

MILK-MARIAS ROTATING BASIN WETLAND ASSESSMENT PROTOCOL

I. Assessment Area Information

A. Establishing the Assessment Area (AA)

1a. **Standard Determination of the AA:** Navigate to the original coordinates using the GPS. This is the AA center. Pull a tape out 40 m in the four cardinal directions and mark the edges of the 40-m radius circular plot in several locations with flagging. This 40-m radius circular plot (0.5 hectares) is the AA. If the total area of the wetland is smaller than 0.5 hectares, then the entire wetland is the AA. If the entire wetland can hold an AA with a 40-m radius, but the point is too close to the wetland perimeter, then go to 1b. If the wetland is linear (e.g., riverine sites) and cannot hold an AA with a 40-m radius, then go to 1c.

1b. **Adjusting the AA for Wetlands that Can Hold an AA with a 40-m Radius:** If the entire wetland can hold an AA with a 40-m radius but the point is too close to the wetland perimeter, then the center of the AA can be moved up to 20 meters from the original coordinate location.

1c. **Adjusting the AA for Wetlands that are Too Narrow to Hold an AA with a 40-m Radius:** If the wetland is <25 m wide and linear (e.g., riparian zone or lacustrine fringe), the AA will be a rectangle starting at the point and moving upstream no more than 200 m. The AA will be **smaller** than 0.5 hectares. For example, if the wetland habitat is 20 m wide, then the AA would be $20 \times 200 = 4,000\text{m}^2 = 0.4$ hectares. Note: The AA should occur on only one side of the channel.

If the wetland is >25 m wide and linear, then the AA will be laid out beginning at the point and moving upstream the distance needed to produce a rectangular AA of 0.5 hectares. For example, if the wetland habitat along a river is 35 m wide, then the length of the AA would be $5,000 \text{ m}^2 / 35 \text{ m} = 143 \text{ m}$

B. General Assessment Area (AA) Information

1b. **Site ID:** This is the unique identifier assigned during the sample selection process. This identifier **MUST** be maintained throughout the project duration. Place the Site ID on each sheet of the data form.

2b. **Site Name:** This is not required, but assigning a name to an assessment area may help organize different sites in the field.

3b. **Level 4 Ecoregion:** This should be assigned in the office.

4b. **Land Ownership:** This should be determined prior to any site visit and then filled in on the form during the assessment.

5b. **HUC4/HUC5/HUC6:** The hydrologic unit codes for the subbasin, watershed, and subwatershed should be assigned in the office using the National Hydrography Dataset.

6b. **Date:** Record the date the wetland was assessed.

7b. **Observers:** List the initials of all observers present during the wetland assessment.

C. GPS Coordinates at the AA Center

1c. **Waypoint ID:** This is the ID assigned to the waypoint taken at the center of the AA. The GPS usually assigns a three digit number, which can be edited if you choose. Be certain to keep the waypoint ID consistent between the data form and the GPS.

2c. **Datum:** This should be NAD83. Methods for changing the datum on the GPS will depend upon the model used.

3c. **Easting (X) and Northing (Y):** Easting and northing refer to coordinates collected in UTM's. Changing the coordinate system on the GPS unit depends upon the model used.

4c. **Accuracy:** Record the accuracy in meters given on the GPS unit.

5c. **Elevation:** Record the elevation in meters given on the GPS unit.

6c. **Notes on movement of the AA center:** Provide details on the reason for moving the AA center and its distance from the original point location.

D. General Assessment Area Description

Include a general description of the assessment area and the surrounding uplands. Note any interesting features of the site.

E. Directions to the Assessment Area and Access Comments

Directions to the site can be written back at the office using the gazetteer. Note any issues that affected access to the AA.

F. Soil Drainage, Topographic Position, and Water Information

1f. **Soil Drainage:** Select the appropriate soil drainage category. This is not as obvious in wetlands without standing water. Clues to soil drainage include details from the soil pit (see Section III) as well as plant species present.

2f. **Topographic Position:** Select the appropriate topographic position category based on the AA position in the landscape.

3f. **Amount of Assessment Area Covered by Standing Water:** Select the appropriate amount of standing water covering the AA.

G. Assessment Area Photos

1g. **Photo Card Photo:** The purpose of this photo is to provide a general overview of the AA. The Photo Card appears in the corner of the photo. Using a dry erase pen, fill in the Site ID, date, and bearing of the photo on the Photo Card. Be sure that the Photo Card takes up very little of the photo, but that the information on the Photo Card is visible in the photo. Note: Watch for glare off of the Photo Card lamination. Record the number of the photo from the camera onto the form. Be certain that this number is maintained when the photos are downloaded onto the computer.

2g. **Photos of AA:** From the AA center, take four photos; one in each cardinal direction. Record a description on the data form, when necessary. Record the number of the photo from the camera onto the form. Be certain that this number is maintained when the photos are downloaded onto the computer.

3g. **Additional Photos:** Take any additional photos that you feel would provide additional information for the AA. Record the number of the photo from the camera onto the form. Be certain that this number is maintained when the photos are downloaded onto the computer.

H. Classification of the Assessment Area

1h. **Ecological System:** Select the appropriate Ecological System of the AA from the list using the Key to Ecological Systems (Appendix I). If none of the provided Ecological Systems is appropriate, check "Other". Select the appropriate Confidence Level for your selection and provide reasoning for your selection on the data form.

2h. **Dominant Vegetation Associations:** Record the dominant vegetation associations that occur within the AA.

3h. **Hydrogeomorphic (HGM) Class:** Select the appropriate HGM class of the AA using the Key to Hydrogeomorphic Classes (Appendix II). Select the appropriate Confidence Level for your selection and provide reasoning for your selection on the data form.

4h. **Cowardin System, Class, Water Regime, and Special Modifier:** Record the appropriate Cowardin classification, using the Cowardin flowchart and Water Regime descriptions (Appendix III and IV).

II. Assessment Area Drawing

Provide a drawing of the assessment area, including major plant zones, direction of drainage into wetland, soil pit placement, and vegetation plot placement. Anthropogenic features like culverts, berms, or impoundments should also be included in the sketch. Also, indicate any major plant zones on the aerial photo of the AA.

III. Soil Description

A. Placement of the Soil Pit: Dig two soil pits within the AA. Make every attempt to place each soil pit in a different area of zonation. This will likely be evident from differences in vegetation.

1a. General soil pit information:

i. Record the Site ID, Soil Pit #, and GPS coordinates in UTM's and their accuracy.

2a. Digging the soil pit:

i. If standing water is not present, then use the auger to dig a hole in the soil to a depth of 60 cm; remove the soil and auger and carefully lay soil on a sheet of clean plastic. For each soil layer, record the depth, texture, matrix color and redoximporpic features on the field form. Be sure to use soil from the inside of the sample to ensure that a clean sample is used. Check all hydric soil indicators on the field form that apply. If an impenetrable layer is encountered at a depth of < 60 cm (e.g., bedrock, large rock, cemented layer, log, etc.), excavate the pit as deeply as possible, describe soils as the depth of the pit allows, and note the occurrence and depth to bedrock or the cemented layer.

3a. Distinguishing among different soil layers: Changes in soil texture (see Appendix V) or soil matrix color using the Munsell Soil Color Chart are indicators of distinct soil layers. For each distinct soil layer, record the following:

i. Depth of the layer in centimeters.

ii. Texture (refer to Appendix V)

iii. Matrix Color: This is the Hue/Value/Chroma for the soil matrix that matches most closely from the Munsell Soil Color Chart. If soils are dry, wet the sample until it no longer changes color. Always have the sun at your back when comparing the soil to the color chart to find the best match.

iv. Hue/Value/Chroma of Redox Concentrations: Redox concentrations are the result of iron oxidation as groundwater levels fluctuate throughout the growing season. These concentrations are orange/reddish-brown (because of iron) and dark reddish-brown/black (because of manganese). Redox concentrations can occur as:

a. nodules or concretions-firm irregularly shaped bodies with diffuse boundaries

b. masses-other bodies occurring throughout the matrix (also known as *mottles*)

c. pore linings-redox concentrations along root channels as a result of oxygen diffusion from the roots of plants into the surrounding soil matrix reacting with iron in the soil (also known as *oxidized rhizospheres*)

v. Hue/Value/Chroma of Redox Depletions: Redox depletions occur when soils are flooded and iron and manganese are reduced to their soluble forms. These soluble forms of iron and

manganese can be leached out of the soil, leaving the natural color (gray or black) of the parent sand, silt, or clay (i.e., the matrix) behind.

vi. Presence of hydric soil indicators-use the Hydric Soil Indicators checklist (Table 1).

Table 1. Hydric soil indicators.

Hydric Soil Indicators
Histosol (Organic layer greater than 20 cm)
Histic Epipedon (Organic layer at least 20 cm from surface)
Sulfidic (rotten eggs) odor
Organic streaking (dark vertical streaks in the subsurface layers)
Gleyed or Low Chroma Colors
Redox depletions-areas in soil that have lost iron; gray or reddish-gray in color
Redox concentrations-oxidation of iron; in patches, along root channels and in pores

vii. Depth to saturation/Depth to standing water: Allow approximately 30 minutes for equilibration of the soil pit. Measure the depth to standing water in the pit or to where water is seeping from the soil onto pit walls. If the pit contains standing water, measure the depth to the water surface and record on the form. If no standing water is present, record “NP” (not present) on the form. If soils at the margins of the pit are saturated with water, record the depth to the saturated layer. Saturation is indicated by a sheen or glistening of the soil. At or below the depth of soil saturation, water may also be oozing from the soil into the pit. Identify that it is not free water, but that the soil is saturated.

4a. **Backfill the excavation:** Return the soil to the pit.

IV. Plant Zone Description for the Assessment Area

Plant zones often consist of more than one plant species, but some zones can be mono-specific. In some cases, one or two plant species dominates each zone. Identify and describe the plant zones that occur within the assessment area. A plant zone should be described if it meets the following rules: 1a. The plant zone is dominated by a stratum distinctly different from the stratum that dominates other plant zones; OR 1b. The plant zone is dominated by the same stratum as other plant zones, BUT each plant zone is dominated by different species AND the average height of the dominant species differs by > 1 m (e.g., *Typha latifolia* vs. *Juncus balticus*). 2. The plant zone makes up more than 5% of the AA (e.g., 250 m² for an AA of 0.5 ha). 3. Each individual patch of the plant zone is greater than 10m².

A. Identify and describe the vegetation strata that occur within the AA

- 1a. Select the appropriate strata (e.g., forest, shrubland, herbaceous, etc.) that occur in each plant zone.
- 2a. Select the appropriate leaf type for each stratum (e.g., broad-leaved, graminoid, etc.) within each plant zone.
- 3a. Record the dominant species observed in each stratum, its height and cover class from the height and cover scales for each dominant species.

4a. Repeat steps 1-3 for each plant zone in the AA.

V. Level 2 Metrics

A. Landscape Context Metrics

1a. **Landscape Connectivity:** This metric measures the percent of unfragmented landscape within 500 meters of the AA (non-riverine) or the degree to which the riverine corridor above and below a floodplain area exhibits connectivity with adjacent natural systems (riverine). Use either metric i.a. or metric i.b. depending on the HGM class.

Measurement Protocol:

i.a. Non-riverine: The intensity of human activity in the landscape often has a proportionate impact on the ecological processes of natural systems. The percentage of altered landscape (e.g., anthropogenic patches) provides an indirect estimate of connectivity among natural ecological systems. To assess this metric, estimate the percent unfragmented area within the 500 meter buffer. Identify the largest unfragmented block and estimate its percentage of the total area within the 500 m buffer. Dirt roads count as fragmentation, but hiking trails can be included in unfragmented blocks. Estimate the landscape connectivity using the following narrative descriptions:

Metrics for Landscape Connectivity – Non-riverine.

(1)	Intact: Assessment area embedded in 90–100% unfragmented, natural landscape.
(2)	Variegated: Assessment area embedded in 60–90% unfragmented, natural landscape.
(3)	Fragmented: Assessment area embedded in 20–60% unfragmented, natural landscape.
(4)	Relictual: Assessment area embedded in <20% unfragmented, natural landscape.

i.b. Riverine: For Riverine wetlands, landscape connectivity is the continuity of the riparian corridor 500 m upstream and 500 m downstream of the AA. Of special concern is the ability of wildlife to enter the riparian area at any place within 500 m of the AA and to move easily through adequate cover along the riparian corridor from either upstream or downstream. Refer to maps provided to estimate the percent of anthropogenic, non-buffer patches within the riparian corridor (the width of the geomorphic floodplain) 500 m upstream and downstream of the AA. Anthropogenic patches include heavily grazed pastures, roads, bridges, urban/industrial development, agriculture fields, and utility right-of-ways. Estimate the landscape connectivity using the following narrative descriptions:

Metrics for Landscape Connectivity – Riverine.

(1)	Intact: Assessment area embedded in 90–100% unfragmented, natural landscape.
(2)	Variiegated: Assessment area embedded in 60–90% unfragmented, natural landscape.
(3)	Fragmented: Assessment area embedded in 20–60% unfragmented, natural landscape.
(4)	Relictual: Assessment area embedded in <20% unfragmented, natural landscape.

2a. **Buffer Index:** This metric calculates the overall area and condition of the buffer immediately surrounding the AA using three measures: percent of AA with buffer (buffer length), average buffer width, and buffer condition. Wetland buffers are vegetated, natural (non-anthropogenic) areas that surround a wetland (Table 2).

Measurement Protocol:

i.a. **Buffer Extent:** This metric can be assessed first using aerial photography but must be verified in the field. Visually estimate the total percentage of the AA perimeter that adjoins land cover types that provide buffer functions (Table 2). To be considered as a buffer, a suitable land cover type must be at least 5 m wide. For Riverine wetlands, do not include the area immediately upstream or downstream as part of the buffer. Only consider areas on one side of the channel or the other. If the AA only represents one side of a channel, only consider the buffer on that side of the channel.

Table 2. Land covers that should be included and excluded from wetland buffer calculations.

Examples of Land Covers Included in Buffers	Examples of Land Covers Excluded from Buffers
<ul style="list-style-type: none"> • Additional wetland/riparian area • Natural upland habitats • Nature or wildland parks • Bike trails • Foot trails • Horse trails • Open rangeland with light grazing • Swales and ditches • Open water • Vegetated levees 	<ul style="list-style-type: none"> • Commercial developments • Residential developments • Paved roads • Dirt roads • Railroads • Parking lots • Fences that interfere with the movements of wildlife • Sound walls • Intensive agriculture (row crops, orchards, vineyards) • Dryland farming • Horse paddocks, animal feedlots • Rangeland with intensive grazing • Lawns • Golf courses • Sports fields • Urbanized parks with active recreation • Paved or heavily used pedestrian/bike trails (frequent traffic)

Use the following narrative descriptions to estimate the buffer length:

Metrics for Buffer Length.

(1)	Buffer is 76–100% of the AA perimeter.
(2)	Buffer is 51–75% of the AA perimeter.
(3)	Buffer is 25–50% of the AA perimeter.
(4)	Buffer is <25% of the AA perimeter, OR no buffer exists.

ii.b. **Buffer Width:** This metric can be assessed first using aerial photography but must be verified in the field. Where buffers exist, visually estimate the average distance between the edge of the AA and the edge of the buffer, adjusted if necessary for slope. For Riverine wetlands, do not include the area immediately upstream or downstream as part of the buffer. Only consider areas on one side of the channel or the other. If the AA only represents one side of a channel, only consider the buffer on that side of the channel. See Table 2 for land covers included and excluded from buffers. Use the following narrative descriptions to estimate the buffer width:

Metrics for Buffer Width.

(1)	Average buffer width between edge of the AA and the edge of the buffer is >200 m.
(2)	Average buffer width between edge of the AA and the edge of the buffer is >100–200 m.
(3)	Average buffer width between edge of the AA and the edge of the buffer is 50–100 m.
(4)	Average buffer width between edge of the AA and the edge of the buffer is <50 m, OR no buffer exists.

iii.c. **Buffer Condition:** Estimate the overall condition of vegetation cover within the buffer (\leq 200 m) based on the following narrative description:

Metrics for Buffer Condition.

(1)	Abundant (>95%) native vegetation cover, little or no (<5%) cover of non-native plants, intact soils, AND little or no trash.
(2)	Substantial (>75–95%) native vegetation cover, low (5–25%) cover of non-native plants, intact or moderately disturbed soils, moderate or lesser amounts of trash, OR evidence of minor human visitation or recreation.
(3)	Moderate (50-75%) native vegetation cover, moderate or extensive soil disturbance, moderate or greater amounts of trash, OR evidence of moderate human visitation or recreation.
(4)	Low (<50%) cover of native vegetation, barren ground and highly disturbed soils, moderate or greater amounts of trash, evidence of high intensity human visitation or recreation, OR no buffer exists.

B. Size Metrics

1b. **Relative Patch Size:** A measure of the current size of the wetland divided by the historic size of the wetland (within the most recent period of intensive settlement or 200 years).

Measurement Protocol:

Relative size should be estimated first in GIS using aerial photographs, orthophoto quads, 7.5 minute topographic quads, National Wetland Inventory maps, etc. Historic aerial photographs are the best tool to estimate historic size, but may not be available. Historic size can be inferred from general landscape topography and obvious signs of human disturbance, such as roads, impoundments, development, ditching, draining, mining, flooding for reservoirs, etc. The definition of the “historic” timeframe generally refers to the intensive Euro-American settlement that began in the 1600s in the eastern United States and extended westward into the 1800s. Size estimates should be verified in the field. Use the following narrative description to estimate the relative size of the wetland:

Metrics for Relative Size.

(A) Excellent	Wetland is >95% of original size
(B) Good	Wetland is >80-95% of original size
(C) Fair	Wetland is >50-80% of original size
(D) Poor	Wetland is <50% of original size

2b. **Absolute Patch Size:** A measure of the current size of the wetland in hectares or linear kilometers.

Measurement Protocol:

Absolute size should be estimated first in GIS using aerial photographs, orthophoto quads, 7.5 minute topographic quads, National Wetland Inventory maps, etc. Size estimates should be verified, if possible, in the field. Wetland boundaries are not delineated using jurisdictional methods (U.S. Army Corps of Engineers 1987); rather, they are delineated by guidelines for determining Ecological System boundaries. Select the appropriate Ecological System and estimate the size of the entire wetland that contains the assessment area. The wetland may be much larger than the assessment area or the assessment area may be the entire wetland. IF YOU ARE UNABLE TO ESTIMATE SIZE, PLEASE INDICATE ON THE FORM THAT THE SIZE SHOULD BE ESTIMATED IN THE OFFICE.

C. Vegetation Structure

1c. **Relative Cover of Native Plant Species:** A measure of the relative percent cover of all plant species that are native to the region.

Metric Measurement Protocol

Relative Cover of Native Plant Species: Estimate the percent of the vegetation cover within the AA that is comprised of native plant species. Note: If 50% of the AA is covered by water and 50% of the AA is covered by vegetation, then estimate the percent of the AA covered by vegetation that is comprised of native vegetation. Estimate the relative cover of native plant species in the AA based on the following narrative descriptions:

Metrics for Relative Cover of Native Plant Species

(1)	>99% of the vegetation cover within the AA is comprised of native vegetation.
(2)	95-99% of the vegetation cover within the AA is comprised of native vegetation.
(3)	80-94% of the vegetation cover within the AA is comprised of native vegetation.
(4)	<80% of the vegetation cover within the AA is comprised of native vegetation.
(5)	<50% of the vegetation cover within the AA is comprised of native vegetation.

2c. Cover of Invasive Exotic Species: Estimate the percent of the relative vegetation cover within the AA that is comprised of invasive exotic plant species from the Montana County Weed List (Appendix VI) based on the following narrative description:

Metrics for Cover of Invasive Exotic Species

(1)	<1% of the vegetation cover within the AA is comprised of invasive exotic species.
(2)	1-3% of the vegetation cover within the AA is comprised of invasive exotic species.
(3)	>3-5% of the vegetation cover within the AA is comprised of invasive exotic species.
(4)	>5% of the vegetation cover within the AA is comprised of invasive exotic species.

3c. Cover of Invasive or Highly Tolerant Native Plant Species: Estimate the percent of the relative vegetation cover within the AA that is of invasive or highly tolerant native species from the Invasive and Highly Tolerant Native Plant Species table (Appendix VII) using the following narrative descriptions:

Metrics for Cover of Invasive or Highly Tolerant Native Plant Species

(1)	<5% of the vegetation cover within the AA is comprised of invasive or tolerant native plant species.
(2)	5-10% of the vegetation cover within the AA is comprised of invasive or tolerant native plant species.
(3)	>10-25% of the vegetation cover within the AA is comprised of invasive or tolerant native plant species.
(4)	>25% of the vegetation cover within the AA is comprised of invasive or tolerant native plant species.

4c. Organic Matter Accumulation: The accumulation of organic material and an intact litter layer are integral to a variety of wetland functions, such as surface water storage, percolation

and recharge, nutrient cycling, and support of wetland plants. Intact litter layers provide areas for primary production and decomposition that are important to maintaining functioning food chains. They nurture fungi essential to the growth of rooted wetland plants. They support soil microbes and other detritivores that comprise the base of the food web in many wetlands. The abundance of organic debris and coarse litter on the substrate surface can significantly influence overall species diversity and food web structure. Fallen debris serves as cover for macroinvertebrates, amphibians, rodents, and even small birds. Litter is the precursor to detritus, which is a dominant source of energy for most wetland ecosystems. However, organic matter accumulation can be a problem in vernal pools and playas because it encourages biological invasions and can lead to deleterious algal blooms.

Use the following narrative descriptions to describe the organic matter accumulation within the AA:

Metrics for Organic Matter Accumulation.

(1)	Site has moderate amount of fine organic matter. New growth is more prevalent than previous years' growth. Layers of litter in pools or areas of topographic lows are thin.
(2)	Site is characterized by small amounts of coarse organic debris, with little plant recruitment, OR debris is somewhat excessive.
(3)	Site has little coarse debris and/or only scant fine debris OR debris is excessive.

5c. Physical Patch Types: Physical patches such as open water, mudflats, floating mats, etc. increase the structural complexity of wetlands as well as perform important ecological functions and can be important indicators of wetland function.

Patch types are recorded on the datasheet by selecting all that apply from a checklist of different physical surfaces or features that may provide habitat for species (Table 3).

Table 3. Checklist and Descriptions for Physical Patch Types.

PHYSICAL PATCH TYPE	DESCRIPTION
Open water-pond or lake	Medium to large natural water body.
Open water -pools	Areas that hold stagnant or slow moving water from groundwater discharge or precipitation but are not associated with a defined channel.
Open water-river/stream	Area of flowing water associated with a sizeable channel.
Open water-oxbow/backwater channel	Areas that hold stagnant or slow moving water that have been partially or completely disassociated from the primary river channel.
Open water-tributary/secondary channel	Areas of flowing water entering the main channel from a secondary source.
Open water-beaver pond	Areas that hold stagnant or slow moving water behind a beaver dam.
Deep emergent plants (> 0.5 m water depth)	Vegetation that is often rooted in deep water with leaves and shoots emerging above the water.
Shallow emergent plants (< 0.5 m water depth)	Vegetation that is often rooted in shallow water or on dry land with leaves and shoots emerging above the water.
Submerged/floating vegetation	Vegetation that remains submerged for most of the growing season or floats on top of the water.
Active beaver dam	Debris damming a stream, clearly constructed by beaver (note: gnawed ends of branches).

PHYSICAL PATCH TYPE	DESCRIPTION
Adjacent or onsite springs/seeps	Localized point of emerging groundwater, often on or at the base of a sloping hillside.
Shrubs/Trees	Sizeable area covered by shrub and/or tree cover.
Transitional meadow	Open area dominated by herbaceous hydrophytic vegetation in the transition zone between the wetland and upland.
Saline meadow	Open area of halophytic (salt tolerant) herbaceous vegetation usually adjacent to a saline depression or alkali flat.
Debris jams/woody debris	Aggregated woody debris in stream channel deposited by high flows.
Pool/riffle complex	Deep, slow moving pools alternating with shallow, fast moving riffles along the relatively straight course of a river or stream.
Point bars	A low ridge of sediment (sand or gravel) formed on the inner bank of a meandering stream.
Mudflats/salt flats/alkali flats	An accumulation of mud/salt/alkaline soil at the edge of shallow waters such as a lake or pond. Often intermittently flooded or exposed.
Wet meadow patches	Small open areas dominated by herbaceous hydrophytic vegetation within an otherwise shrub- or tree-dominated canopy.
Plant hummocks/tussocks/sediment mound.	A mound composed of organic material (peat) or formed by sedges and grasses that have a tussock growth habit as they raise themselves on a pedestal of persistent rhizomes and roots.
Water tracks/hollows	In fens, a depression found between hummocks or mounds that remains permanently saturated or is inundated with slow moving surface water.
Tall herbaceous vegetation (> 0.5 m tall)	Sizeable area dominated by tall herbaceous vegetation (note: typically lacks inundation by water during most growing seasons).
Low herbaceous vegetation (< 0.5 m tall)	Sizeable area dominated by low herbaceous vegetation (note: typically lacks inundation by water during most growing seasons).
Floating mat	Mats of peat held together by roots and rhizomes of sedges. Floating mats are found along the edges of ponds and lakes and are slowly encroaching into open water. The mats are underlain by water and/or very loose peat.
Vegetation cover dominated by sedges/moss	A flat expanse of fen typically dominated by sedges or moss.

D. Physicochemical

1d. Soil Surface Integrity: An indirect measure of soil condition based on stressors that increase the potential for erosion or sedimentation, assessed by evaluating intensity of human dominated land uses on the site.

Measurement Protocol: Use the narrative descriptions provided to describe the soil surface integrity of the AA.

Metrics for Soil Surface Integrity.

(1)	Bare soil is limited to naturally caused disturbances such as flood deposition or game trails.
(2)	Some bare soil due to human causes (including livestock) is present but the extent and impact is minimal. The depth of disturbance is limited to only a few inches and does not show evidence of ponding or channeling water. Any disturbance is likely to recover within a few years after the disturbance is removed.
(3)	Bare soil due to human causes is common and will be slow to recover. There may be pugging due to livestock resulting in several inches of soil disturbance. ORVs or other machinery may have left some shallow ruts. Damage is not excessive and the site will recover with the removal of degrading human influences and moderate recovery times.
(4)	Bare soil substantially degrades the site due to altered hydrology or other long-lasting impacts. Deep ruts from ORVs or machinery may be present, or livestock pugging and/or trails are widespread. Water, if present, would be channeled or ponded. The site will not recover without restoration and/or long recovery times.

2d. Water Quality: An assessment of water quality based on visual evidence of water clarity and eutrophic species abundance.

Measurement Protocol: Use the narrative descriptions provided to describe the water quality of the AA.

Metrics for Water Quality.

(1)	No visual evidence of degraded water quality. Wetland species that respond to high nutrient levels are minimally present, if at all. Water is clear with no strong green tint or sheen.
(2)	Some negative water quality indicators are present, but limited to small and localized areas within the wetland. Wetland species that respond to high nutrient levels may be present but are not dominant. Water may have a minimal greenish tint, cloudiness, or sheen.
(3)	Negative water quality indicators or wetland species that respond to high nutrient levels are common. Sources of water quality degradation are apparent. Water may have a moderate greenish tint, sheen or other turbidity with algae common.
(4)	Wetland is dominated by vegetation species that respond to high nutrient levels or there is widespread evidence of other negative water quality indicators. Algal mats may be extensive, blocking light to the bottom. Sources of water quality degradation are typically apparent. Water has strong greenish tint, sheen, or turbidity. The bottom may be difficult to see during the growing season.

E. Hydrology

1e. **Water Source:** An assessment of the extent, duration, and frequency of saturated or ponded conditions within a wetland, as affected by the kinds of direct inputs of water into, or any diversions of water away from, the wetland.

Water sources encompass the forms, or places, of direct inputs of water to the AA as well as any unnatural diversions of water from the AA. Diversions are considered a water source because they affect the ability of the AA to function as a source of water for other habitats while also directly affecting the hydrology of the AA. Inputs of water affecting conditions during the *dry season* are especially important because these strongly influence structure and composition of wetland plant and animal communities. The Water Source metric, therefore, focuses on conditions that affect *dry season* hydrology.

Natural water sources include precipitation, ground water discharge, and flooding of the AA due to naturally high flows, seasonal runoff, etc. Examples of unnatural sources include storm drains that empty directly into the AA or into an immediately adjacent area. For seeps and springs that occur at the toe of an earthen dam, the reservoir behind the dam is an unnatural water source. Large reservoirs and lakes that do not drain directly into the AA should not be considered water sources, although they can have systemic, ubiquitous effects on the condition of the AA. Engineered hydrological controls, such as pumps, weirs, flashboards, grade control structures, check dams, etc., are not considered water sources.

Measurement Protocol:

The assessment of this metric is the same for all wetland systems. It can be assessed initially in the office using the aerial imagery, and then revised based on the field visit. For all wetlands, including fringe habitat, this metric focuses on *direct* sources of water as defined above. The natural sources will tend to be more obvious than the unnatural sources. Evaluation of this metric should therefore emphasize the identification of the unnatural sources or diversions that directly affect the dry season conditions of the AA.

The office work should initially focus on the immediate margin of the AA and its wetland, and then expand in focus to include the smallest watershed or storm drain system that directly contributes to the AA or its immediate environment. This includes areas outside the AA but within the same wetland or an adjacent reach of the same riverine or riparian system. Landscape indicators of unnatural water sources include adjacent intensive development or irrigated agriculture, nearby wastewater treatment plants, and nearby reservoirs (Table 4).

Table 4. Appropriate landscape positions for each wetland class.

Wetland Type	Natural Landscape Position	Unnatural Landscape Position
Slope Wetlands	Along the bases or middle reaches of hillslopes or dunes, typically at breaks in the slope, transitions between one slope and another, in landslide topography, or at contacts between geological strata.	In flat, “mesa-like” areas or along tops of hills or ridges where water in the dry season must be pumped in order to reach the site.
Riverine Wetlands	Along valley bottoms and canyon bottoms with at least seasonal flow.	Along unnatural channels (e.g., flumes, ditches, and canals).
All Other Wetlands	Topographic low points in basins, on natural topographic saddles, or on bedrock or other impermeable substrate. The basins may be distinct or diffuse and subtle.	At elevations above the topographic low point of a basin, on hillslopes or high ground lacking adequate catchment and runoff such that water in dry season must be pumped in order to reach the site.

The typical suite of natural water sources differs among wetland types. The effects of unnatural water sources are also unique among wetland types. The following discussion may be helpful in understanding these differences and recognizing them in the field.

Slope Wetlands: Groundwater is the source of water for seep, spring, and slope wetlands. It is generally expected that the source is perennial and relatively constant in volume throughout most years. The water source can be assessed, therefore, based on plant indicators of its permanence and consistency. The hydrologic needs of many plant species commonly found in wetlands have been determined (Reed 1988; Reed et al. 1993). A data column indicating whether each of these species is a wetland obligate, facultative, or considered to be restricted to upland habitat, is provided in the plant species table in Appendix VIII.

Riverine, Depressional, and Lacustrine Wetlands: Natural sources of water for these wetlands include snowmelt, rainfall, groundwater, and riverine flows. Whether the wetlands are perennial or seasonal, alterations in the water sources result in changes in either the high water or low water levels. Such changes can be assessed based on the patterns of plant growth along the wetland margins or across the bottom of the wetlands. Use the following narrative descriptions to describe the water source for the AA.

Metrics for Water Source.

(1)	Sources are precipitation, groundwater, and/or natural runoff, or natural flow from an adjacent freshwater body, or the AA naturally lacks water in the dry season.
(2)	Sources are mostly natural but can include occasional or small effects of modified hydrology (e.g., developed land or irrigated agricultural land comprising less than 20% of the drainage basin within 2 km of the AA, presence of a few small stormdrains or scattered homes with septic systems). No large point sources or dams control the overall hydrology.
(3)	Sources or withdrawals are primarily from anthropogenic sources (e.g., urban runoff, direct irrigation, diversions, pumped water, impoundments, regulated releases through a dam, developed or irrigated agricultural land comprising more than 20% of the drainage basin within 2 km of the AA, presence of major drainage point source discharges that obviously control the hydrology of the AA).
(4)	Natural sources have been eliminated based on the following indicators: impoundment of all possible wet season inflows, diversions of all dry-season inflows, predominance of xeric vegetation, etc.

2e. Hydroperiod or Channel Stability: An assessment of the characteristic frequency and duration of inundation or saturation of a wetland during a typical year. Depressional, lacustrine, and riverine wetlands typically have daily variations in water height that are governed by diurnal increases in evapotranspiration, and seasonal cycles that are governed by wet season rainfall and runoff. Slope wetlands that depend on groundwater may have relatively slight seasonal variations in hydroperiod.

The concept of channel stability only pertains to riverine wetlands. It is assessed as the degree of channel aggradation (i.e., net accumulation of sediment on the channel bed such that it is rising over time), or degradation (i.e., net loss of sediment from the bed such that it is being lowered over time). There is much interest in channel entrenchment (i.e., the inability of flows in a channel to exceed the channel banks) and this is addressed in the Hydrologic Connectivity metric.

Measurement Protocol:

This metric evaluates recent changes in the hydroperiod, flow regime, or sediment regime of a wetland and the degree to which these changes affect the structure and composition of the wetland plant community or, in the case of riverine wetlands, the stability of the riverine channel. Common indicators are presented for the different wetland classes. This metric focuses on changes that have occurred in the last 2-3 years.

Depressional, Lacustrine, and Slope Wetlands (except fens): Assessment of the hydroperiod for these kinds of wetlands should be initiated with an office-based review of diversions or augmentations of flows to the wetland. Field indicators for altered hydroperiod include pumps, spring boxes, ditches, hoses and pipes, encroachment of terrestrial vegetation, excessive exotic

vegetation along the perimeter of the wetland, and desiccation during periods of the year when comparable wetlands are typically inundated or saturated. Use the following narrative description to describe the hydroperiod of the AA:

Metrics for Hydroperiod for depressional, lacustrine, and slope wetlands (*except fens*).

(1)	Hydroperiod of the AA is characterized by natural patterns of filling or inundation and drying or drawdowns.
(2)	The filling or inundation patterns in the AA are of greater magnitude or duration than would be expected under natural conditions, but thereafter the AA is subject to natural drawdown or drying.
(3)	Hydroperiod of the AA is characterized by natural patterns of filling or inundation, but thereafter, is subject to more rapid or extreme drawdown or drying, as compared to more natural wetlands. OR The filling or inundation patterns in the AA are of substantially lower magnitude or duration than would be expected under natural conditions, but thereafter, the AA is subject to natural drawdown or drying.
(4)	Both the inundation and drawdown of the AA deviate from natural conditions (either increased or decreased in magnitude and/or duration).

Metrics for Hydroperiod for fens.

(1)	Hydroperiod of the site is characterized by stable, saturated hydrology, or by naturally damped cycles of saturation and partial drying.
(2)	Hydroperiod of the site experiences minor altered inflows or drawdown/drying, as compared to more natural wetlands (e.g., ditching).
(3)	Hydroperiod of the site is somewhat altered by greater increased inflow from runoff, or experiences moderate drawdown or drying, as compared to more natural wetlands (e.g., ditching).
(4)	Hydroperiod of the site is greatly altered by increased inflow from runoff or experiences large drawdown or drying, as compared to more natural wetlands (e.g., ditching).

Hydroperiod for Riverine Wetlands: The hydroperiod of a riverine wetland can be assessed based on a variety of statistical parameters, including the frequency and duration of flooding. These characteristics, plus channel form in cross-section and plan view (aerial view), steepness of the channel bed, material composition of the bed, sediment load, and the amount of woody material entering the channel, all interact to create the physical structure and form of the channel at any given time.

The data needed to calculate hydroperiod are not available for most riverine systems in the Rocky Mountains. Rapid assessments must therefore rely on field indicators of hydroperiod. For a broad diagnosis of overall riverine wetland condition, the physical stability or instability of the system is especially important. Whether a riverine system is stable (i.e., sediment supplies and water supplies are in dynamic equilibrium with each other and with the stabilizing qualities of

riparian vegetation), or if it is degrading (i.e., subject to chronic incision of the channel bed), or aggrading (i.e., the bed is being elevated due to in-channel storage of excess sediment) can have large effects on downstream flooding, contaminant transport, riparian vegetation structure and composition, and wildlife support. For riverine systems, physical stability is used to gauge wetland hydroperiod.

Every stable riverine channel tends to have a particular form in cross section, profile, and plan view that is in dynamic equilibrium with the inputs of water and sediment. If these supplies change enough, the channel will tend to adjust toward a new equilibrium form. An increase in the supply of sediment, relative to the supply of water, can cause a channel to aggrade (i.e., the elevation of the channel bed increases), which might cause simple increases in the duration of inundation for existing wetlands, or complex changes in channel location and morphology through braiding, avulsion, burial of wetlands, creation of new wetlands, spray and fan development, etc. An increase in water relative to sediment might cause a channel to incise (i.e., the bed elevation decreases), leading to bank erosion, headward erosion of the channel bed, floodplain abandonment, and dewatering of riparian habitats. For most riverine systems, chronic incision (i.e., bed degradation) is generally regarded as more deleterious than aggradation because it is more likely to cause significant decreases in the extent of riverine wetland and riparian habitats.

There are many well-known field indicators of equilibrium conditions, or deviations from equilibrium, that can be used to assess the existing mode of behavior of a channel and hence the degree to which its hydroperiod can sustain wetland and riparian habitats. To evaluate this metric, visually survey the AA for field indicators of aggradation or degradation (Table 5). After reviewing the entire AA and comparing the conditions to those described in the table, determine whether the AA is in equilibrium, degrading, or aggrading.

Table 5. Field indicators of hydrology for riverine wetlands.

Condition	Field Indicators (Check all existing conditions)
Channel Equilibrium	The channel (or multiple channels in braided systems) has a well-defined usual high water line, or bankfull stage that is clearly indicated by an obvious floodplain, topographic bench that represents an abrupt change in the cross-sectional profile of the channel throughout most of the site.
	The usual high water line or bank full stage corresponds to the lower limit of riparian vascular vegetation.
	Leaf litter, thatch, wrack, and/or mosses exist in most pools.
	The channel contains embedded woody debris of the size and amount consistent with what is available in the riparian area.
	There is little or no active undercutting or burial of riparian vegetation.
	There is little evidence of recent deposition of cobble or very coarse gravel on the floodplain, although recent sandy deposits may be evident.
	There are no densely vegetated mid-channel bars and/or point bars.
	The spacing between pools in the channel tends to be 5-7 channel widths.
	The larger bed material supports abundant periphyton.
Active Degradation	The channel through the site is characterized by deeply undercut banks with exposed living roots of trees or shrubs. There are abundant bank slides or slumps, or the banks are uniformly scoured and unvegetated.
	Riparian vegetation may be declining in stature or vigor, and/or riparian trees and shrubs may be falling into the channel.
	Abundant organic debris has accumulated on what seems to be the historical floodplain.
	The channel bed appears scoured to bedrock or dense clay.
	The channel bed lacks any fine-grained sediment.
	Recently active flow pathways appear to have coalesced into one channel (i.e. a previously braided system is no longer braided).
	There are one or more nick points along the channel, indicating headward erosion of the channel bed.
Active Aggradation	The channel through the site lacks a well-defined usual high water line.
	There is an active floodplain with fresh splays of sediment covering older soils or recent vegetation.
	There are partially buried tree trunks or shrubs.
	Cobbles and/or coarse gravels have recently been deposited on the floodplain.
	There is a lack of in-channel pools, their spacing is greater than 5-7 channel widths, or many pools seem to be filling with sediment.
	There are partially buried, or sediment-choked, culverts.
	Transitional or upland vegetation is encroaching into the channel throughout most of the site.
	The bed material is loose and mostly devoid of periphyton.

Use the following narrative descriptions to describe the hydroperiod of the AA:

Metrics for Hydroperiod for riverine wetlands.

(1)	Most of the channel through the AA is characterized by equilibrium conditions, with little evidence of aggradation or degradation (based on field indicators listed in the worksheet).
(2)	Most of the channel through the AA is characterized by some aggradation or degradation, none of which is severe, and the channel seems to be approaching an equilibrium form (based on the field indicators listed in the worksheet).
(3)	There is evidence of severe aggradation or degradation of most of the channel through the AA (based on the field indicators listed in the worksheet), or the channel is artificially hardened through less than half of the AA.
(4)	The channel is concrete or otherwise artificially hardened through most of the AA.

3e. Hydrologic Connectivity: An assessment of the ability of the water to flow into or out of the wetland, or to accommodate rising flood waters without persistent changes in water level that can result in stress to wetland plants and animals.

Measurement Protocol:

Assessment of this metric is based solely on field indicators and is different by HGM class. See tables and figures below for guidance.

Metrics for Hydrologic Connectivity for depressional, lacustrine, and slope wetlands (*except isolated fens*).


(1)	Rising water in the AA has unrestricted access to adjacent areas, without levees or other obstructions to the lateral movement of flood waters.
(2)	Unnatural features such as levees or road grades limit the amount of adjacent transition zone or the lateral movement of floodwaters, relative to what is expected for the setting, but the limitations exist for less than 50% of the AA perimeter. Restrictions may be intermittent along the margins of the AA, or they may occur only along one bank or shore.
(3)	The amount of adjacent transition zone or the lateral movement of flood waters to and from the AA is limited, relative to what is expected for the setting, by unnatural features such as levees or road grades, for 50–90% of the AA perimeter. Flood flows may exceed the obstructions, but drainage out of the AA is probably obstructed.
(4)	The amount of adjacent transition zone or the lateral movement of flood waters is limited, relative to what is expected for the setting, by unnatural features such as levees or road grades, for more than 90% of the AA perimeter.

Metrics for Hydrologic Connectivity for fens that are naturally isolated.

(1)	No natural connectivity with the surrounding water bodies.
(2)	Partial connectivity (e.g., ditching or draining to dry the fen).
(3)	Substantial to full connectivity that has obvious effects of drying the peat body.

Hydrologic Connectivity for Riverine Wetlands: For riverine wetlands and riparian habitats, hydrologic connectivity is assessed based on the degree of channel entrenchment (Rosgen 1996; MacDonald and Montgomery 2002). Entrenchment is a field measurement calculated as the flood-prone width divided by the bankfull width. Bankfull width is the channel width at the height of bankfull flow. The flood-prone channel width is measured at the elevation of twice the maximum bankfull depth. The process for estimating entrenchment is outlined below. Entrenchment varies naturally with channel confinement. Channels in steep canyons naturally tend to be confined, and tend to have small entrenchment ratios indicating less hydrologic connectivity. Assessments of hydrologic connectivity based on entrenchment must therefore be adjusted for channel confinement (Figures 2 and 3), according to the following worksheet (Table 6).

Table 6. Riverine wetland entrenchment ratio calculation.

The following 5 steps should be conducted for each of 3 cross sections located in the AA at the approximate mid-points along straight riffles or glides, away from deep pools or meander bends.				
Steps	Replicate cross-sections 	1	2	3
1. Estimate bankfull width.	If the stream is entrenched, the height of bankfull flow is identified as a scour line, narrow bench, or the top of active point bars well below the top of apparent channel banks. If the stream is not entrenched, bankfull stage can correspond to the elevation of a broader floodplain with indicative riparian vegetation. Estimate or measure the distance between the right and left bankfull contours.			
2. Estimate max bankfull depth.	Imagine a line between right and left bankfull contours. Estimate or measure the height of the line above the thalweg (the deepest part of the channel).			
3. Estimate flood prone height.	Double the estimate of maximum bankfull depth from Step 2.			
4. Estimate flood prone width.	Imagine a level line having a height equal to the flood prone depth from Step 3. Note the location of the new height on the channel bank. Estimate the width of the channel at the flood prone height.			
5. Calculate entrenchment.	Divide the flood prone width (Step 4) by the maximum bankfull width (Step 1).			
6. Calculate average entrenchment	Average the results of Step 5 for all three cross-sections and enter it here.			

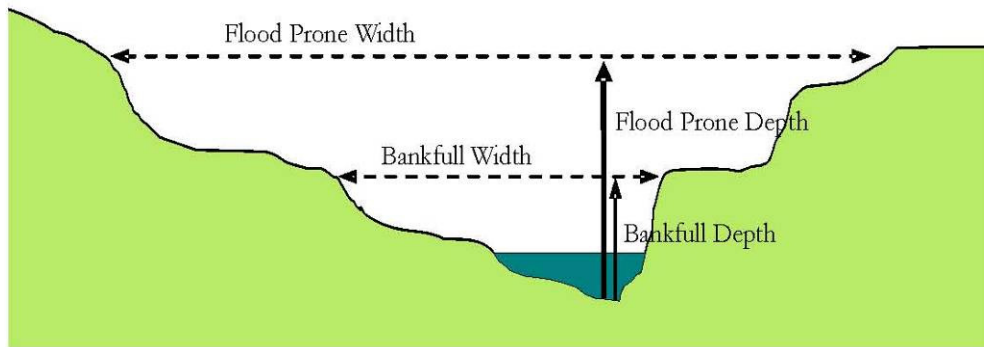


Figure 1: Parameters of channel entrenchment. Flood prone depth is twice maximum bankfull depth. Entrenchment equals flood prone width divided by bankfull width.

Use the following narrative descriptions to describe the hydrologic connectivity of the AA:

Metrics for Hydrologic Connectivity for confined riverine wetlands.

(1)	Entrenchment ratio >2.0.
(2)	Entrenchment ratio 1.6–2.0.
(3)	Entrenchment ratio 1.2–1.5.
(4)	Entrenchment ratio <1.2.

Metrics for Hydrologic Connectivity for unconfined riverine wetlands.

(1)	Entrenchment ratio >2.2.
(2)	Entrenchment ratio 1.9–2.2.
(3)	Entrenchment ratio 1.5–1.8.
(4)	Entrenchment ratio <1.5.

Confined Flow	Unconfined Flow
<ul style="list-style-type: none"> ▪ channelized flow ▪ distinct floodplain may not exist ▪ closely spaced contour lines that form a narrow upstream-pointing V-shape ▪ minor changes in flow velocity ▪ relatively narrow and steep 	<ul style="list-style-type: none"> ▪ flow often wider than the active channel ▪ widely spaced contours that form an open V- or U-shape ▪ velocity changes from high to low



Figure 2. Example of a confined flow.



Figure 3. Example of an unconfined flow.

VI. Land Use and Stressors

Definition: Document the intensity of human dominated land uses within a 500 m buffer of the AA, the land uses within the AA, and stressors that potentially affect the hydrology of the AA. Using Table 7 (provided below and on the field form), check each land use/stressor that occurs and enter the total on the form.

Table 7. Land use and stressor table.

Land Use Observed Within 500 m of the AA
Paved roads / parking lots
Domestic or commercially developed buildings
Gravel pit operation, open pit mining, strip mining
Unpaved Roads (e.g., driveway, tractor trail, 4-wheel drive roads)
Mining (other than gravel, open pit, and strip mining), abandoned mines
Resource extraction (oil and gas development)
Agriculture - dryland farming
Intensively managed golf courses, sports fields
Vegetation conversion (chaining, cabling, rotochopping, clearcut)
Heavy grazing by livestock
Intense recreation (ATV use / camping / popular fishing spot, etc.)
Logging or tree removal with 50-75% of trees >50 cm dbh removed
Agriculture – irrigated cropland
Agriculture – permanent tree plantation
Dam sites and flood disturbed shorelines around water storage reservoirs
Recent old fields and other disturbed fallow lands dominated by exotic species
Moderate grazing on rangeland
Moderate recreation (high-use trail)
Selective logging or tree removal with <50% of trees >50 cm dbh removed
Light grazing on rangeland
Light recreation (low-use trail)
Haying of native grassland
Fallow with no history of grazing or other human use in past 10 yrs
Natural area / land managed for native vegetation
Land Use Observed Within the AA
Vegetation conversion (chaining, cabling, rotochopping, clearcut)
Heavy grazing by livestock
Intense recreation (ATV use / camping / popular fishing spot, etc.)
Logging or tree removal with 50-75% of trees >50 cm dbh removed
Dam sites and flood disturbed shorelines around water storage reservoirs
Recent old fields and other disturbed fallow lands dominated by exotic species
Moderate grazing
Moderate recreation (high-use trail)
Selective logging or tree removal with <50% of trees >50 cm dbh removed

Land Use Observed Within 500 m of the AA
Light grazing
Light recreation (low-use trail)
Natural area / land managed for native vegetation
Hydrology Within 500 m of the AA
Upstream spring boxes
Impoundment
Pumps, diversions, or ditches that move water out of the wetland
Evidence of aquatic life mortality
Encroachment of terrestrial vegetation
Stress or mortality of hydrophytes
Compressed or reduced plant zonation
Berm
Dike
Pumps, diversions, or ditches that move water into the wetland
Recently drowned riparian vegetation
Extensive fine-grained deposits

VII. Vegetation Measurements for Intensive Wetland Assessment

Intensive assessments involve the collection of plant species cover and composition data. The vegetation plot is adapted from the flexible-plot method developed by Peet et al. (1998). The entire plot measures 20 m x 50 m (1,000 m² = 0.1 ha). The plot is comprised of ten 10 m x 10 m modules (100 m² = 0.01 ha). In general, an AA area consisting of a 0.5 ha circular plot will hold a standard vegetation plot, consisting of a two by five array of ten 10 m x 10 m modules (Figure 4). For the purposes of the Milk-Marias Rotating Basin Assessment, we are only measuring vegetation in five of these modules.

The location and layout of the vegetation plot within the AA is based on the AA size and site characteristics. In most AAs, a single standard vegetation plot will be used to assess the vegetation of the AA. For situations where AAs are not 0.5 hectare circular plots, alternate plot configurations may be required, such as changing the shape of the plot array (see Alternate Plot Configurations, below).

A. Selecting the vegetation plot configuration and location within the AA

Vegetation plots should be placed to maximize abiotic/biotic heterogeneity within the AA. Capturing heterogeneity of the AA ensures adequate representation of vegetation patterns and local variations in environment such as directional gradients, microtopography, natural disturbances such as flooding, and anthropogenic disturbances such as grazing. For many wetlands, vegetation may be relatively homogeneous, and its variability will be captured by placing the vegetation plot in the center of the AA. In situations where vegetation is heterogeneous across the AA, variability can be effectively characterized with a standard plot by 1) laying out the long axis (50 m) of the plot so that it parallels the primary environmental

gradient or is perpendicular to distinct vegetation zones, or 2) by orienting the plot to capture mosaics of patchy vegetation, or 3) use one of several alternate plot configurations. To determine the appropriate vegetation plot configuration, use the following key:

- 1a. AA < 20 m or < 50 m long, or total AA < 0.1 ha
 **See Alternative plot configuration figures**
- 1b. AA is a 0.5 hectare circular plot or a rectangle with width \geq 20 m and length \geq 50 m... **2**
- 2a. Vegetation of AA is homogeneous, a mosaic of small-scale interspersed patches, and/or lacking clear directional environmental gradients..... **Standard plot, centered in AA**
- 2b. Vegetation of AA is heterogeneous, clear directional environmental gradients present and/or vegetation occurring in distinct zones **3**
- 3a. Vegetation with several distinct large-scale patches (\geq 100 m²) within the AA (e.g., shrub patches, tall and low herbaceous patches, etc.).....
 **Standard plot placed to included multiple patch types**
- 3b. Vegetation distributed along a directional environmental gradient or arranged in clear bands or zones **4**
- 4a. Directional environmental gradient **Standard plot, long axis parallel to gradient**
- 4b. Clear vegetation zonation **Standard plot, long axis perpendicular to zonation**

Alternative Plot Configurations:

If the AA has an irregular shape (e.g., long, narrow riparian strip, lake edge, wetland smaller than 0.1 ha or < 20 m wide or < 50 m long), then select an alternate plot configuration. This configuration can include different dimensions for the 100 m² modules or a different array for the modules other than the standard two by five array. To facilitate comparison among AAs, the number of modules surveyed should be the same, so that equal levels of sample effort are maintained across AAs. However, in small or narrow AAs there may be occasional situations where five modules will not fit. In this case, do as many modules as possible within the AA.

B. Vegetation Plot

1b. Standard Plot Layout: The standard plot consists of a two by five array of 10 100 m² modules. To set up the vegetation plot, pull a tape out 50 meters and use a flagged pin to stake the tape. The tape functions as the centerline for the vegetation plot. Take a GPS coordinate at both the 0 m (plot origin) and the 50 m end point to capture the location of the beginning and the end of the plot. If necessary, flag the centerline at 10 m intervals, so that the centerline is visible throughout data collection.

Using ropes or multiple 10-m tapes, layout your first 10 x 10 meter modules (Figure 4). Within this first module, mark the corner that begins at the origin of the tape at 1 m, so that a 1 m x 1

m corner of the module is marked. This nested corner plot serves to focus the observers' attention to compile a plant species list. Set up subsequent modules along the centerline as the vegetation plot is surveyed.

2b. Plot Photos: Take a photo of the entire vegetation plot from the plot origin (0 m) and record the photo number and bearing. Take additional photos of each module surveyed, standing at the centerline.

3b. Vegetation Plot Layout: Circle the location of the intensive modules and note any changes made to the layout of the plot.

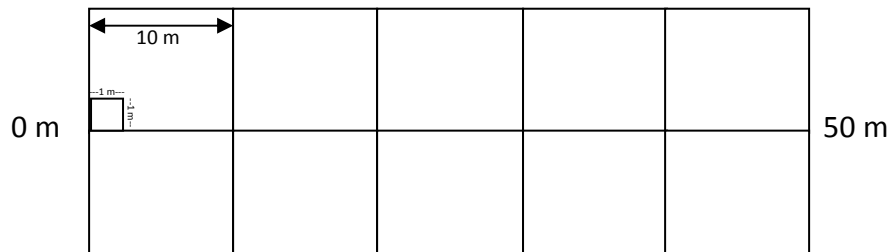


Figure 4. Schematic of the 20 m x 50 m vegetation plot with a two by five array of ten 10 m x 10 m modules. Note the 1 m x 1 m corner plot in the first module.

4b. Plot Representativeness: Discuss decisions for plot placement, whether plot is representative of the AA, whether an alternative configuration was used, etc.

C. Plant Species Presence and Percent Cover

1c. Nested corner plot in the first module: List all species in each stratum and estimate percent cover using the cover scale for the corner plot. For tree species, estimate seedling, sapling, and mature trees separately. Plant species must be **rooted** in the module to be recorded. Record plant species using a six letter code consisting of the first three letters of the genus and the first three letters of the species (e.g., *Juncus balticus* = JUNBAL).

2c. Intensive module: Starting with the uppermost stratum, list all species in each stratum and estimate percent cover using the cover scale for each module. For tree species, estimate seedling, sapling, and mature trees separately.

3c. Ground cover: Record the presence of water, bare ground, litter, and bryophytes and their cover within each module.

4c. Residual species within vegetation plot: Survey the remaining modules and list any species found in the residual "R" column and estimate percent cover for the entire vegetation plot.

5c. Other species observed in AA: List any species that occur in the AA but outside of the vegetation plot at the bottom of the list or designate with a **0** in the Cover Class column.

6c. Module arrangement: Mark the location of intensive modules on the schematic of the vegetation plot on the field and, if possible, on the aerial photo for reference.

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Appendix I: Field Key to Wetland Ecological Systems of the Milk-Marias Basin, Montana

- 1a. Total woody canopy cover generally 10% or more **GO TO KEY A: Woodland and Shrubland Ecological Systems**
- 1b. Total woody canopy cover generally less than 10%..... **2**
- 2a. Total canopy cover generally 10% or more **GO TO KEY B: Herbaceous Ecological Systems**
- 2b. Total canopy cover generally less than 10%..... **GO TO KEY C: Sparse Vegetation**

KEY A: Woodland and Shrubland Ecological Systems

- 1a. Woody wetland associated with a stream channel (Riverine) **2**
- 1b. Woody wetland associated with the discharge of groundwater to the surface, ponds, or sites with overflow but no channel formation (Slope or Depressional)..... **8**
- 2a. Higher elevation woodlands and shrublands *generally* >2,500 m..... **3**
- 2b. Middle and lower elevation woodlands and shrublands *generally* <2,500 m **4**
- 3a. High elevation woodlands (canopy dominated by trees) **Rocky Mountain Subalpine-Montane Riparian Woodland**
- 3b. High elevation shrublands. Species of *Salix*, *Alnus*, or *Betula* are commonly present..... **Rocky Mountain Subalpine-Montane Riparian Shrubland (Riverine)**
- 4a. Lower montane-foothill riparian woodlands and shrublands associated with mountain ranges of the Northern and Middle Rockies in western Montana and northwestern Wyoming. This type *excludes* island mountain ranges east of the Continental Divide in Montana. *Populus balsamifera* ssp. *trichocarpa* is typically the canopy dominant in woodlands. Other common tree species include *Populus tremuloides*, *Betula papyifera*, *Betula occidentalis*, and *Picea glauca*. Shrub understory species include *Cornus sericea*, *Acer glabrum*, *Alnus incana*, *Oplopanax horridus*, and *Symphoricarpos albus*. Areas of riparian shrubland and open wet meadows are common **Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland**
- 4b. Riparian woodlands and shrublands of other regions..... **5**
- 5a. Riparian woodlands and shrublands of the Northwestern or Western Great Plains of eastern Montana **6**
- 5b. Lower montane-foothill riparian woodlands and shrublands associated with island mountain ranges in central and eastern Montana. Woodlands are dominated by *Populus* spp. including *Populus angustifolia*, *Populus balsamifera* ssp. *trichocarpa*, *Populus deltoides*, and *Populus fremontii*. Other tree species include *Picea pungens*, *Pseudotsuga menziesii*, *Populus tremuloides*, and *Juniperus scopulorum*. **Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland**

6a. Woodlands and shrublands of draws and ravines associated with permanent or ephemeral streams or steep north-facing slopes or canyon bottoms that do not experience flooding. Common tree species include *Fraxinus* spp., *Acer negundo*, *Populus tremuloides*, and *Ulmus* spp. Important shrub species include *Crataegus* spp., *Prunus virginiana*, *Rhus* spp., *Rosa woodsii*, *Symphoricarpos occidentalis*, and *Shepherdia argentea*
..... **Western Great Plains Wooded Draw and Ravine**

6b. Woodlands and shrublands of small to large streams and rivers of the Northwestern or Western Great Plains **7**

7a. Woodlands and shrublands of riparian areas of medium and small rivers and streams with little or no floodplain development and typically flashy hydrology.....
..... **(Northwestern Great Plains Riparian) Western Great Plains Riparian**

7b. Woodlands and shrublands of riparian areas along medium and large rivers with extensive floodplain development and periodic flooding
..... **(Northwestern Great Plains Floodplain) Western Great Plains Floodplain**

8a. Woody wetland associated with small, shallow ponds. Ponds are ringed by trees including *Populus balsamifera* ssp. *trichocarpa*, *Populus tremuloides*, *Betula papyrifera*, *Abies grandis*, *Abies lasiocarpa*, *Picea engelmannii*, *Pinus contorta*, and *Pseudotsuga menziesii*. Typical shrub species include *Cornus sericea*, *Amelanchier alnifolia*, and *Salix* spp.
..... **Northern Rocky Mountain Wooded Vernal Pool**

8b. Woody wetland associated with the discharge of groundwater to the surface or sites with overflow but no channel formation (Slope) **9**

9a. Coniferous woodlands associated with poorly drained soils that are saturated year round or seasonally flooded **Northern Rocky Mountain Conifer Swamp**

9b. Woody wetlands dominated by shrubs **10**

10a. High elevation shrubby wetlands dominated by species of *Salix*, *Alnus*, or *Betula*
..... **Rocky Mountain Subalpine-Montane Riparian Shrubland (Slope)**

10b. Lower foothills to valley bottom shrublands restricted to temporarily or intermittently flooded drainages or flats and dominated by *Sarcobatus vermiculatus*
..... **Inter-Mountain Basins Greasewood Flat**

KEY B: Herbaceous Wetland Ecological Systems

- 1a. Middle and lower elevation herbaceous wetlands..... **2**
- 1b. High elevation herbaceous wetlands (subalpine to montane)..... **7**
- 2a. Depressional herbaceous wetlands of the Northwestern Glaciated, Northwestern Great Plains, or Western Great Plains region of eastern Montana..... **3**
- 2b. Herbaceous wetlands of other regions..... **6**
- 3a. Wetland occurs within a complex of depressional wetlands within the glaciated plains of northern Montana. Typical species include *Schoenoplectus* spp. and *Typha latifolia* on wetter, semi-permanently flooded sites, and *Eleocharis* spp., *Pascopyrum smithii*, and *Hordeum jubatum* on drier, temporarily flooded sites **Great Plains Prairie Pothole**
- 3b. Wetland does not occur within a complex of depressional wetlands..... **4**
- 4a. Depressional wetlands with saline soils. Salt encrustations can occur on the surface. Species are typically salt-tolerant such as *Distichlis spicata*, *Puccinellia* spp., *Salicornia* spp., and *Schoenoplectus maritimus* **Western Great Plains Saline Depression Wetland**
- 4b. Depressional wetlands dominated by emergent vegetation typical of freshwater wetlands. **5**
- 5a. Depressional wetlands primarily within in a matrix of upland vegetation. Presence of an impermeable layer such as dense clay is common. The wetland is rarely linked to outside groundwater sources and does not have an extensive watershed. Common plant species include *Pascopyrum smithii*, *Hordeum jubatum*, *Eleocharis* spp. and *Polygonum* spp.....
..... **Western Great Plains Closed Depression Wetland**
- 5b. Depressional wetlands with a significant connection to the groundwater table and/or an association with a relatively large watershed. Typical plant species include *Phalaris arundinacea*, *Schoenoplectus* spp., *Calamagrostis canadensis*, *Eleocharis* spp., *Scirpus* spp., *Potamogeton* spp., and *Polygonum* spp.....
..... **Western Great Plains Open Freshwater Depression Wetland**
- 6a. Herbaceous wetlands dominated by common emergent and floating vegetation, including species of *Scirpus*, *Schoenoplectus*, *Typha*, *Juncus*, *Carex*, *Potamogeton*, *Polygonum*, and *Phalaris* **Western North American Emergent Marsh**
- 6b. Sites occur in areas of alkaline to saline clay soils with hardpans. Salt encrustations can occur on the surface. Species are typically salt-tolerant such as *Distichlis spicata*, *Puccinellia* spp., *Leymus* sp., *Poa secunda*, *Salicornia* spp., and *Schoenoplectus maritimus*. Communities within this system often occur in alkaline basins and swales and along the drawdown zones of lakes and ponds **Inter-Mountain Basins Alkaline Closed Depression**
- 7a. Herbaceous wetlands associated with a stream channel.....
..... **Rocky Mountain Alpine-Montane Wet Meadow (Riverine)**
- 7b. Herbaceous wetlands associated with the discharge of groundwater to the surface or sites with saturated overflow with no channel formation (Slope) **8**

- 8a. Wetlands defined by groundwater inflows and peat accumulation of at least 40 cm (unless underlain by bedrock) **Rocky Mountain Subalpine-Montane Fen**
- 8b. High elevation wetlands with less than 40 cm of organic matter accumulation. Sites are dominated by herbaceous species; typically graminoids have the highest canopy cover including *Carex* spp., *Calamagrostis* spp., and *Deschampsia cespitosa*
**Rocky Mountain Alpine-Montane Wet Meadow**

KEY C: Sparsely Vegetated Ecological Systems

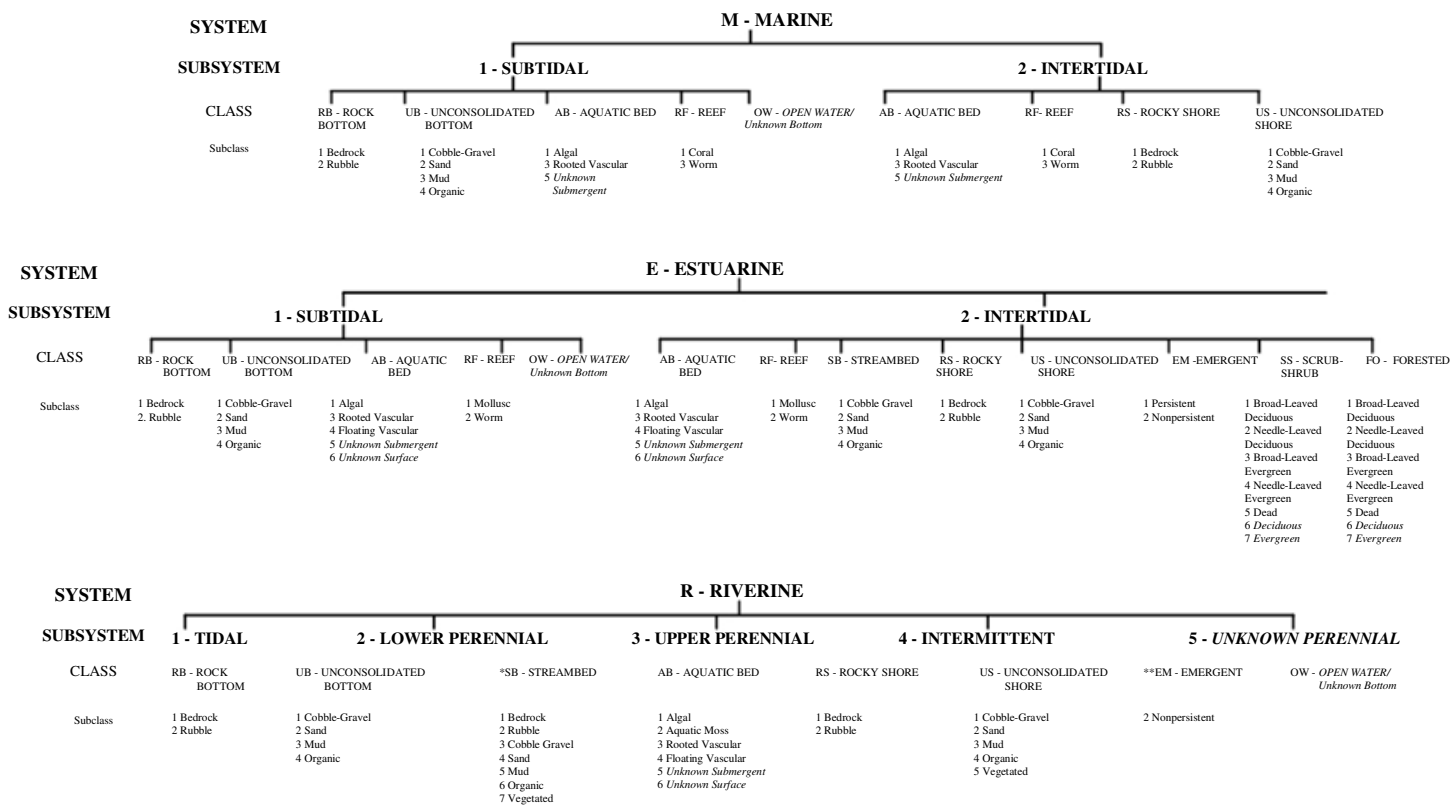
- 1a. Sites are restricted to drainages with a variety of sparse or patchy vegetation including *Sarcobatus vermiculatus*, *Ericameria nauseosa*, *Artemisia cana*, *Artemisia tridentata*, *Grayia spinosa*, *Distichlis spicata*, and *Sporobolus airoides*
 **Inter-Mountain Basins Wash**
- 1b. Sites occur on barren or sparsely vegetated playas that are intermittently flooded and may remain dry for several years. Soil is typically saline, and salt encrustations are common. Plant species are salt-tolerant and can include *Sarcobatus vermiculatus*, *Distichlis spicata*, and *Atriplex* spp.**Inter-Mountain Basins Playa**

Appendix II: Key to Hydrogeomorphic Classes

- 1a. Wetland occurs around a shallow, open water area or in an area with topography such that water collects (i.e., closed elevation contours). Surface water inflow and outflow may be strongly seasonal. These areas may be flooded year round or can be dry by mid- to late-summer **Depressional Wetland**
- 1b. Wetland lacks significant water storage capacity (i.e., open elevation contours)..... **2**
- 2a. Wetland hydrology is dominated by vertical fluctuations and water is lost primarily through evapotranspiration. The wetland receives virtually no groundwater discharge and often has an impermeable layer (e.g., clay) **Flat**
- 2b. Wetland is not dominated by vertical fluctuations **3**
- 3a. Wetland is within the 100-year floodplain of a perennial river or stream and is associated with channelized flow. Wetlands associated with beaver ponds are included here. Wetland is **not** located at the base of a fluvial terrace..... **Riverine Wetland**
- 3b. Wetland is not located within the 100-year floodplain of a perennial river or stream, **or** if it is within the floodplain, then wetland is located at the base of a fluvial terrace. **Groundwater discharge dominates hydrologic inputs.** Wetland can be on sloping or relatively flat terrain. Springs and seeps may be present **Slope Wetland**

Appendix III: National Wetland Inventory Classification System (Cowardin et al. 1979).

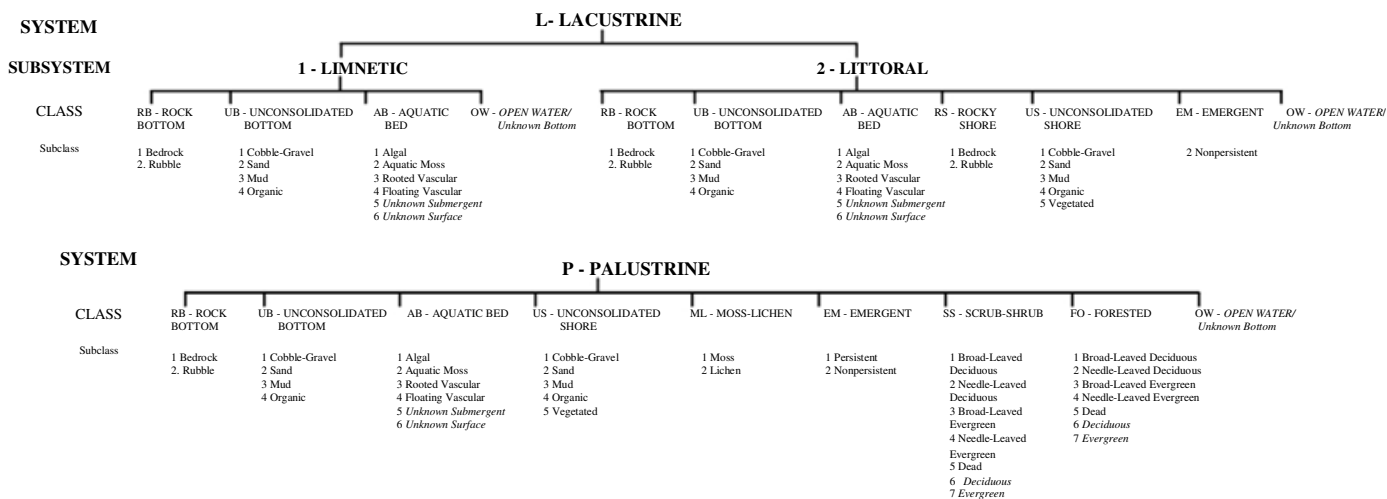
WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



* STREAMBED is limited to TIDAL and INTERMITTENT SUBSYSTEMS, and comprises the only CLASS in the INTERMITTENT SUBSYSTEM.
 ** EMERGENT is limited to TIDAL and LOWER PERENNIAL SUBSYSTEMS.

Appendix III: National Wetland Inventory Classification System (Cowardin et al. 1979).

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



MODIFIERS										
In order to more adequately describe the wetland and deepwater habitats one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.										
WATER REGIME				WATER CHEMISTRY			SOIL	SPECIAL MODIFIERS		
Non-Tidal		Tidal		Coastal Salinity	Inland Salinity	pH Modifiers for all Fresh Water				
A Temporarily Flooded	H Permanently Flooded	K Artificially Flooded	*S Temporary-Tidal	1 Hyperhaline	7 Hypersaline	a Acid	g Organic	b Beaver	h Diked/Impounded	
B Saturated	J Intermittently Flooded	L Subtidal	*R Seasonal-Tidal	2 Euthaline	8 Eusaline	t Circumneutral	n Mineral	d Partially Drained/Ditched	r Artificial Substrate	
C Seasonally Flooded	K Artificially Flooded	M Irregularly Exposed	*T Semipermanent-Tidal	3 Mixohaline (<i>Brackish</i>)	9 Mixosaline	i Alkaline		f Farmed	s Spoil	
D Seasonally Flooded/ <i>Well Drained</i>	W Intermittently Flooded/Temporary	N Regularly Exposed	*V Permanent-Tidal	4 Polyhaline	0 Fresh				x Excavated	
E Seasonally Flooded/ <i>Saturated</i>	Y Saturated/Semipermanent/ Seasonal	P Irregularly Flooded	U <i>Unknown</i>	5 Mesohaline						
F Semipermanently Flooded	Z Intermittently Exposed/Permanent			6 Oligohaline						
G Intermittently Exposed	U <i>Unknown</i>			0 Fresh						

*These water regimes are only used in tidally influenced, freshwater systems.

NOTE: Italicized terms were added for mapping by the National Wetlands Inventory program.

Appendix IV: National Wetland Inventory Water Regime Modifiers

Modified from Cowardin et al. 1979

In order from driest to wettest

Intermittently Flooded (J): The substrate is usually exposed, but surface water is present for variable periods without detectable seasonal periodicity. Weeks, months, or even years may intervene between periods of inundation.

Temporarily Flooded (A): Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the season. Plants that grow both in uplands and wetlands are characteristic of the temporarily flooded regime.

Saturated (B): The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present. This modifier is applied to fen like areas with stable water tables regardless of their connectivity.

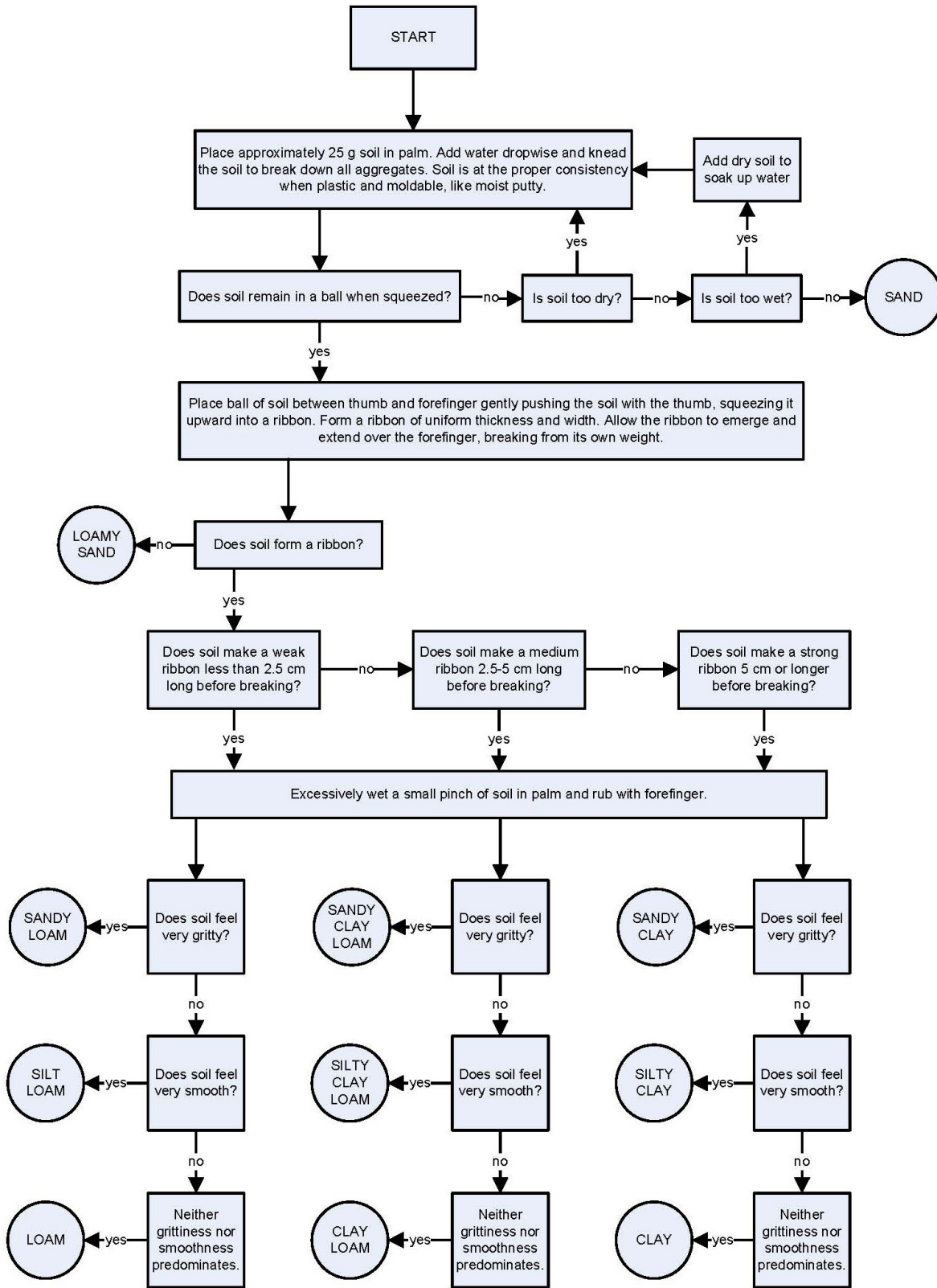
Seasonally Flooded (C): Surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface.

Semipermanently Flooded (F): Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.

Intermittently Exposed (G): Surface water is present throughout the year except in years of extreme drought. This is applied to large ponds and shallow lakes where the water does not appear likely to dry up.

Permanently Flooded (H): Water covers the land surface throughout the year in all years. Vegetation is composed of obligate hydrophytes. Mostly applied to deepwater habitats such as lakes where there is no chance drying.

Appendix V: Soil Texture Flowchart



Appendix VI: Montana County Noxious Weed List Effective March 27, 2008

Category 1.

Category 1 noxious weeds are weeds that are currently established and generally widespread in many counties of the state. Management criteria include awareness and education, containment and suppression of existing infestations and prevention of new infestations. These weeds are capable of rapid spread and render land unfit or greatly limit beneficial uses.

- (a) Canada thistle (*Cirsium arvense*)
- (b) Field bindweed (*Convolvulus arvensis*)
- (c) Whitetop or Hoary cress (*Cardaria draba*)
- (d) Leafy spurge (*Euphorbia esula*)
- (e) Russian knapweed (*Centaurea repens*)
- (f) Spotted knapweed (*Centaurea maculosa*)
- (g) Diffuse knapweed (*Centaurea diffusa*)
- (h) Dalmatian toadflax (*Linaria dalmatica*)
- (i) St. Johnswort (*Hypericum perforatum*)
- (j) Sulfur (Erect) cinquefoil (*Potentilla recta*)
- (k) Common tansy (*Tanacetum vulgare*)
- (l) Oxeye-daisy (*Chrysanthemum leucanthemum* L.)
- (m) Houndstongue (*Cynoglossum officinale* L.)
- (n) Yellow toadflax (*Linaria vulgaris*)
- (o) Hoary alyssum (*Berteroa incana*)

Category 2.

Category 2 noxious weeds have recently been introduced into the state or are rapidly spreading from their current infestation sites. These weeds are capable of rapid spread and invasion of lands, rendering lands unfit for beneficial uses. Management criteria include awareness and education, monitoring and containment of known infestations and eradication where possible.

- (a) Purple loosestrife or lythrum (*Lythrum salicaria*, *L. virgatum*, and any hybrid crosses thereof).
- (b) Tansy ragwort (*Senecio jacobea* L.)
- (c) Meadow hawkweed complex (*Hieracium pratense*, *H. floribundum*, *H. piloselloides*)
- (d) Orange hawkweed (*Hieracium aurantiacum* L.)
- (e) Tall buttercup (*Ranunculus acris* L.)
- (f) Tamarisk [Saltcedar] (*Tamarix* spp.)
- (g) Perennial pepperweed (*Lepidium latifolium*)
- (h) Rush skeletonweed (*Chondrilla juncea*)
- (i) Yellowflag iris (*Iris pseudacorus*)
- (j) Blueweed (*Echium vulgare*)

Category 3.

Category 3 noxious weeds have not been detected in the state or may be found only in small, scattered, localized infestations. Management criteria include awareness and education, early

detection and immediate action to eradicate infestations. These weeds are known pests in nearby states and are capable of rapid spread and render land unfit for beneficial uses.

- (a) Yellow starthistle (*Centaurea solstitialis*)
- (b) Common crupina (*Crupina vulgaris*)
- (c) Eurasian watermilfoil (*Myriophyllum spicatum*)
- (d) Dyer's woad (*Isatis tinctoria*)
- (e) Flowering rush (*Butomus umbellatus*)
- (f) Japanese knotweed complex (*Polygonum cuspidatum, sachalinense & polystachyum*)

Category 4.

Category 4 noxious weeds are invasive plants and may cause significant economic or environmental impacts if allowed to become established in Montana. Management criteria include prohibition from sale by the nursery trade. Research and monitoring may result in the plant being listed in a different category.

- (a) Scotch broom (*Cytisus scoparius*)

Appendix VII: List of non-native, invasive native, and tolerant native plant species.

Non-native

<i>Poa pratensis</i>	Kentucky bluegrass
<i>Bromus inermis</i>	Smooth brome
<i>Agropyron cristatum</i>	Crested wheatgrass
<i>Alopecurus pratensis</i>	Meadow foxtail
<i>Melilotus officinalis</i>	Yellow sweetclover
<i>Phleum pratense</i>	Common timothy
<i>Agrostis gigantea</i>	Redtop
<i>Phragmites australis</i>	Common reed
<i>Agrostis stolonifera</i>	Creeping bentgrass
<i>Bromus arvensis</i>	Field brome
<i>Bromus tectorum</i>	Cheatgrass
<i>Verbascum thapsus</i>	Common mullein
<i>Taraxacum officinale</i>	Common dandelion
<i>Cirsium arvense</i>	Canada thistle
<i>Cirsium vulgare</i>	Bull thistle
<i>Thlaspi arvense</i>	Field pennycress
<i>Elymus repens</i>	Quackgrass
<i>Lactuca scariola</i>	Prickly lettuce
<i>Rumex crispus</i>	Curly dock
<i>Hieracium caespitosum</i>	Meadow hawkweed

Invasive Natives

<i>Phalaris arundinacea</i>	Reed canarygrass
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Tolerant Native

<i>Carex nebrascensis</i>	Nebraska sedge
<i>Juncus balticus</i>	Baltic rush
<i>Iris missouriensis</i>	Rocky Mountain iris
<i>Mentha arvensis</i>	Field mint
<i>Symphoricarpos occidentalis</i>	Western snowberry
<i>Rosa woodsii</i>	Woods' rose
<i>Typha latifolia</i>	Cattail

Appendix VIII: Wetland plant list (modified from Reed 1988; Reed et al. 1993)

Species Code	Scientific Name	Common Name	National Indicator Status	Regional Indicator Status
ABILAS	<i>Abies lasiocarpa</i>	FIR,SUBALPINE	UPL,FAC	FACU
ACHMIL	<i>Achillea millefolium</i>	YARROW,COMMON	FACU	FACU
AGOGLA	<i>Agoseris glauca</i>	FALSE-DANDELION,PALE	FACU,FAC	FAC
AGRIGIG	<i>Agrostis gigantea</i>	BENTGRASS,BLACK	FAC?	NI
AGRSCA	<i>Agrostis scabra</i>	BENTGRASS,ROUGH	FAC,FAC+	FAC
AGRSTO	<i>Agrostis stolonifera</i>	BENTGRASS,SPREADING	FAC+,FACW	FAC+
ALIPLA	<i>Alisma plantago-aquatica</i>	WATER-PLANTAIN,BROAD-LEAF	OBL	OBL
ALLSCH	<i>Allium schoenoprasum</i>	CHIVES	FACU,FACW+	FACW+
ALOAEQ	<i>Alopecurus aequalis</i>	FOXTAIL,SHORT-AWN	OBL	OBL
ALOALP	<i>Alopecurus alpinus</i>	FOXTAIL,MOUNTAIN	FACW	FACW
ALOPRA	<i>Alopecurus pratensis</i>	FOXTAIL,MEADOW	FAC,FACW	FACW
ANGARG	<i>Angelica arguta</i>	ANGELICA,LYALL'S	FACW	FACW
ARCUVA	<i>Arctostaphylos uva-ursi</i>	BEARBERRY	UPL,FACU	FACU-
ARNCHA	<i>Arnica chamissonis</i>	ARNICA,LEAFY	FACW	FACW
ARNMOL	<i>Arnica mollis</i>	ARNICA,HAIRY	FAC,FACW	FAC
ARTCAN	<i>Artemisia cana</i>	SAGEBRUSH,SILVER	FACU,FACW	FAC
ARTLUD	<i>Artemisia ludoviciana</i>	SAGEBRUSH,WHITE	UPL,FACU	UPL
ASCspe	<i>Asclepias speciosa</i>	MILKWEED,SHOWY	FAC,FACW	FAC+
ASTOCC	<i>Aster occidentalis</i>	ASTER,WESTERN MOUNTAIN	FAC	FAC
ATRPAT	<i>Atriplex patula</i>	SALTBUSH,HALBERD-LEAF	FAC,FACW	FACW
ATRTRI	<i>Atriplex tridentata</i>	SALTBUSH,BASIN	FACW	NI
BECSYZ	<i>Beckmannia syzigachne</i>	SLOUGHGRASS,AMERICAN	OBL	OBL
BROCIL	<i>Bromus ciliatus</i>	BROME,FRINGED	FACU,FACW	FAC+
BROJAP	<i>Bromus japonicus</i>	BROME,JAPANESE	UPL,FACU	FACU
CALCAN	<i>Calamagrostis canadensis</i>	REEDGRASS,BLUE-JOINT	FAC,OBL	FACW+
CAMROT	<i>Campanula rotundifolia</i>	BELLFLOWER,SCOTCH	UPL,FAC	FACU+
CAPBUR	<i>Capsella bursa-pastoris</i>	PURSE,COMMON SHEPHERD'S	FACU,FAC	FAC-
CARAQU	<i>Carex aquatilis</i>	SEDGE,WATER	OBL	OBL

Species Code	Scientific Name	Common Name	National Indicator Status	Regional Indicator Status
CARATH	<i>Carex atherodes</i>	SEDGE,SLOUGH	OBL	OBL
CARBRE	<i>Carex brevior</i>	SEDGE,SHORT-BEAK	UPL,OBL	OBL
CARLIM	<i>Carex limosa</i>	SEDGE,MUD	OBL	OBL
CARMIC	<i>Carex microptera</i>	SEDGE,SMALL-WING	FAC,FACW	FAC
CARNEB	<i>Carex nebrascensis</i>	SEDGE,NEBRASKA	OBL	OBL
CARPAC	<i>Carex pachystachya</i>	SEDGE,THICK-HEAD	FACU,FACW	FAC
CARPRA	<i>Carex praegracilis</i>	SEDGE,CLUSTERED FIELD	FACW-,FACW+	FACW
CARROS	<i>Carex rostrata</i>	SEDGE,BEAKED	OBL	OBL
CARVES	<i>Carex vesicaria</i>	SEDGE,INFLATED	OBL	OBL
CATAQU	<i>Catabrosa aquatica</i>	BROOKGRASS	OBL	OBL
CHEALB	<i>Chenopodium album</i>	GOOSEFOOT,WHITE	FACU,FAC	FAC
CICDOU	<i>Cicuta douglasii</i>	WATER-HEMLOCK,WESTERN	OBL	OBL
CICMAC	<i>Cicuta maculata</i>	WATER-HEMLOCK,SPOTTED	OBL	NI
CIRARV	<i>Cirsium arvense</i>	THISTLE,CREEPING	FACU-,FAC	FACU+
CIRVUL	<i>Cirsium vulgare</i>	THISTLE,BULL	UPL,FAC	FACU
COMUMB	<i>Comandra umbellata</i>	TOAD-FLAX,UMBELLATE BASTARD	UPL,FACU	UPL
DESCES	<i>Deschampsia cespitosa</i>	HAIRGRASS,TUFTED	FAC,FACW+	FACW
DISSPI	<i>Distichlis spicata</i>	SALTGRASS,INLAND	FAC+,FACW	FAC+
DISSPI	<i>Distichlis spicata</i>	SALTGRASS,SEASHORE	FAC+,FACW+	FACW
ELEACI	<i>Eleocharis acicularis</i>	SPIKERUSH,LEAST	OBL	OBL
ELEPAL	<i>Eleocharis palustris</i>	SPIKERUSH,CREEPING	OBL	OBL
ELOCAN	<i>Elodea canadensis</i>	WATER-WEED,BROAD	OBL	OBL
ELYGLA	<i>Elymus glaucus</i>	WILD-RYE,BLUE	FACU	FACU
EPIANG	<i>Epilobium angustifolium</i>	FIREWEED	FACU,FAC	FACU+
EPICIL	<i>Epilobium ciliatum</i>	WILLOW-HERB,HAIRY	FACU,OBL	FACW-
EPIGLA	<i>Epilobium glaberrimum</i>	WILLOW-HERB,GLAUCOUS	FACW,OBL	FACW
EPIPAL	<i>Epilobium palustre</i>	WILLOW-HERB,MARSH	OBL	OBL
EQUARV	<i>Equisetum arvense</i>	HORSETAIL,FIELD	FACU,FACW-	FAC
EQUFLU	<i>Equisetum fluviatile</i>	HORSETAIL,WATER	OBL	OBL

Species Code	Scientific Name	Common Name	National Indicator Status	Regional Indicator Status
EQULAE	<i>Equisetum laevigatum</i>	SCOURING-RUSH,SMOOTH	FAC,FACW	FACW
FRAVIR	<i>Fragaria virginiana</i>	STRAWBERRY,VIRGINIA	UPL,FAC	UPL
GALBOR	<i>Galium boreale</i>	BEDSTRAW,NORTHERN	FACU,FAC	FACU
GALTRI	<i>Galium triflorum</i>	BEDSTRAW,SWEET-SCENT	FACU,FACU+	FACU
GENAFF	<i>Gentiana affinis</i>	GENTIAN,PRAIRIE	FACU	FACU
GERRIC	<i>Geranium richardsonii</i>	CRANE'S-BILL,RICHARDSON'S	FACU,FACW	FACU+
GERVIS	<i>Geranium viscosissimum</i>	CRANE'S-BILL,STICKY	FACU,FAC	FACU+
GEUMAC	<i>Geum macrophyllum</i>	AVENS,LARGE-LEAF	FACW,OBL	FACW+
GEUTRI	<i>Geum triflorum</i>	WHISKERS,OLD-MAN'S	UPL,FAC	FACU
GLYBOR	<i>Glyceria borealis</i>	GRASS,SMALL FLOATING MANNA	OBL	OBL
GLYLEP	<i>Glycyrrhiza lepidota</i>	LICORICE,AMERICAN	UPL,FAC+	FAC+
GLYSTR	<i>Glyceria striata</i>	GRASS,FOWL MANNA	OBL	OBL
GRAEBR	<i>Gratiola ebracteata</i>	HEDGEHYSSOP,BRACTLESS	OBL	OBL
GRINAN	<i>Grindelia nana</i>	GUMWEED,IDAHO	FACU,FACU+	FACU+
GRISQU	<i>Grindelia squarrosa</i>	GUMWEED,CURLY-CUP	UPL,FACU	FACU
HACFLO	<i>Hackelia floribunda</i>	STICKSEED,DAVIS MOUNTAIN	FACU-,FAC	FACU-
HAPUNI	<i>Haplopappus uniflorus</i>	GOLDEN-WEED,PLANTAIN	FAC,FACW-	FAC+
HERLAN	<i>Heracleum lanatum</i>	COW-PARSNIP	FACU-,OBL	FAC
HIPVUL	<i>Hippuris vulgaris</i>	MARE'S-TAIL,COMMON	OBL	OBL
HORBRA	<i>Hordeum brachyantherum</i>	BARLEY,MEADOW	FAC,FACW	FACW
HORJUB	<i>Hordeum jubatum</i>	BARLEY,FOX-TAIL	FAC,FACW	FAC+
IRIMIS	<i>Iris missouriensis</i>	IRIS,ROCKY MOUNTAIN	FACW-,OBL	FACW+
JUNALP	<i>Juncus alpinoarticulatus</i>	RUSH,RICHARDSON'S	OBL	OBL
JUNBAL	<i>Juncus balticus</i>	RUSH,BALTIC	FACW,OBL	OBL
JUNBUF	<i>Juncus bufonius</i>	RUSH,TOAD	FACW,OBL	FACW+
JUNENS	<i>Juncus ensifolius</i>	RUSH,THREE-STAMEN	FACW,FACW+	FACW
JUNLON	<i>Juncus longistylis</i>	RUSH,LONG-STYLE	FACW,FACW+	FACW
JUNNEV	<i>Juncus nevadensis</i>	RUSH,SIERRA	FACW	FACW
JUNNOD	<i>Juncus nodosus</i>	RUSH,KNOTTED	OBL	OBL

Species Code	Scientific Name	Common Name	National Indicator Status	Regional Indicator Status
JUNREG	<i>Juncus regelii</i>	RUSH,REGEL'S	FACW,OBL	FACW
JUNTEN	<i>Juncus tenuis</i>	RUSH,SLENDER	FAC-,FACW	FAC
KOCSCO	<i>Kochia scoparia</i>	SUMMER-CYPRESS,MEXICAN	UPL,FAC	FAC
LACSER	<i>Lactuca serriola</i>	LETTUCE,PRICKLY	FACU,FAC	FAC-
LEMMIN	<i>Lemna minor</i>	DUCKWEED,LESSER	OBL	OBL
LEMTRI	<i>Lemna trisulca</i>	DUCKWEED,STAR	OBL	OBL
LEPPER	<i>Lepidium perfoliatum</i>	PEPPER-GRASS,CLASPING	UPL,FAC	FACU+
LIMAQU	<i>Limosella aquatica</i>	MUDWORT,NORTHERN	OBL	OBL
LONINV	<i>Lonicera involucrata</i>	HONEYSUCKLE,FOUR-LINE	UPL,FAC	FAC
LUZPAR	<i>Luzula parviflora</i>	WOODRUSH,SMALL-FLOWER	FACU,FAC	FAC-
MEDLUP	<i>Medicago lupulina</i>	MEDIC,BLACK	UPL,FAC	FAC
MELOFF	<i>Melilotus officinalis</i>	SWEETCLOVER,YELLOW	FACU-,FACU+	FACU
MENARV	<i>Mentha arvensis</i>	MINT,FIELD MONKEY-FLOWER,COMMON	FAC,FACW	FAC
MIMGUT	<i>Mimulus guttatus</i>	LARGE	OBL	OBL
MUHASP	<i>Muhlenbergia asperifolia</i>	MUHLY,ALKALI	FACW,FACW+	FACW
MUHFIL	<i>Muhlenbergia filiformis</i>	MUHLY,PULLUP	FACW,OBL	FACW
MUHRIC	<i>Muhlenbergia richardsonis</i>	MUHLY,MAT	FACU,FACW	FACW
OENFLA	<i>Oenothera flava</i>	EVENING-PRIMROSE,YELLOW	FAC+,FACW	FAC+
ORTLUT	<i>Orthocarpus luteus</i>	OWL'S-CLOVER,YELLOW	FACU-,FACU	FACU-
PARPAL	<i>Parnassia palustris</i>	GRASS-OF-PARNASSUS,NORTHERN	FACW,OBL	OBL
PASSMI	<i>Pascopyrum smithii</i>	WHEATGRASS, WESTERN	UPL,FACU-	FACU
PEDGRO	<i>Pedicularis groenlandica</i>	LOUSEWORT,ELEPHANT'S-HEAD	OBL	OBL
PENPRO	<i>Penstemon procerus</i>	BEARDTONGUE,SMALL-FLOWER	FAC	NI
PERGAI	<i>Perideridia gairdneri</i>	YAMPAH,GAIRDNER'S	FACU,FACW	FACU
PETFRI	<i>Petasites frigidus</i>	COLTSFOOT,ARCTIC SWEET	FAC,FACW	FACW
PHAARU	<i>Phalaris arundinacea</i>	GRASS,REED CANARY	FACW,OBL	FACW
PHLPRA	<i>Phleum pratense</i>	TIMOTHY	FACU	FACU
PHRAUS	<i>Phragmites australis</i>	REED,COMMON	FACW,FACW+	FACW+

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PICENG	<i>Picea engelmannii</i>	SPRUCE,ENGELMANN'S	FACU-,FAC	FAC
PLADIL	<i>Platanthera dilatata</i>	ORCHID,LEAFY WHITE	FACW,FACW+	FACW+
PLAMAJ	<i>Plantago major</i>	PLANTAIN,COMMON	FACU,FACW	FAC+
PLASCO	<i>Plagiobothrys scouleri</i>	POPCORN-FLOWER,SCOULER	FACW,OBL	FACW
POAJUN	<i>Poa juncifolia</i>	BLUEGRASS,ALKALI	FACU,FAC	FACU+
POAPAL	<i>Poa palustris</i>	BLUEGRASS,FOWL	FACU,FACW+	FAC
POAPRA	<i>Poa pratensis</i>	BLUEGRASS,KENTUCKY	FACU,FAC-	FACU+
POLAMP	<i>Polygonum amphibium</i>	SMARTWEED,WATER	OBL	OBL
POTALP	<i>Potamogeton alpinus</i>	PONDWEED,ALPINE	OBL	OBL
POTEPI	<i>Potamogeton epihydrus</i>	PONDWEED,RIBBON-LEAF	OBL	OBL
POTFIL	<i>Potamogeton filiformis</i>	PONDWEED,FINE-LEAF	OBL	OBL
POTFOL	<i>Potamogeton foliosus</i>	PONDWEED,LEAFY	OBL	OBL
POTFRI	<i>Potamogeton friesii</i>	PONDWEED,FRIES'S	OBL	OBL
POTGRA	<i>Potentilla gracilis</i>	CINQUEFOIL,NORTHWEST	FAC-,FACW	FAC
POTPAR	<i>Potentilla paradoxa</i>	CINQUEFOIL,BUSHY	FAC,OBL	FACW
POTRIC	<i>Potamogeton richardsonii</i>	PONDWEED,RICHARDSON	OBL	OBL
PRIINC	<i>Primula incana</i>	PRIMROSE,AMERICAN	FACW,OBL	OBL
PUCNUT	<i>Puccinellia nuttalliana</i>	GRASS,NUTTALL'S ALKALI	FAC,OBL	OBL
PYRASA	<i>Pyrola asarifolia</i>	WINTERGREEN,PINK	FACU,FACW	FACU
RANABO	<i>Ranunculus abortivus</i>	BUTTER-CUP,SUBALPINE	FAC,FACW	FACW-
RANACR	<i>Ranunculus acris</i>	BUTTER-CUP,TALL	FAC+,FACW	FACW-
RANAQU	<i>Ranunculus aquatilis</i>	BUTTER-CUP,WHITE WATER	OBL	OBL
RANFLA	<i>Ranunculus flammula</i>	BUTTER-CUP,SPEARWORT BUTTER-CUP,SMALL YELLOW	FACW	FACW
RANGME	<i>Ranunculus gmelinii</i>	WATER	FACW,OBL	FACW
RANMAC	<i>Ranunculus macounii</i>	BUTTER-CUP,MACOUN'S	FACW,OBL	OBL
RANREP	<i>Ranunculus repens</i>	BUTTER-CUP,CREEPING	FAC,FACW+	FACW
RIBLAC	<i>Ribes lacustre</i>	CURRENT,PRICKLY	FAC,FACW	FAC+
RORCUR	<i>Rorippa curvipes</i>	YELLOW-CRESS,BLUNT-LEAF	FACW,OBL	FACW

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ROSWOO	<i>Rosa woodsii</i>	ROSE, WOODS	UPL,FAC-	FACU
RUDOCC	<i>Rudbeckia occidentalis</i>	CONEFLOWER, WESTERN	FACU,FAC	FAC-
RUMACE	<i>Rumex acetosella</i>	SORREL, SHEEP	UPL,FACW	FACU
RUMCRI	<i>Rumex crispus</i>	DOCK, CURLY	FACU,FACW	FACW
RUMMAR	<i>Rumex maritimus</i>	DOCK, GOLDEN	FACW-, OBL	FACW+
RUMSAL	<i>Rumex salicifolius</i>	DOCK, WILLOW	FAC, OBL	FACW
SAGCUN	<i>Sagittaria cuneata</i>	ARROW-HEAD, NORTHERN	OBL	OBL
SALBEB	<i>Salix bebbiana</i>	WILLOW, BEBB	FAC,FACW+	FACW
SALBOO	<i>Salix boothii</i>	WILLOW, BOOTH'S	OBL	OBL
SALCAN	<i>Salix candida</i>	WILLOW, HOARY	OBL	OBL
SALDRU	<i>Salix drummondiana</i>	WILLOW, DRUMMOND	FACW, OBL	FACW
SALEXI	<i>Salix exigua</i>	WILLOW, SANDBAR	FACW, OBL	OBL
SALLUT	<i>Salix lutea</i>	WILLOW, YELLOW	FACW+, OBL	OBL
SALPLA	<i>Salix planifolia</i>	WILLOW, DIAMOND-LEAF	FACW, OBL	OBL
SALRUB	<i>Salicornia rubra</i>	SALTWORT, RED	OBL	OBL
SALWOL	<i>Salix wolfii</i>	WILLOW, WOLF	FACW+, OBL	FACW+
SARVER	<i>Sarcobatus vermiculatus</i>	GREASEWOOD, BLACK	FACU,FACU+	FACU+
SCIACU	<i>Scirpus acutus</i>	BULRUSH, HARD-STEM	OBL	OBL
SCIAME	<i>Scirpus americanus</i>	BULRUSH, OLNEY'S	OBL	OBL
SCIMAR	<i>Scirpus maritimus</i>	BULRUSH, SALTMARSH	OBL	OBL
SCINEV	<i>Scirpus nevadensis</i>	BULRUSH, NEVADA	OBL	OBL
SCIPAL	<i>Scirpus pallidus</i>	BULRUSH, CLOAKED	OBL	OBL
SENDEB	<i>Senecio debilis</i>	GROUNDSEL, WEAK	FACW	FACW
SENHYD	<i>Senecio hydrophilus</i>	GROUNDSEL, WATER	OBL	OBL
SENTRI	<i>Senecio triangularis</i>	GROUNDSEL, ARROW-LEAF	FACW, OBL	FACW+
SHECAN	<i>Shepherdia canadensis</i>	BUFFALO-BERRY, CANADA	NI	NI
SISANG	<i>Sisyrinchium angustifolium</i>	BLUE-EYE-GRASS, POINTED	FACU,FACW-	FACW-
SIUSUA	<i>Sium suave</i>	WATER-PARSNIP, HEMLOCK	OBL	OBL
SOLCAN	<i>Solidago canadensis</i>	GOLDEN-ROD, CANADA	FACU,FACU+	FACU

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SONARV	<i>Sonchus arvensis</i>	SOWTHISTLE, FIELD	UPL, FAC	FACU+
SPAEME	<i>Sparganium emersum</i>	BURREED, NARROW-LEAF	OBL	OBL
SPAGRA	<i>Spartina gracilis</i>	CORDGRASS, ALKALI	FACW	FACW
SPAPEC	<i>Spartina pectinata</i>	CORDGRASS, PRAIRIE	FACW, OBL	OBL
SPIROM	<i>Spiranthes romanzoffiana</i>	LADIES'-TRESSES, HOODED	FACW, OBL	OBL
STAPAL	<i>Stachys palustris</i>	HEDGENETTLE, MARSH	FACW, OBL	FACW+
STELON	<i>Stellaria longipes</i>	STARWORT, LONG-STALK	FACU-, OBL	FACW-
STRAMP	<i>Streptopus amplexifolius</i>	TWISTED-STALK, CLASP-LEAF	UPL, OBL	FAC-
SWEPER	<i>Swertia perennis</i>	FELWORT	FAC, FACW	FACW
SYMORE	<i>Symphoricarpos oreophilus</i>	SNOWBERRY, MOUNTAIN	UPL, FACU	UPL
TAROFF	<i>Taraxacum officinale</i>	DANDELION, COMMON	FACU-, FACU+	FACU
THAOCC	<i>Thalictrum occidentale</i>	MEADOW-RUE, WESTERN	FACU, FAC+	FACU
THLARV	<i>Thlaspi arvense</i>	PENNY-CRESS, FIELD	FACU?	NI
TRIHYP	<i>Trifolium hybridum</i>	CLOVER, ALSIKE	FACU-, FAC	FACU+
TRILON	<i>Trifolium longipes</i>	CLOVER, LONG-STALK	FACU, FACW	FAC-
TRIMAR	<i>Triglochin maritimum</i>	ARROW-GRASS, SEASIDE	OBL	OBL
TRIPAL	<i>Triglochin palustre</i>	ARROW-GRASS, MARSH	OBL	OBL
TRIREP	<i>Trifolium repens</i>	CLOVER, WHITE	FACU-, FAC	FACU+
TYPLAT	<i>Typha latifolia</i>	CATTAIL, BROAD-LEAF	OBL	OBL
URTDIO	<i>Urtica dioica</i>	NETTLE, STINGING	FACU, FACW	FAC+
UTRMAC	<i>Utricularia macrorhiza</i>	BLADDERWORT, COMMON	OBL	OBL
VERAME	<i>Veronica americana</i>	SPEEDWELL, AMERICAN	OBL	OBL
VERBRA	<i>Verbena bracteata</i>	VERVAIN, PROSTRATE	UPL, FACW	FACU+
VERPER	<i>Veronica peregrina</i>	SPEEDWELL, PURSLANE	FACU-, OBL	OBL
VERSCU	<i>Veronica scutellata</i>	SPEEDWELL, MARSH	OBL	OBL
VICAME	<i>Vicia americana</i>	VETCH, AMERICAN PURPLE	FAC?	NI
VULOCT	<i>Vulpia octoflora</i>	FESCUE, SIX-WEEKS	UPL, FACU+	UPL
ZIGELE	<i>Zigadenus elegans</i>	DEATHCAMAS, MOUNTAIN	UPL, FACW+	FAC+
ZIGVEN	<i>Zigadenus venenosus</i>	DEATHCAMAS, MEADOW	FAC	FAC

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ZIZAPT	Zizia aptera	ALEXANDERS,HEART-LEAF	FACU,FACW-	FAC+