic soils forming at approximately one inch in 40 years in Western Washington, and even slower in Eastern Washington. Bogs and nutrient poor fens are generally acidic and low fertility for plants. Plants growing in these sensitive wetlands are specifically adapted to such conditions, and are usually not found, or uncommonly found, elsewhere. Thus, minor changes in the water regime or nutrient levels in bogs may cause major changes in the plant community. Bogs, and their associated acidic peat environment, provide a habitat for many unique and specialized species of plants and animals. It is not currently possible to construct or restore bogs. The environment is too complex and it takes centuries for the peat to accumulate. There are no known examples of successful bog restoration or creation.

Bogs and nutrient poor fens in Washington state can be either open or forested. Open bogs are dominated by short, emergent vegetation that rarely exceeds six feet in height in western

Washington and three feet in eastern Washington. The ground is usually very spongy and covered with Sphagnum moss. Some open bogs will actually be floating on top of a small lake or pond and have open water underneath. Open bogs may contain stunted individual trees of sitka spruce, western red cedar, western hemlock, lodgepole pine, western white pine, aspen, Engelmann's spruce, or crab apple.

Forested bogs are harder to identify. These contain mature, full-sized trees of sitka spruce, western red cedar, western hemlock, lodgepole pine, western white pine, Engelmann's spruce, or aspen. The characteristics which typically identify these forests as bogs are a layer of Sphagnum moss and deep organic soils. Also, the ground often feels spongy and is frequently saturated with water even during the dry season. The Sphagnum may not be easily seen, especially if there are pools of standing water in the forest or it is covered by litter. Forested bogs may also have a ground cover of salal or other upland species growing from hummocks or downed logs giving the area the superficial appearance of an upland forest. One often has to look under the ground cover and in pools of standing water to determine whether Sphagnum is present.

Identifying bogs can be challenging, particularly in a forested setting. It is necessary to confirm the presence of organic soils by digging soil pits and it requires the identification of plant species. It may also be difficult to determine the boundaries of a bog. In many cases, it may be necessary to ask for the assistance of a wetlands specialist. The DNR and DOE have staff available to assist with bog identification. The following key was developed as a guide to help in the identification of bogs.

Forest Practices Bog Identification Key

	Question	Resp	Action
1.	Area is dominated by mosses, low grass-like or shrubby vegetation, in 1/4 acre or more.	Yes No	go to 4 go to 2.
2.	Area has a mixture of stunted trees (sitka spruce, western hemlock, western red cedar, lodgepole pine, Engelmann's spruce, western white pine, aspen or crab apple) and low vegetation in 1/4 acre or more.	Yes No	go to 4 go to 3.
3.	Area is forested with sitka spruce, western red cedar, western hemlock, lodgepole pine, quaking aspen, or western white pine, WITH Sphagnum moss as a dominant ground cover (> 30% coverage of the ground) within at least 1/4 acre of the wetland.	Yes No	go to 4. Is not a bog.

NOTE: A 30% cover of Sphagnum in 1/4 acre means that 30% of the ground within an area of 1/4 acre is shaded by Sphagnum if a light were placed directly over the vegetation. The Sphagnum may be found under a cover of other emergent or shrub vegetation, and at the bottom of temporary pools during the wet season.

	Question	Resp	Action
4.	Area has organic soils, either peats or mucks, deeper than 16 inches. Organic soils are defined as follows based on the information in <i>Soil Taxonomy</i> (1992): a. soils with an organic carbon content of 18% or more (excluding live roots) if the mineral fraction contains more than 60% clay; b. soils with an organic carbon content of 12% if the mineral fraction contains no clay; c. soils with an organic carbon content between 12-18% based on the percentage of clay present (multiply the actual percentage of clay by 0.1 and add to 12%).	Yes No	go to 6 go to 5

It is not usually necessary, however, to do a chemical analysis of the soil to determine if a soil is organic. Organic soils are easy to recognize as black-colored mucks or as black or dark brown peats. Mucks feel greasy and stain fingers when rubbed between the fingers. Peats have plant fragments visible throughout the soil and feel fibrous. Many organic soils, both peats and mucks, may smell of hydrogen sulfide (rotten eggs).

	Question	Resp	Action
5.	Area has organic soils, either peats or mucks that are less than 16 inches deep over bedrock or hardpan.	Yes No	go to 6 Is not a bog.
6.	More than 30% of the total plant cover is provided by one or more of the species listed in Table 8.1. Total cover is estimated by assessing the area of land covered by the shadow of plants if the sun were directly overhead.	Yes No	IS A BOG. Is not a bog.

NOTE: Forests may contain several layers of plants that cover the ground. In arriving at the 30% minimum cover look at plants in the “canopy”, the “understory”, and the “groundcover”. The objective is to try to determine whether the total “footprint” of plants listed in Table 8.1, be they canopy, understory, or groundcover, is more than 30%.

Table 8.1 Characteristic bog species in Washington State

<i>Andromeda polifolia</i>	Bog rosemary
<i>Betula glandulosa</i>	Bog birch
<i>Carex brunescens</i>	Brownish sedge
<i>Carex buxbaumii</i>	Brown bog sedge
<i>Carex canescens</i>	Hoary sedge
<i>Carex chordorhiza</i>	Creeping sedge
<i>Carex comosa</i>	Bearded sedge
<i>Carex lasiocarpa</i>	Wolly-fruit sedge
<i>Carex leptalea</i>	Bristly-stalk sedge
<i>Carex limosa</i>	Mud sedge
<i>Carex livida</i>	Livid sedge
<i>Carex paupercula</i>	Poor sedge
<i>Carex rostrata</i>	Beaked sedge
<i>Carex saxatilis</i>	Russet sedge
<i>Carex sitchensis</i>	Sitka sedge
<i>Carex interior</i>	Inland sedge
<i>Carex pauciflora</i>	Few-flower sedge
<i>Cladina rangifera</i>	Reindeer lichen
<i>Drosera rotundifolia</i>	Sundew
<i>Eleocharis pauciflora</i>	Few-flower spike rush
<i>Empetrum nigrum</i>	Black crowberry
<i>Eriophorum chamissonis</i>	Cottongrass
<i>Eriophorum polystachion</i>	Coldswamp cottongrass
<i>Fauria crista-galli</i>	Deer-cabbage
<i>Gentiana douglasiana</i>	Swamp gentian
<i>Juncus supiniformis</i>	Hairy leaf rush
<i>Kalmia occidentalis</i>	Bog laurel
<i>Ledum groenlandicum</i>	Labrador tea
<i>Lysichitum americanum</i>	American skunk cabbage
<i>Malus fusca</i>	Pacific crabapple
<i>Menyanthes trifoliata</i>	Bog bean
<i>Myrica gale</i>	Sweet gale
<i>Pedicularis groenlandica</i>	Elephant's-head lousewort
<i>Picea engelmannii</i>	Engelmann's spruce
<i>Picea sitchensis</i>	Sitka spruce
<i>Pinus contorta</i>	Lodgepole pine
<i>Pinus monticola</i>	Western white pine
<i>Platanthera dilatata</i>	Leafy white orchid
<i>Populus tremula</i>	Quaking aspen
<i>Potentilla palustris</i>	Marsh cinquefoil
<i>Pteridium aquilinum</i>	Bracken fern

Table 8.1 (Continued)

Characteristic bog species in Washington State

<i>Rhynchospora alba</i>	White beakrush
<i>Salix commutata</i>	Under-green willow
<i>Salix eastwoodiae</i>	Mountain willow
<i>Salix farriae</i>	Farr willow
<i>Salix myrtillifolia</i>	Blue-berry willow
<i>Salix planifolia</i>	Diamond leaf willow
<i>Sanguisorba officinalis</i>	Great burnet
<i>Sphagnum spp.</i>	Sphagnum mosses
<i>Spiranthes romanzofianna</i>	Hooded ladies' -tresses
<i>Thuja plicata</i>	Western red cedar
<i>Tofieldia glutinosa</i>	Sticky false-asphodel
<i>Tsuga heterophylla</i>	Western hemlock
<i>Vaccinium occidentale</i>	Western huckleberry
<i>Vaccinium oxycoccus</i>	Bog cranberry

NOTE: Latin names and spelling are based on the U.S. Fish and Wildlife Service, "National List of Plant Species that Occur in Wetlands: Washington". Biological Report May 1988. NERC-88/18.47.

Appendix A Criteria for Vegetation, Soils, and Hydrology

Wetland Hydrology Criteria

Wetland hydrology is the sum total of wetness characteristics in areas that are inundated or have saturated soil conditions for a sufficient duration to support hydrophytic vegetation. The presence of inundated or saturated conditions for more than a minimum (e.g. usually “long” or “very long”) duration typically creates anaerobic conditions that lead to chemical reduction in the soil and affects the types of plants that can grow and the types of soils that develop on a site.

Numerous factors influence hydrology in an area including, precipitation, stratigraphy, topography, soil permeability, and plant cover (e.g. through evapotranspiration). All sites that can truly be called wetland have at least a seasonal abundance of water that occurs with predictable frequency and for at least a minimum duration. If a site does not have one or more sources of water that are at least seasonally active in more years than half on a long-term basis, it cannot be called a wetland. There are only a limited number of possible sources of water from which a wetland can be maintained: runoff from direct precipitation (including snowmelt); flooding (headwater, backwater, or tidal); ground water (apparent, perched, or artesian water tables); or, some combination of these sources.

The criteria for wetland hydrology is as follows:

*****The area is inundated either permanently or periodically to a depth at which emergent vegetation interfaces with open water, or the soil has a frequently occurring high water table that remains within 12 inches of the surface for more than 14 consecutive days during the growing season of the prevalent vegetation.*****

NOTE: In most instances, determination that a site is a wetland will be based on the use of “field indicators” of hydrology (Part 3) rather than meeting the wetland hydrology “criteria” directly. For the purposes of this manual, observation of a field indicators of hydrology will infer that the criteria requirements for frequency, duration, and season are met. In the case of a dispute, direct measurements and observations can be taken to determine if the wetland hydrology criteria are met and such observations will take precedence over field indicators. However, it is not the intent of this manual to require direct observation of hydrology and measurements of its duration in order to correctly identify wetlands and determine their boundaries.

Hydrophytic Vegetation Criteria

For the purposes of this manual, hydrophytic vegetation is defined as macrophytic plant life growing in water, soil, or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. Probability of a plant species occurring in a wetland will be determined as specified in the “National List of Plant Species that Occur in Wetlands” (Reed 1988) or its most recent revision as revisions become available. Water tolerance of plants differs from species to species. Based on probability of occurrence in a wetland, this list categorizes plant species with an “indicator status” placing it into one of five basic groups as shown below.

Indicator Status	Symbol	Definition	Estimated Probability of Occurrence in Wetlands
Obligate Wetland Plants	OBL	Plants that under natural conditions almost always occur in wetlands	>99%
Facultative Wetland Plants	FACW	Plants that usually occur in wetlands but occasionally are found in nonwetlands	67-99%
Facultative Plants	FAC	Plants that are equally likely to occur in wetlands or nonwetlands	34-66%
Facultative Upland Plants	FACU	Plants that usually occur in nonwetlands but occasionally are found in wetlands	1-33%
Obligate Upland Plants	UPL	Plants that under natural conditions almost always occur in a nonwetland	<1%

The criteria for hydrophytic vegetation is as follows

*****If, under normal circumstances, more than 50 percent of the dominant species totaled from all vegetation strata are OBL, FACW, or FAC.*****

For each stratum (e.g. tree, shrub/sapling, herb) in the plant community, dominant species will include the most abundant plant species (when ranked in descending order of abundance and cumulatively totaled) that immediately exceed 50 percent of the total dominance measure (e.g. basal area or aerial coverage for that stratum) plus any additional species comprising 20 percent or more of the total dominance measure for the stratum. (Note: if available, importance values will supersede dominance figures alone for determining dominant species.) All dominants, regardless of stratum, will be treated equally in making the calculation to determine whether or not the hydrophytic vegetation criterion is satisfied. The same species can be counted more than once if, in fact, it occurs as a dominant in more than one stratum.

For the purposes of this manual, dominance for all vegetative strata is estimated or sampled in plots at essentially the same elevation in the same soil type encompassing an area no less than 30 feet in radius except for the herbaceous and/or bryophyte strata that for which plots no less than 5 feet in radius are used. The shape and dimension of plots can be altered to fit the field situation so long as the minimum sampling area, equivalent elevation, and similar soil type guidance is followed.

Hydric Soils Criterion

Hydric soils are defined as “soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part”. “Soils” are defined as unconsolidated natural material that supports or is capable of supporting plant life. “Ponded” means the site has visible water standing on the surface of the soil in a depression or basin. “Flooded” means the site has visible water on the surface from a flowing source (e.g. overflow from a river). “Saturated” means that all the pore spaces in the soil that can be filled with water are

filled with water. The “growing season” means when the soil in all layers down to 50 cm (19.7 inches) exceeds 5 degrees C (41 degrees F) above which temperature microbial activity in the soil has its greatest effect in intermediating soil processes. In the case of the hydric soil definition, “anaerobic conditions” means not only devoid of adequate oxygen, but infers that oxygen has been lacking for a sufficient period that the soil chemistry is actually a reducing regime rather than an oxidizing regime. “In the upper part” means the water is getting into the controlling portion of the root zone of whatever plants dominate the site. “Long Enough” means that all this is happening for a period of time sufficient to exclude or eliminate long term colonization of the site by plants intolerant of wetness.

The criteria for hydric soils is as follows.

*****Unless drained or protected from inundation:**

1. All Histosols (peats and mucks) except Folists, or
2. Soils in Aquic suborder, Aquic subgroups, Albolls suborder, Salorthids great group, Pell great groups of Vertisols, Pachic subgroups, or Cumulic subgroups that are:
 - a. “Somewhat poorly drained” and have a frequently occurring water table at less than 0.5 foot (ft) from the surface for a significant period (usually more than 2 weeks) during the growing season, or
 - b. “Poorly” or “Very Poorly” drained and have either:
 - i. a frequently occurring water table at less than 0.5 ft from the surface for a significant period (usually more than 2 weeks) during the growing season if textures are coarse sand, sand, or fine sand in all layers within 20 inches (in), or for other soils
 - ii. a frequently occurring water table at less than 1.0 ft from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is equal to or greater than 6.0 in/hour (hr) in all layers within 20 inches (in), or
 - iii. a frequently occurring water table at less than 1.5 ft from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is less than 6.0 in/hr in any layer within 20 in, or
3. Soils that are frequently ponded for “long duration” or “very long duration” during the growing season, or
4. Soils that are frequently flooded for “long duration” or “very long duration” during the growing season.***

Appendix B Method For Disturbed Areas

Apply the following procedures or reasonable modifications of them when evidence indicates human activities or natural events preclude characterization of one or more parameters. These are sites in which assistance from wetland specialists from DNR, DOE, or other sources may be advisable. The point of this section is to assist the delineator in determining whether all three parameters would have been met prior to its alteration making the site a wetland. (NOTE: If the alteration was authorized or if the site would not have been regulated prior to the alteration, this procedure is not necessary.) Record the findings for each parameter as follows and include them in a brief report documenting conclusions for the site. For further guidance, refer to the section on "Disturbed Areas" in the 1989 "Federal Manual for Identifying and Delineating Jurisdictional Wetlands" and the section on "Atypical Situations" in the 1987 "Corps of Engineers Wetland Delineation Manual". These publications give excellent guidance. However, in making final decisions, the criteria listed in Appendix A of this manual will take precedence.

1. **Vegetation.**

- a. Describe the type of alteration (e.g. land clearing, clear cutting, selective removal of certain species).
- b. Document the effect of the alteration on the vegetation.
- c. Characterize the previous vegetation. Obtain all necessary supporting evidence. Some potential sources include:
 - i. Aerial photography
 - ii. Onsite inspection of remaining vegetation
 - iii. Previous site surveys
 - iv. Vegetation in adjacent areas
 - v. Existing records (e.g. ASCS, SCS, FS, etc.)
 - vi. Landowner's own observations
 - vii. Information from the public
 - viii. National Wetland Inventory maps
- d. Record the indicator status of the dominant plant species.
 - i. If more than 50 percent of the dominant plant species were FAC, FACW, and/or OBL, the previous vegetation was hydrophytic.
 - ii. If condition (1) above is not satisfied, site is NONWETLAND.
 - iii. If the previous vegetation could not be characterized, base the decision on Soil and Hydrology (below).
- e. Record results of vegetation analysis with conclusion. Determine whether or not either the soils or hydrology of the site have been altered.
 - i. If soils and hydrology have not been altered, go to method **for Accurate Delineation of Wetland Boundaries** Step 1 (a) and continue the procedure from that point inserting the conclusions regarding vegetation made here.
 - ii. If either soils or hydrology have been altered, go to "2. Soil".

2. **Soil.**

- a. Describe the alteration (e.g. plowing, filling, surface layers removed).
- b. Document effect on soil.
- c. Characterize previous soils. Obtain all necessary supporting evidence. Some potential sources include:
 - i. Soil surveys.

- ii. Characterization of buried soil profiles.
 - iii. Adjacent unaltered soil. (Reference area must be in the same topographic position and nearby.)
 - iv. Remnant profile where soil layers have been removed.
 - d. Determine whether or not the previous soil was hydric by applying the indicators.
 - i. If a positive indicator is found, hydric soil was formerly present.
 - ii. If no positive indicator is found, **NON-WETLAND**.
 - iii. If previous soil could not be characterized, base decision on Vegetation and Hydrology.
 - e. Record results of soil analysis with conclusion. Determine whether or not the hydrology of the site has been altered.
 - i. If hydrology has not been altered, go to method for **Accurate Delineation of Wetland Boundaries Step 1 (a)** and continue the procedure from that point inserting the conclusions regarding soils made here.
 - ii. If hydrology has been altered, go to “3. Hydrology”.
- 3. **Hydrology.**
 - a. Describe the type of alteration (e.g. site ditched, tiled, levied, diked, etc.).
 - b. Describe the effect of the alteration on hydrology.
 - c. Characterize the previous hydrology. Obtain all necessary supporting evidence. Some potential sources include:
 - i. Stream, lake, or tidal gage data.
 - ii. Remaining field indicators.
 - iii. Aerial photography.
 - iv. Historical records.
 - v. Floodplain management maps.
 - vi. Public official or local observers.
 - d. Determine whether or not wetland hydrology previously occurred by applying the wetland hydrology indicators.
 - i. If a positive indicator is found, wetland hydrology formerly was present.
 - ii. If no indicator is found, **NONWETLAND**.
 - iii. If previous hydrology could not be characterized, base decision on Vegetation and Soil.
 - e. Record results of hydrology analysis with conclusion. Go to method for Accurate Delineation of Wetland Boundaries Step 1 (a) and continue the procedure from that point inserting the conclusions regarding hydrology made here.

Appendix C Problem Area Wetlands

There are certain types of wetlands and/or conditions that may make wetland identification difficult because field indicators of the three criteria may be absent, at least during certain times of the year. These wetlands are considered problem areas and not disturbed wetlands because the difficulty in identification is due to the peculiarity of their ecology and not the result of human activities or catastrophic natural events, with the exception of newly created wetlands. These are sites in which assistance from wetland specialists from DNR, DOE, or other sources may be advisable. Examples of problem area wetlands encountered in the State of Washington include but are not limited to the following examples:

1. **Evergreen Forested Wetlands.** Wetlands dominated by evergreen trees occur in many parts of the country. In some cases, the trees are OBL, FACW, and FAC species. In other cases, however, the dominant evergreen trees are FACU species such as Western Hemlock (*Tsuga heterophylla*). In dense stands, these trees may preclude establishment of understory vegetation or in some cases, understory vegetation may be FACU species. Since plant communities of these types are usually found in nonwetlands, the ones established in wetland areas may be difficult to recognize at first glance. The landscape position of the evergreen forested areas such as depressions, drainage ways, bottomlands, flats in sloping terrain, and seepage slopes should be considered because it often gives clues to the likelihood of a wetland. If the site is a wetland, there should be clear indications of both hydric soils and wetland hydrology.
2. **Wetlands on Glacial Till.** Sloping wetlands can occur in glaciated areas where thin soils cover relatively impermeable glacial till or where layers of glacial till have different hydraulic conditions that permit groundwater seepage. Such areas are seldom if ever flooded, but downslope groundwater movement keeps the soils saturated for a sufficient portion of the growing season to produce anaerobic and reducing conditions in the soil. This promotes the development of hydric soils and hydrophytic vegetation. Since these are groundwater dominated systems, indicators of wetland hydrology may be lacking during the drier portion of the growing season (e.g. summer or early fall in Washington). Likewise, soil profiles may be difficult to examine in particularly stony tills.
3. **Highly Variable Seasonal Wetlands.** In many regions (especially in arid and semi-arid regions) depressional areas occur that may have indicators of all three wetland criteria during the wetter portions of the growing season (e.g. early spring), but may lack indicators of wetland hydrology (e.g. the ponded surface water all has evaporated) and/or hydrophytic vegetation (e.g. the short lived wetland annuals have completed their life cycle and die) during the drier portion of the growing season. In addition, soil profiles in some of these areas do not have classic wetness characteristic as often observed in most other wetlands. In these systems, OBL and FACW species generally are dominant during the wetter portion of the growing season while FACU and UPL species (also usually annuals) may be dominant during the drier portion of the growing season and during droughts.
4. **Newly Created Wetlands.** These areas include manmade (“created” or “constructed”) wetlands, beaver-created wetlands, and other natural wetlands. Such wetlands may be purposely or accidentally created (e.g. road impoundments, undersized culverts, irrigation, and seepage from earthdammed impoundments) by human activities. Many of these will

have indicators of wetland hydrology and hydrophytic vegetation, but the area may lack typical soil profile characteristics frequently associated with other hydric soils since the soils have only recently been exposed to inundation and/or saturation. Since all of these types of wetlands are newly established, field indicators of one or more of the wetland identification criteria may not be present.

5. **Entisols (including floodplain and sandy soils).** Entisols include a group of soils in a taxonomic order characterized by soils that are young or recently formed and have little or no evidence of pedogenically developed horizons. These soils are typical of floodplains throughout the U.S. (including Washington), but are also found in glacial outwash plains, along tidal waters, and in other areas. They often include sandy soils of riverine islands, bars, and banks, and also finer textured soils of floodplain terraces. Wet entisols that have an aquic or paraquic moisture regime are considered hydric unless effectively drained. Some entisols are easily recognized as hydric soils such as the “Sulfaquents” of tidal marshes, whereas others pose problems because they do not possess profile characteristics typical of many other hydric soils. On a site where entisols are likely to occur, if indicators of hydrophytic vegetation and wetland hydrology are present, confirm whether or not the soil is an entisol. If so, refer to guidance in “Keys to Soil Taxonomy” for guidance in interpreting the soil profile.

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GLOSSARY

Aerobic: A condition in which molecular oxygen is a part of the environment.

Anaerobic: A condition in which molecular oxygen is absent (or effectively so) from the environment.

Aquic moisture regime: A moisture condition associated with a seasonal reducing environment that is virtually free of dissolved oxygen because the soil is saturated by ground water or by water of the capillary fringe, as in soils in Aquic suborders and Aquic subgroups.

Areal cover: A measure of dominance that defines the degree to which above ground portions of plants cover the ground surface; it is possible for the total areal cover for all strata combined in a community or for single stratum to exceed 100 percent because:

- (1) most plant communities consist of two or more vegetative strata;
- (2) areal cover is estimated by vegetative layer; and
- (3) foliage within a single layer may overlap.

Basal area: The cross-sectional area of a tree trunk measured in square inches, square centimeters, etc.; basal area is normally measured at 4.5 feet above ground level and is used as a measure of dominance; the most commonly used tool for measuring basal area is a diameter tape or a D-tape (then convert to basal area).

Bryophytes: A major taxonomic group of nonvascular plants comprised of true liverworts, horned liverworts, and mosses.

Capillary fringe: A zone immediately above the water table in which water is drawn upward from the water table by capillary action.

Chemical reduction: Any process by which one compound or ion acts as an electron donor; in such cases, the valence state of the electron donor is decreased.

Chroma: The relative purity or saturation of a color; intensity of distinctive hue as related to grayness; one of the three variables of color.

Concretion: A localized concentration of chemical compounds, (e.g. calcium carbonate and iron oxide) in the form of a grain or nodule of varying size, shape, hardness, and color; concretions of significance in hydric soils are usually iron oxides and manganese oxides occurring at or near the soil surface, which have developed under conditions of fluctuating water tables.

Criteria: Technical requirements upon which a judgment or decision may be based. (As used in this manual, criteria are observations that in and of themselves are sufficiently conclusive to satisfy that a parameter is indicative of a wetland rather than nonwetland condition.)

Disturbed condition: As used herein, this term refers to areas in which indicators of one or more characteristics (vegetation, soil, and/or hydrology) have been sufficiently altered by man's activities or natural events so as to make it more difficult to recognize whether or not the wetland identification criteria are met.

Dominance: As used herein, refers to the spatial extent of a species; commonly the most abundant species in each vegetation stratum that, when ranked in descending order of abundance and cumulatively totaled, immediately exceeds 50 percent of the total dominance measure (e.g. areal cover or basal area) for the stratum, plus any additional species comprising 20 percent or more of the total dominance measure for the stratum.

Dominance measure: The means or method by which dominance is established, including areal coverage and basal area; the total dominance measure is the sum total of the dominance measure values for all species comprising a given stratum.

Dominant species: For each stratum, dominant species are those that, when ranked in descending rank order and cumulatively totaled, immediately exceed 50 percent of the total dominance measure, plus any additional species comprising 20 percent or more of the total dominance measure for the stratum.

Drift line: An accumulation of water-carried debris along a contour or at the base of vegetation that provides direct evidence of prior inundation and often indicates the directional flow of flood waters.

Duff: The matted, friable, partly decomposed, organic surface layer of forested soils. This term is used to identify a generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus. (It does not refer to peat or muck, which develop under permanent or nearly permanent periods of saturated soil conditions.)

Duration (of inundation or soil saturation): The length of time that water stands above the soil surface (inundation), or that water fills most soil pores near the soil surface; as used herein, “duration” refers to a period during the growing season.

Effectively drained: A condition in which surface and/or groundwater has been removed sufficiently by human-induced or natural causes such that an area no longer meets the wetland hydrology criterion. (Note: this condition does not require the total removal of water.)

Facultative species: Species that can occur both in wetlands and uplands; there are three subcategories of facultative species: (1) *facultative wetland plants* (FACW) that usually occur in wetlands (estimated probability 67-99%), but occasionally are found in nonwetlands, (2) *facultative plants* (FAC) that are equally likely to occur in wetlands or nonwetlands (estimated probability 34-66%), and (3) *facultative upland plants* (FACU) that usually occur in nonwetlands (estimated probability 67-99%), but occasionally are found in wetlands (estimated probability 1-33%).

Field Indicators: Observable features that infer the criteria are met. (For the purposes of this manual, these are non-“criteria” observations that, in the same manner as circumstantial evidence, make the case for wetland indirectly rather than directly.)

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.

Flooding, frequent: Flooding is likely to occur often during usual weather conditions (i.e. more than a 50 percent chance of flooding in any year, or more than 50 times in 100 years).

Frequency (of inundation or soil saturation): The periodicity of coverage of an area by surface water or saturation of the soil; it is usually expressed as the number of years the soil is inundated or saturated during part of the growing season of the prevalent vegetation (e.g. 50 years per 100 years) or as a 1-, 2-, 5-year, etc., inundation frequency.

Gleization: A process in saturated or nearly saturated soils, which involves the reduction of iron, its segregation into mottles and concretions, or its removal by leaching from the gleyed horizon.

Gleyed: A soil condition resulting from gleization which is manifested by the presence of neutral gray, bluish or greenish colors through the soil matrix or in mottles (spots or streaks) among other colors.

Growing season: The portion of the year when soil temperatures are above biologic zero (41° F) as defined by Soil Taxonomy; the following growing season months are assumed for each of the soil temperature regimes:

- (1) thermic (February-October);
- (2) mesic (March-October);
- (3) frigid (May-September);
- (4) cryic (June-August);
- (5) pergelic (July-August);
- (6) isohyperthermic (January-December);
- (7) hyperthermic (February-December);
- (8) isothermic (January-December) and
- (9) isomesic (January-December).

Herb: Nonwoody (herbaceous) plants including graminoids (grass and grasslike plants), forbs, ferns, fern allies, and nonwoody vines; for the purposes of this manual, seedlings of woody plants less than 3 feet in height are also considered herbs.

Histic epipedon: An 8- to 16- inch thick soil layer at or near the surface that is saturated for 30 consecutive days or more during the growing season in most years and contains a minimum of 20 percent organic matter when no clay is present or a minimum of 30 percent of organic matter when 60 percent or more clay is present; generally a thin horizon of peat or muck if the soil has not been plowed.

Histosols: An order in “Soil Taxonomy” (Soil Survey Staff 1975) composed of organic soils (mucks and peats) that have organic soil materials in more than half of the upper 32 inches or that are of any thickness if overlying rock.

Hue: A characteristic of color related to one of the main spectral colors (red, yellow, green, blue, or purple), or various combinations of these principle colors; one of the three variables of color; each color chart in the Munsell Soil Color Charts (Munsell Soil Color 1990) represents a specific hue.

Hydric soil: A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part.

Hydrology: The science dealing with the properties, distribution, and circulation of water.

Hydrophyte: Any macrophyte that grows in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content; plants typically found in wetlands and other aquatic habitats.

Hydrophytic vegetation: Plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Inclusion: Regarding soil survey report maps, refers to a recognizable, substantive variation from the norm in a mapping unit that due to the scale or detail of the map produced, is not shown on the map itself. Such a substantive variation from the norm is described verbally in the map unit description within the soil survey report as a caution to map users.

Indicator: An event, entity, or condition that typically characterizes a prescribed environment or situation; indicators determine or aid in determining whether or not certain stated circumstances exist or criteria are satisfied.

Inundation: A condition in which water temporarily or permanently covers a land surface.

Long duration (flooding): A duration class in which inundation for a single event ranges from 7 days to 1 month.

Macrophyte: Any plant species that can be readily observed without the aid of optical magnification, including all vascular plant species and bryophytes (e.g. Sphagnum spp.), as well as large algae (e.g. Chara spp., and Fucus spp.).

Matrix: The natural soil material composed of both mineral and organic matter; matrix color refers to the predominant color of the soil in a particular horizon.

Microbial: Pertaining to work by microorganisms too small to be seen with the naked eye.

Mineral soil: Any soil consisting primarily of mineral (sand, silt, and clay) material, rather than organic matter.

Mottles: Spots or blotches of different color or shades of color interspersed within the dominant matrix color in a soil layer; distinct mottles are readily seen and easily distinguished from the color of the matrix; prominent mottles are obvious and mottling is one of the outstanding features of the horizon.

Nonhydric soil: A soil that has developed under predominantly aerobic soil conditions.

Nonwetland: Any area that has sufficiently dry conditions that hydrophytic vegetation, hydric soils, and/or wetland hydrology are lacking; it includes upland as well as former wetlands that are effectively drained.

Normal circumstances: Refers to the soil and hydrology conditions that are normally present, without regard to whether the vegetation has been removed.

Obligate wetland species: A plant species that is nearly always found in wetlands; its frequency of occurrence in wetlands is 99% or more.

Organic soil: See Histosols.

Oxidation-reduction process: A complex of biochemical reactions in soil that influences the valence state of elements and their ions found in the soil; long periods of soil saturation during the growing season tend to elicit anaerobic conditions that shift the overall process to a reducing condition.

Oxidized rhizospheres: Oxidized channels and soil surrounding living roots and rhizomes in plants.

Parameter: A characteristic component of a unit that can be defined. (For purposes of this manual, hydrology, soils, and vegetation are the three parameters used to define wetlands.)

Peraquic moisture regime: A soil condition in which reducing conditions always occur due to the presence of ground water at or near the soil surface.

Periodically: Used herein, to define detectable regular or irregular saturated soil conditions or inundation, resulting from ponding of ground water, precipitation, overland flow, stream flooding, or tidal influences that occur(s) with hours, days, weeks, months, or even years between events.

Permanently flooded: A water regime condition where standing water covers the land surface throughout the year (but may be absent during extreme droughts).

Permeability: The quality of the soil that enables water to move downward through the profile, measured as the number of inches per hour that water moves downward through the saturated soil.

Plant community: The plant populations existing in a shared habitat or environment.

Ponded: A condition in which free water covers the soil surface, for example, in a closed depression; the water is removed only by percolation, evaporation, or transpiration.

Poorly drained: A condition in which water is removed from the soil so slowly that the soil is saturated periodically during the growing season or remains wet for long periods greater than 7 days.

Problem area wetland: A wetland that is difficult to identify because it may lack indicators of wetland hydrology and/or hydric soils, or its dominant plant species are more common of nonwetlands.

Reduction: The process of changing an element from a higher to a lower oxidation state as in the reduction of ferric (Fe^{3+}) iron into ferrous iron (Fe^{2+}).

Rhizosphere: The zone of soil in which interactions between living plant roots and microorganisms occur.

Sapling: Woody vegetation ≥ 0.4 to < 5.0 inches in diameter at breast height and ≤ 20 feet in height, exclusive of woody vines.

Saturated: A condition in which all easily drained voids (pores) between soil particles are temporarily or permanently filled with water; significant saturation during the growing season is considered to be usually one week or more.

Shrub: Wood vegetation usually > 3 feet but less than 20 feet tall, including multi-stemmed bushy specimens and small trees and saplings. (Note: Woody seedlings less than 3 feet tall are considered part of the herbaceous stratum.)

Soil matrix: The portion of a given soil having the dominant color; in most cases, the matrix will be the portion of the soil having more than 50 percent of the same color.

Soil permeability: The ease with which gases, liquids, or plant roots penetrate or pass through a layer of soil.

Soil pore: An area within soil occupied by either air or water, resulting from the arrangement of individual soil particles or peds.

Somewhat poorly drained: A condition in which water is removed slowly enough that the soil is wet for significant periods during the growing season.

Spodic horizon: A subsurface layer of soil characterized by the accumulation of aluminum oxides (with or without iron oxides) and organic matter; a diagnostic horizon for Spodosols.

Stratigraphy: A term referring to the origin, composition, distribution, and succession of geologic strata (layers).

Stratum: A layer of vegetation used to determine dominant species in a plant community.
Suborder (soils): Second highest taxonomic level of the current U.S. soil classification system.

Swamp: A wetland dominated by trees; a forested wetland.

Topography: The configuration of a surface, including its relief and the position of its natural and manmade features.

Transpiration: The process in plants by which water is released into the gaseous environment (atmosphere), primarily through stomata.

Tree: A woody plant 5 inches or greater in diameter at breast height and 20 feet or more tall.

Upland: Any area that does not qualify as a wetland because the associated hydrologic regime is not sufficiently wet to elicit development of vegetation, soils, and/or hydrologic characteristics

associated with wetlands. Such areas occurring in floodplains are more appropriately termed nonwetlands.

Value (soil color): The relative lightness or intensity of color; approximately a function of the square root of the total amount of light; one of the three variables of color.

Vascular (plant): Possessing a well-developed system of conducting tissue to transport water, mineral salts, and foods within the plant.

Vegetation: The sum total of macrophytes that occupy a given area.

Very long duration (flooding): A duration class in which inundation for a single event is greater than 1 month.

Vertisols: Shrinking and swelling dark clay soils.

Very poorly drained: A condition in which water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season.

Vine (also Liana): A plant climbing or scrambling on some support, the stem not standing upright of itself. (As used in this manual, defines a vegetation stratum consist only of the woody species greater than 3 feet in length.)

Watermark: A line on vegetation or other upright structures that represents the maximum height reached in an inundation vent.

Water table: The depth to which the water surface equalizes with air pressure in an unlined borehole; it includes a zone of saturation at least six inches thick and persists in the soil for more than a few weeks.

Wetlands: As used herein, areas that under normal circumstances have hydrophytic vegetation, hydric soils, and wetland hydrology.

Wetland boundary: The point on the ground at which a shift from wetlands to nonwetlands occurs.

Wetland determination: The process by which an area is identified as a wetland or nonwetland.

Wetland hydrology: In general terms, permanent or periodic inundation or prolonged soil saturation sufficient to create anaerobic conditions in the soil.

Wetland indicator status: The exclusiveness with which a plant species occurs in wetlands; the different indicator categories (i.e., facultative species, and obligate wetland species) are defined elsewhere in this glossary.