

MnRAM 3.4

FOR EVALUATING WETLAND FUNCTIONS

MnRAM 3.4 is designed to help assess functions and values associated with Minnesota wetlands. The Comprehensive Guidance document (available at www.bwsr.state.mn.us) contains explanations, references, definitions, and a ranking formula for each function. After using this tool, the Management Classification Reference will help to organize the results for managing local wetland resources.

GENERAL INFORMATION:

Project Number or Name:		Wetland Number:	
Location: County;	Section;	Township	Range
Major Watershed:	Subwatershed:	City:	
Evaluator(s):	Date of Site Visit:		

SCOPE AND LIMITATIONS:

- Note unusual climatic conditions experienced during this assessment due to seasonal considerations and/or unusual existing hydrologic and climatologic conditions:
- Describe the **purpose** of this assessment: inventory/planning/monitoring/regulatory/classification_____

SUMMARY TABLE

ACTUAL CONDITIONS	FUNCTIONAL INDEX*		
	N/A	Functional Index Score	Comments
FUNCTIONS (and Related Values)			
Vegetative Diversity/Integrity**			
Plant Comm. #1			
Plant Comm. #2			
Plant Comm. #3			
Maintenance of Characteristic Hydrologic Regime			
Flood/Stormwater/Attenuation			
Downstream Water Quality			
Maintenance of Wetland Water Quality			
Shoreline Protection			
Maintenance of Characteristic Wildlife Habitat Structure			
Maintenance of Characteristic Fish Habitat			
Maintenance of Characteristic Amphibian Habitat			
Aesthetics/Recreation/Education/Cultural			
Commercial Uses			
Groundwater Interaction			
Additional Information			
Wetland Restoration Potential			
Sensitivity to Stormwater and Urban Development			
Additional Stormwater Treatment Needs			

*The functional index may be calculated manually using formulas in the Comprehensive Guidance.

**If more than 3 plant communities are present, use an additional summary table.

FUNCTIONAL ASSESSMENT - Special Features

Is the wetland part of, or directly adjacent to, an area of special natural resource interest?

Check those that apply:

- a. Designated trout streams or trout lakes (For Minnesota, see MnDNR Commissioners Order 2450 Part 6262.0400 subparts 3 and 5) (*if yes, Fish Habitat Rating is Exceptional*).
- b. Calcareous fen (Special Status— For Minnesota, see MN Rule Chapter 7050) (*if yes, Vegetative Diversity/Integrity functional rating is Exceptional*). Consult DNR for regulatory purposes.
- c. DNR designated scientific and natural area (*if yes, then Aesthetics/Recreation/Education/Cultural functional rating is Exceptional*).
- d. Rare natural community. Defined as: a wetland native plant community having a state element rank of S1, S2, or S3¹ that is mapped or determined to be eligible for mapping in the Natural Heritage Information System (NHIS) maintained by the Minnesota Department of Natural Resources OR a wetland native plant community contained within an area mapped or determined to be eligible for mapping in the NHIS as a Site of Outstanding or High Biological Diversity.² *If present, then the ratings for Vegetative Diversity/Integrity and Wildlife Habitat are Exceptional (see MnRAM question 5). For Minnesota, refer to Minn. Rule Ch. 8420.0548, Subp. 3. This answer automatically makes the answer to #5 = "Yes."*
- e. High priority wetland, environmentally sensitive area or environmental corridor identified in a local water management plan.
- f. Public park, forest, trail or recreation area.
- g. State or Federal fish and wildlife refuges and fish and wildlife management areas, and water fowl protection areas (*if yes, then Wildlife and/or Fish Habitat functional rating is Exceptional*).
- h. Archeological or historic site as designated by the State Historic Preservation Office (*if yes, then Aesthetics/Recreation/Education/Cultural functional rating is Exceptional*).
- i. Plant species: naturally occurring, persistent populations that are³:
Federally listed: Endangered Threatened
State listed: Endangered Threatened (In Minnesota, see Minn. Rule Ch. 8420.0548, Subp. 2)
Species of special concern: _____
List the species: _____ .

If yes, then question 35 is yes, then the Vegetative Diversity/Integrity functional rating is Exceptional. This answer automatically makes the answer to #4 = "Yes."

¹ State element ranks are assigned to all native plant communities in the state based on their extent and status as follows: S1 = critically imperiled in the state due to extreme rarity; S2 = imperiled in the state due to rarity; S3 = rare or uncommon in the state; S4 = apparently secure in the state; S5 = demonstrably secure in the state. For information on state element ranks for specific native plant communities, contact the DNR at 651-259-5125 or 651-259-5109 or email Ecoservices@dnr.state.mn.us and put "Wetlands/NHIS" in the subject line.

² Information on the NHIS and how to obtain NHIS reports for a specific location is available at: http://www.dnr.state.mn.us/ecological_services/nhnrp/nhis.html .

³ Information on known occurrences of listed plant species is available from the NHIS. See footnote 2.

- j. **Wildlife species** in or using the wetland that are⁴:
Federally listed: ___ Endangered ___ Threatened
State listed: ___ Endangered ___ Threatened (In Minnesota, see Minn. Rule Ch. 8420.0548, Subp. 2)
Species of special concern: ___
List the species: _____ .

If present, then the Wildlife Habitat functional rating is Exceptional.

- k. ___ Local Shoreland Management Plan area.
l. ___ State Coastal Zone or Shoreland Management Plan area.
m. ___ Shoreland area identified in a zoning ordinance (generally within 1000 feet from a water basin and 300 feet from a watercourse).
n. ___ Floodplain area identified in a zoning ordinance or map.
o. ___ Wetland restored or preserved under a conservation easement.
p. ___ Wetland restored or created for mitigation purposes.
q. ___ Designated Wellhead or Sourcewater Protection Area (*if yes and Ground Water Interaction is Recharge, then Ground Water functional index is Exceptional*).
r. ___ Sensitive ground-water area (*if yes and Ground Water Interaction is Recharge, then Ground Water functional index is Exceptional*).
s. ___ State or Federal designated wild and scenic river (In Minnesota, see MN Rule Chapter 7050).
t. ___ Federally identified special area management plan, special wetland inventory study, or an advanced delineation and identification study.
u. ___ State or Federal designated wilderness area (*if yes, then Aesthetics/Recreation/Education/Cultural functional rating is Exceptional*).

⁴ Information on known occurrences of listed animal species is available from the NHIS. See footnote 2

Vegetative Diversity and Integrity

1. Go to upper canopy to key out wetland plant community(-ities) within the evaluation area using the following key⁵. Evaluate only each contiguous type that comprises at least 10% of the vegetated wetland area; the exception is a shallow, open water community in which any fringe emergent communities must be evaluated. Be sure to sample shallow, open water areas for submergent vegetation. Enter in page one of field data form, MnRAM database second tab, or the manual-use summary table located in the Guidance.

Wetland Community Classification Key

- 1A. Mature trees (dbh of 6 inches or more) are present and form closed stands (more than 17 trees per acre; more than a 50 percent canopy cover) on wet, lowland soils (usually floodplains and ancient lake basins).
 - 2A. Hardwood trees are dominant (>50% areal coverage or basal area of the tree stratum); usually alluvial, peaty/mucky, or poorly drained mineral soils.
 - 3A. Silver maple, American elm, river birch, green ash, black willow, box elder and/or eastern cottonwood are dominant; growing on alluvial soils associated with riverine systems..... **FLOODPLAIN FOREST**
(Type 1); (PFO; 1,6; A)
 - 3B. Black ash, green ash, American elm, eastern cottonwood, black willow, box elder, yellow birch, silver maple, quaking aspen and/or red maple are dominant; northern white cedar may be subdominant; growing on poorly-drained mineral or peat/muck soils, often associated with ancient lake basins..... **HARDWOOD SWAMP**
(Type 7); (PFO;1, 6; A, B, C)
 - 2B. Coniferous trees are dominant (>50% areal coverage or basal area of the tree stratum); soils usually peaty.
 - 4A. Tamarack and/or black spruce are dominant; growing on a continuous sphagnum moss mat and acid, peat soils..... **CONIFEROUS BOG**
(Type 8); (PFO; 2, 4, 6, 7; B)
 - 4B. Northern white cedar and/or tamarack are dominant; continuous sphagnum moss mat absent; usually growing on neutral to alkaline peat/muck soils..... **CONIFEROUS SWAMP**
(Type 7); (PFO;2, 4, 6, 7; B, C)
- 1B. Mature trees are absent or, if present, form open, sparse stands; other woody plants, if present, are shrubs or saplings and pole-size trees (dbh less than 6 inches) less than 20 feet high and growing on wet, lowland, or poorly-drained soils, or in ground-water seepage areas.
 - 5A. Community dominated (>50% areal coverage) by woody shrubs.

⁵ Refer to Pages 19 - 22 of "Wetland Plants and Plant Communities of MN and WI"; (USACOE - St. Paul District; Eggers and Reed).

- 6A. Low, woody shrubs usually less than 3 feet high; sphagnum moss mat layer may or may not be present.
- 7A. Shrubs are ericaceous and evergreen growing on a sphagnum moss mat layer; peat soils are acidic.....**OPEN BOG**
(Type 8); (PSS;2, 3, 4, 7; B)
- 7B. Shrubs are deciduous, mostly shrubby cinquefoil, often growing on sloping sites with a spring-fed supply of internally flowing, calcareous waters; other calciphiles are also dominant; sphagnum moss mat layer absent; muck/poorly-drained mineral soils are alkaline.....**CALCAREOUS FEN**
(Type 2/6), (PEM/PSS;1; B)
- 6B. Tall, woody deciduous shrubs usually greater than 3 feet high; sphagnum moss mat layer absent: **SHRUB SWAMPS**.
- 8A. Speckled alder is dominant; usually on acidic soils in and north of the vegetation tension zone (a map of the tension zone is on page 9 of Eggers and Reed [1997]).**ALDER THICKET**
(Type 6); (PSS;1, 6; B, C)
- 8B. Willows, red-osier dogwood, silky dogwood, meadowsweet and/or steeplebush are dominant on neutral to alkaline poorly drained muck/mineral soils; found north and south of the vegetation tension zone. NOTE: Non-native buckthorns (*Rhamnus cathartica* and *R. frangula*) may occur as dominant shrubs or small trees in disturbed shrub-carrs.**SHRUB-CARR**
(Type 6); (PSS;1, 6; B, C)
- 5B. Community dominated (>50% areal coverage) by herbaceous plants.
- 9A. Essentially closed communities, usually with more than 50 percent cover.
- 10A. Sphagnum moss mat on acid peat soils; leatherleaf, pitcher plants, certain sedges, and other herbaceous species tolerant of low nutrient conditions may be present.**OPEN BOG**
(Type 8); (PSS; 2, 3, 4, 7; B; and PML; 1; B)
- 10B. Sphagnum moss mat absent; dominant vegetation consists of sedges (Cyperaceae), grasses (Gramineae), cattails, giant bur-reed, arrowheads, forbs and/or calciphiles. Soils are usually neutral to alkaline, poorly-drained mineral soils and mucks.
- 11A. Over 50 percent of the cover dominance contributed by the sedge family, cattails, giant bur-reed, arrowheads, wild rice, and/or giant reed grass (*Phragmites*).
- 12A. Herbaceous emergent plants growing on saturated soils to areas

covered by standing water up to 6 inches in depth throughout most of the growing season.

13A. Major cover dominance by the sedges (primarily genus *Carex*) typically on saturated soils with, at most, short periods of inundation. Canada blue-joint grass may be a subdominant. Lake sedges (*Carex lacustris*, *C. utriculata*) and slough sedge (*Carex atherodes*) can also be dominants in shallow marshes – see 13B. below.....**SEDGE MEADOW**
(Type 2), (PEM; 1; B)

13B. Major cover dominance by cattails, bulrushes, water plantain, *Phragmites*, arrowheads, slough sedge and/or lake sedges typically on soils that are inundated by up to 6 inches of water depth for a significant portion of most growing seasons.....**SHALLOW MARSH**
(Type 3); (PEM; 1, 2; C)

12B. Herbaceous submergent, floating-leaved, floating and emergent plants growing in areas covered by standing water greater than 6 inches in depth throughout most of the growing season.....**DEEP MARSH**
(Type 4); (PEM; 1, 2; F, G, H; and PAB; 2, 4, 5; F, G; and PUB; F, G; and L2EM2; F, G; and L2AB; 2, 4, 5; F, G)

11B. Over 50 percent of the cover dominance contributed by grasses (except wild rice and *Phragmites*), forbs and/or calciphiles.

14A. Spring-fed supply of internally flowing, calcareous waters, often sloping sites; calciphiles such as sterile sedge, wild timothy, Grass-of-Parnassus and lesser fringed gentian are dominant...**CALCAREOUS FEN**
(Type 2); (PEM; 1; B)

14B. Water source(s) variable; calciphiles not dominant.

15A. Dominated by native prairie grasses (e.g., big bluestem, prairie cordgrass, Canada blue-joint grass) usually with characteristic wet prairie forbs (e.g., Riddell's goldenrod, gayfeather, mountain mint)...**WET TO WET- MESIC PRAIRIE**
(Type 2); (PEM; 1; A, B)

15B. Dominated by other grass species (e.g., reed canary grass, redtop) and/or generalist forbs (e.g., giant goldenrod, giant sunflower, swamp aster, marsh aster, wild mint).....**FRESH (WET) MEADOW**
(Type 2); (PEM; 1; B)

9B. Essentially open communities, either flats or basins usually with less than 50

percent vegetative cover during the early portion of the growing season, or shallow open water with submergent, floating and/or floating-leaved aquatic vegetation.

16A. Areas of shallow, open water (< 6.6 feet in depth) dominated by submergent, floating and/or floating-leaved aquatic vegetation
.....**SHALLOW, OPEN WATER COMMUNITIES**
(Type 5); (PAB; 2, 4, 5; G, H; and PUB; G, H; and L2EM; 2; G, H; and L2AB; 2, 4, 5; G, H)

16B. Shallow depressions or flats including vernal pools; standing water may be present for a few weeks each year, but are dry for much of the growing season; often cultivated or dominated by annuals such as smartweeds and wild millet; when not cultivated, perennial vegetation may be present (see Table 4 on page 15).....**SEASONALLY FLOODED BASIN**
(Type 1); (PEM; A)

2. Utilizing the “50/20 Rule” identify the dominant species within each plant community and which ones are non-native or invasive and the cover class of each species present. Use species list found on the MnDNR website⁶ that includes non-native status and use the following six cover classes⁷: *Note: Cover Class 1 and 2 are for use with invasive species only.*

Cover Class	Class Range
1	0 – 3%
2	>3 – <10%
3	>10 –25%
4	>25 –50%
5	>50 –75%
6	>75 – 100%

Table 1: Partial List of Invasive Species⁸

Scientific Name	Common Name	Scientific Name	Common Name
<i>Acer negundo</i>	Box elder	<i>Myriophyllum spicatum</i>	Eurasian water milfoil
<i>Alliaria petiolata</i>	Garlic mustard	<i>Pastinaca sativa</i>	Wild parsnip
<i>Berteroa incana</i>	Hoary alyssum	<i>Phalaris arundinacea</i>	Reed canary grass
<i>Bromus inermis</i>	Smooth brome grass	<i>Phragmites australis</i>	Common reed grass
<i>Butomus umbellatus</i>	Flowering rush	<i>Potamogeton crispus</i>	Curly leaf pondweed
<i>Cirsium arvense</i>	Canada thistle	<i>Rhamnus cathartica</i>	Common buckthorn
<i>Cirsium vulgare</i>	Bull thistle	<i>Rhamnus frangula</i>	Glossy buckthorn
<i>Euphorbia esula</i>	Leafy spurge	<i>Sonchus arvensis</i>	Sow thistle
<i>Glechoma hederacea</i>	Creeping charlie, ground ivy	<i>Trapa natans</i>	Water chestnut

⁶ www.dnr.state.mn.us

⁷ Adapted from Kuchler, A.W.

⁸ See MnRAM 3.1 database for a list of invasive/non-native plant species referenced from the MnDNR.

<i>Hydrilla verticillata</i>	Hydrilla	<i>Typha angustifolia</i>	Narrow leaved cattail
<i>Hydrocharis morsus-ranae</i>	European frog-bit	<i>Ulmus pumila</i>	Siberian elm
<i>Iris pseudacorus</i>	Yellow iris	<i>Urtica dioica</i>	Stinging nettle
<i>Lonicera x bella</i>	Honeysuckle	<i>Vicia cracca</i>	Cow vetch
<i>Lotus corniculatus</i>	Birdsfoot trefoil	<i>Vicia villosa</i>	Hairy vetch
* <i>Typha x glauca</i>	Blue (hybrid) cattail	<i>Setaria glauca</i>	Yellow foxtail
<i>Lythrum salicaria</i>	Purple loosestrife	<i>Echinochloa crusgalli</i>	Barnyard grass
<i>Salix fragilis</i>	Crack willow	<i>Elytrigia repens</i>	Quack grass
<i>Salix alba</i>	White willow	<i>Sonchus arvensis</i>	Perennial sowthistle
<i>Salix babylonica</i>	Weeping willow	<i>Cirsium vulgare</i>	Bull thistle
<i>Ambrosia artemisiifolia</i>	Common ragweed	<i>Alliaria petiolata</i>	Garlic mustard

***Cattail Key (Adapted from Smith, 1986)**

Two species of cattail (*Typha* sp.) occur in Minnesota and they readily hybridize producing a highly variable hybrid known by the common name of White (or Blue or hybrid) cattail *Typha x glauca* (ITIS 2002) as referred to in the 'National List of Plant Species That Occur In Wetlands Region 3 – North Central, second printing 1988. Broad-leaved cattail (*Typha latifolia*) is native throughout Minnesota. Narrow-leaved cattail (*Typha angustifolia*) is believed to be native to the eastern region of the U.S. and made its way to the Upper Midwest where it began to hybridize with *T. latifolia*. Both *Typha angustifolia* and *Typha x glauca* are more tolerant to a wide range of human influences including hydrologic changes, nutrient inputs, loading of certain toxic compounds such as chloride and heavy metals such as cadmium, copper and zinc and are therefore more invasive. Older, more extensive stands may have both *Typha* species present; various generations of the hybrid make reliable species cover estimates difficult. The following condensed key may be used to help determine what species of cattail is encountered in the field. See the database for a more detailed key.

Table 2: Diagnostic characteristics of cattails

Characteristic	<i>Typha latifolia</i> (Broad-leaved cattail)	<i>Typha angustifolia</i> (Narrow-leaved cattail)	<i>Typha x glauca</i> (White/Blue or hybrid cattail)
Mature Leaf width	14 – 23 mm	4 – 10 mm	10 – 14 mm
Leaf Cross-section shape	Flat, scarcely concave below mid.	Convex below middle	Flat to convex below middle
Spike width	25 – 34 mm	15 – 22 mm	19 – 25 mm
Pistillate length	≤15 cm	≤15 cm	>15 cm
Spike separation	Frequently contiguous but not more than 2 cm apart	Separated by at least 2 cm and usually >3 cm	Occasionally contiguous, more commonly up to 4 cm
Spike color	Dark brown to black	Brown	Brown to bright brown
Colony density	Sparse, often large gaps between shoots	Frequently very dense	Density intermediate

3. Characterize the current vegetative quality of each wetland community comprising at least 10% of the wetland using the following key and enter the community proportion of the whole wetland (3a), and the

vegetative quality rating for each community in the table below. **Compute the index for vegetative diversity and integrity for each plant community by doing the following:** If any of questions #4-6 are answered yes and/or if any of the Special Features **b, d, or i** have been selected, enter **Exceptional** for the functional index; if not, use the answer in the Vegetative Quality Index from the table for each community (Question 3). The overall vegetative diversity index for the wetland may be calculated one of four ways. The method should be based on the purpose of the assessment:

- 3b) Maintain Individual Community Scores:** preserves data to the highest level by maintaining the quality ratings of each community within the wetland. While it may be cumbersome to maintain this data for a large number of wetlands, this data should always be maintained and reported when the MnRAM is utilized for inventory or regulatory purposes.
- 3c) Highest Quality Community:** This method of presenting the Vegetative Diversity/Integrity can be utilized for determining sensitivity to impacts such as stormwater/hydrologic alterations. Typically, communities with the highest quality are also those that are most sensitive to alteration. *(This method would be preferable in regulatory situations in which a wetland basin may be impacted).*
- 3d) Non-Weighted Average Quality of all Communities:** This method of data presentation results in the greatest dilution of the individual community data. However, it may be the only reasonable method for comparing large numbers of wetlands such as for an inventory and/or planning project. In some instances, it may not be possible, given budget and scope constraints, to collect community dominance data. In that case, one way to get a single measure of overall wetland vegetative diversity/integrity quality is to utilize the non-weighted average. It is important to maintain and report the individual community quality data, even if it cannot be readily used to develop management classifications. *(This method is not recommended for regulatory purposes).*
- 3e) Weighted Average Quality Based on Percentage of Each Community:** This data presentation method provides the best average Vegetative Diversity/Integrity measure for the entire wetland. Here the quality rating is computed by summing the product of each community rating and the proportion of the wetland that community comprises. Whenever possible, the community proportion data should be collected to preserve the highest possible value for a single Vegetative Diversity/Integrity rating. Again, the individual community ratings should be preserved and reported to provide a complete data set. *(This method is not recommended for regulatory purposes).*

Guidance: The plant community rating incorporates two principal components: integrity and diversity.

Diversity refers to species richness, e.g., number of plant species. Generally, the more floristically diverse a community is, the higher the rating. **Integrity** refers to the condition of the plant community in comparison to the reference standard for that community. The highest rating is given to those communities that represent the characteristic condition of that particular community. The degree (e.g., minor versus substantial) and type of disturbance typically play an important role in the diversity/integrity of plant communities. Some native plant communities are maintained by periodic, natural disturbances (e.g., fire, annual floods). For purposes of this functional assessment, disturbances are more in reference to man-induced alterations (e.g., filling, dredging, drainage) that are typically detrimental to vegetative diversity/integrity.

It is important to note that some native wetland plants naturally form large colonies or clones creating communities that are low in diversity, but high in integrity. Examples are stands of wild rice, arrowhead, lake sedges, river bulrush, hardstem bulrush, American lotus, wild celery, pickerelweed, wire-grass sedge and tussock sedge. Plant communities with low diversity but high integrity can have a high vegetative diversity/integrity ranking if they represent the characteristic condition of that plant community (i.e., compared

to the reference standard community).

Size of the area sampled for the rating can also be a factor. If the area sampled is small, the evaluator must be aware that it may not naturally support the diversity of species a larger area of the same plant community supports.

User Notes: Each community is outlined below with descriptions for high, medium, and low quality. Many sites have more than one community; consult the descriptions individually to decide the appropriate rating for each community, *except* the following description of “exceptional” quality is applicable to all communities:

Exceptional Quality: Plant community is undisturbed, or sufficiently recovered from past disturbances, such that it represents pre-European settlement conditions. Non-native plant species are absent or, if present, constitute a minor percent cover of the community. Unique features (e.g., old growth forest, never-plowed wet prairie, T/E species) may also be present.

NOTE: For purposes here, “dominant” or “dominated by” refers to the dominant species determined by the “50/20 Rule” or other appropriate method for determining which species are dominants. “Subdominant” refers to species that may not meet the “50/20 Rule” for dominance, but have at least 10 percent areal cover (or other dominance measure)⁹.

16A. SHALLOW, OPEN WATER COMMUNITIES¹⁰

High Quality: Aquatic bed communities with greater than 10 percent coverage of the open water area and dominated by 3 or more species of native aquatic plants such as pondweeds, water lilies, bladderworts, wild celery, duckweed, water crowfoots, native milfoils, etc.; or communities with low diversity but high integrity as given in additional guidance (e.g., beds of wild celery). Eurasian water milfoil and/or curly leaf pondweed, if present, cumulatively comprise less than 20 percent cover of the aquatic bed community.

Medium Quality: Aquatic bed communities with greater than 10 percent coverage of the open water area and dominated by 1 or 2 species of native aquatic plants; and/or Eurasian water milfoil and/or curly leaf pondweed cumulatively comprise 20 to 50 percent cover of the aquatic bed community.

Low Quality: Aquatic vegetation absent or coverage is less than 10 percent of the open water area; or, Eurasian water milfoil and/or curly leaf pondweed cumulatively comprise greater than 50 percent cover of the aquatic bed community.

13B. SHALLOW MARSHES¹¹

High Quality: Three or more native aquatic plants (e.g., bur-reeds, bulrushes, arrowheads, duckweeds, cattails, sweet flag, pondweeds) are dominants; or, communities with low diversity but high integrity as described in guidance (e.g., stands of arrowhead, lake sedges). Cattails, if present, comprise less than 40 percent cover. Purple loosestrife absent or comprises less than 20 percent cover.

⁹ The “50/20 Rule” is explained in the *Corps of Engineers Wetlands Delineation Manual* (1987).

¹⁰ I., page 28, Eggers and Reed.

¹¹ II.B., pages 51-53, Eggers and Reed.

Medium Quality: At least 2 species of native aquatic plants are dominants; and/or purple loosestrife comprises 20 to 50 percent cover; and/or cattails comprise 40 to 85 percent cover.

Low Quality: Dominated by 1 native aquatic species; and/or purple loosestrife comprise more than 50 percent cover; and/or cattail comprises more than 85 percent cover.

12B. DEEP MARSHES¹²

High Quality: Three or more species of native aquatic plants (e.g., bur-reeds, bulrushes, arrowheads, duckweeds, cattails, sweet flag, pondweeds) are dominants; or communities with low diversity but high integrity as described in guidance (e.g., stands of bulrushes, wild rice, lotus, arrowheads). Cattails, if present, comprise less than 40 percent cover. Purple loosestrife and/or Eurasian water milfoil absent or cumulatively comprise less than 20 percent cover.

Medium Quality: Dominated by 2 species of native aquatic plants; and/or purple loosestrife and/or Eurasian water milfoil, cumulatively comprise 20 to 50 percent cover; and/or cattail comprises 40 to 85 percent cover.

Low Quality: Dominated by 1 native aquatic species; and/or purple loosestrife and/or Eurasian water milfoil cumulatively comprise more than 50 percent cover; and/or cattail comprises more than 85 percent cover.

13A. SEDGE MEADOWS¹³

High Quality: Stands dominated solely by sedges (e.g., wiregrass sedge, hummock sedge, lake sedge, woolgrass [*Carex lasiocarpa*, *C. stricta*, *C. lacustris*, *Scirpus cyperinus*, respectively]) including nearly monotypic stands; or stands with a mixture of sedge dominants and dominant or subdominant native forbs/ferns/grasses/rushes (e.g., Canada blue-joint grass, joe-pye weed, giant sunflower). Reed canary grass, purple loosestrife, stinging nettle and/or other invasive species (Table 1) are absent or cumulatively comprise less than 20 percent cover in the herbaceous stratum. Non-native buckthorns, if present, comprise less than 10 percent cover within the sedge meadow community.

Medium Quality: Stands of sedges where the invasive species listed above cumulatively comprise 20 to 40 percent cover in the herbaceous stratum; and/or non-native buckthorns comprise 10 to 30 percent cover within the sedge meadow community.

Low Quality: Invasive herbaceous species listed above cumulatively comprise 40 to 50 percent cover; and/or non-native buckthorns comprise 30 to 50 percent cover within the sedge meadow community.

[Note: Stands with less than 50 percent cover by sedges key out to wet meadows, 15B. Stands with greater than 50 percent cover by buckthorn shrubs key out to shrub-carrs, 8B.]

15B. WET MEADOWS¹⁴

¹² II.A., pages 51-53, Eggers and Reed.

¹³ III.A., page 86, Eggers and Reed.

¹⁴ III.B., page 105, Eggers and Reed.

High Quality: Composed of 10 or more species of native/non-invasive grasses, sedges, ferns, rushes and/or forbs. Reed canary grass, purple loosestrife, stinging nettle and/or other invasive species (Table 1), if present, cumulatively comprise less than 20 percent cover. Non-native buckthorns absent or comprise less than 10 percent cover within the wet meadow community.

Medium Quality: Community composed of 5 to 9 species of native grasses, sedges, rushes, ferns and/or forbs; and/or invasive herbaceous species listed above cumulatively comprise 20 to 50 percent cover; and/or non-native buckthorns, comprise 10 to 30 percent cover within the wet meadow community.

Low Quality: Composed of 4 or fewer species of native grasses, sedges, rushes, ferns and/or forbs; and/or invasive herbaceous species listed above cumulatively comprise more than 50 percent cover; and/or non-native buckthorns comprise 30 to 50 percent cover within the wet meadow community. For example, this rating includes the nearly monotypic stands of reed canary grass that are commonly encountered.

[Note: Greater than 50 percent cover by buckthorn shrubs key out to shrub-carrs, 8B.]

15A. WET to WET-MESIC PRAIRIES¹⁵

High Quality: Community composed of native grasses (e.g., prairie cord-grass, switchgrass, Canada blue-joint grass), sedges, and forbs characteristic of wet to wet-mesic prairies. Reed canary grass, purple loosestrife, quack grass, Canada thistle and/or other invasive species (Table 1) are absent or cumulatively comprise less than 20 percent cover. Non-native buckthorns absent or comprise less than 10 percent cover within in the prairie community.

Medium Quality: Invasive species listed above cumulatively comprise 20 to 50 percent cover in the herbaceous stratum; and/or non-native buckthorns comprise 10 to 30 percent cover within the prairie community.

Low Quality: Invasive species listed above cumulatively comprise more than 50 percent cover in the herbaceous stratum; and/or non-native buckthorns comprise 30 to 50 percent cover within the prairie community.

7B. & 14A. CALCAREOUS FENS¹⁶

Due to their uniqueness, rarity, and disproportionate number of threatened and special concern plant species, calcareous fen communities are rated as “exceptional” for vegetative diversity/integrity (see Special Features, item b.).

7A. & 10A. OPEN BOGS¹⁷

High Quality: Composed of the characteristic assemblage of sphagnum mosses, sedges and heath family

¹⁵ III.C., page 125, Eggers and Reed.

¹⁶ III.D., page 141, Eggers and Reed.

¹⁷ IV.A., page 161, Eggers and Reed.

shrubs, often with carnivorous plants and various orchid species. Cattails, quaking aspen, non-native buckthorns, reed canary grass, stinging nettle and/or other invasive species (Table 1) are absent or comprise less than 20 percent cover in each stratum (e.g., bryophyte, herbaceous, shrub).

Medium Quality: Invasive species listed above comprise 20 to 50 percent cover in one or more strata.

Low Quality: Invasive species listed above comprise greater than 50 percent cover in one or more strata. Dieback of sphagnum mosses due to flooding, nutrient loading, salt spray, sediment input, etc., can be an indicator.

4A. CONIFEROUS BOGS¹⁸

High Quality: Stands of tamarack and/or black spruce with the characteristic assemblage of sphagnum mosses, sedges and heath family shrubs. Cattails, quaking aspen, non-native buckthorns, stinging nettle, reed canary grass, and/or other invasive species (Table 1) comprise less than 20 percent cover in any stratum (e.g., bryophyte, herbaceous, shrub, tree).

Medium Quality: Stands of tamarack and/or black spruce invaded by cattail, quaking aspen, non-native buckthorns, stinging nettle and other invasive species (Table 1) that comprise 20 to 50 percent cover in one or more strata.

Low Quality: Non-native buckthorns, quaking aspen, stinging nettle, cattail and/or other invasive species (Table 1) cumulatively comprise more than 50 percent cover in one or more strata. Also includes stands where greater than 50 percent of the black spruce and tamarack are dead (due to impoundment, drainage, salt spray, etc.).

8B. SHRUB-CARRS¹⁹

High Quality: Dominated by native shrubs (e.g., dogwoods, willows) with a herbaceous stratum composed of five or more species of native grasses, sedges, rushes, ferns and/or forbs. Non-native buckthorns, non-native honeysuckles, box elder and/or other invasive woody species (Table 1), cumulatively comprise less than 20 percent cover of the shrub stratum. Reed canary grass and other invasive herbaceous species comprise less than 20 percent cover of the herbaceous stratum.

Medium Quality: Invasive species listed above comprise 20 to 50 percent cover in any one stratum (shrub or herbaceous or both); and/or the herbaceous stratum has 4 or fewer species of native grasses, sedges, rushes, ferns or forbs.

Low Quality: Invasive species listed above comprise more than 50 percent cover in any one stratum (shrub or herbaceous or both).

8A. ALDER THICKETS²⁰

¹⁸ IV.B., page 175, Eggers and Reed.

¹⁹ V.A., page 180, Eggers and Reed.

²⁰ V.B., page 192, Eggers and Reed.

High Quality: Stands of speckled alder with less than 20 percent cumulative cover by non-native buckthorns, non-native honeysuckles, box elder and/or other invasive woody species (Table 1). Herbaceous stratum composed of 5 or more species of native grasses, sedges, rushes, ferns and forbs. Reed canary grass, if present, comprises less than 20 percent cover.

Medium Quality: Invasive species listed above cumulatively comprise 20 to 40 percent cover of the shrub stratum; and/or the herbaceous stratum has 4 or fewer native herbaceous species; and/or herbaceous stratum has 20 to 50 percent cover of reed canary grass or other invasive species.

Low Quality: Forty to 50 percent cover of the shrub stratum consists of invasive woody species listed above (Table 1); and/or reed canary grass comprises more than 50 percent cover of the herbaceous stratum.

[Note: Stands with more than 50 percent cover by buckthorns, key out to shrub-carrs, 8B.]

3B. HARDWOOD SWAMPS and 4B. CONIFEROUS SWAMPS²¹

High Quality: Tree/sapling/shrub strata each have less than 20 percent cover of box elder, non-native buckthorns, non-native honeysuckles, eastern cottonwood, quaking aspen (see note below regarding aspen) and/or other invasive species (Table 1). Herbaceous stratum composed of 5 or more species of native grasses, sedges, rushes, ferns and/or forbs, and reed canary grass comprises less than 20 percent cover. Another factor is the common presence of seedlings/saplings of the characteristic tree species, which indicates regeneration of the stand, as opposed to observing abundant seedlings/saplings of invasive woody species. NOTE: aspen parkland in northern Minnesota is a special case. Stands of quaking aspen with a ground layer of native prairie species should be rated by a separate method specific to aspen parklands.

Medium Quality: Invasive species listed above comprise 20 to 50 percent cover in one or more strata, and/or the herbaceous stratum has 4 or fewer species of native grasses, sedges, rushes, ferns and forbs. This rating also includes early successional forests of quaking aspen with an understory of characteristic tree species of swamps (e.g., green ash, black ash, red maple, balsam poplar, northern white cedar.).

Low Quality: Invasive species listed above comprise more than 50 percent cover in one or more strata (e.g., tree, sapling, shrub, herbaceous). Typically, few to no indications of regeneration of the characteristic tree species are present.

3A. FLOODPLAIN FORESTS²²

High Quality: Tree stratum with less than 20 percent cumulative cover by box elder, crack willow, weeping willow or white willow. Herbaceous stratum, if present, composed of native forbs, ferns, sedges and grasses characteristic of floodplain forests (e.g., wood nettle, jewelweed, Virginia rye, cut-leaf coneflower) with less than 20 percent cover by reed canary grass.

Medium Quality: Invasive species listed above comprise 20 to 50 percent cover in one or more strata.

²¹ VI.A and VI.B., pages 197 to 213, Eggers and Reed.

²² VII., page 214, Eggers and Reed

Low Quality: Invasive species listed above comprise greater than 50 percent cover in one or more strata. Also include stands where greater than 50 percent of the trees are dead.

16B. SEASONALLY FLOODED BASINS²³

High Quality: Dominated by native/non-invasive species (examples in Table 4) with less than 20 percent cover in any one stratum by non-native and/or invasive species (e.g., common buckthorn, reed canary grass, Canada thistle, yellow foxtail, barnyard grass, common ragweed, stinging nettle, quack grass – see Table 1). Typically located within an area of permanent vegetative cover (e.g., forest, prairie, non-agricultural settings) undisturbed or minimally disturbed by artificial drainage, haying, grazing, plowing, stormwater input, or other disturbances.

Medium Quality: Invasive species listed above comprise 20-50 percent cover in one or more strata. Typically located in areas that are partially drained, infrequently cropped, lightly grazed, subject to some stormwater input, etc.

Low Quality: Invasive species listed above comprise greater than 50 percent cover in one or more strata. Typically located in frequently cropped agricultural fields, heavily grazed, or subjected to substantial inputs of stormwater, or other adverse disturbances.

Table 4: Examples of Native/Non-Invasive Species of Seasonally Flooded Basins Including Vernal Pools

Scientific Name	Common Name	Scientific Name	Common Name
<i>Onoclea sensibilis</i>	Sensitive fern	<i>Geum canadense</i>	White avens
<i>Athyrium filix-femina</i>	Lady fern	<i>Impatiens capensis</i>	Jewelweed
<i>Ribes americanum</i>	Wild black currant	<i>Juncus canadensis</i>	Canada rush
<i>Sambucus canadensis</i>	Common elderberry	<i>Juncus tenuis</i>	Slender rush
<i>Vitis riparia</i>	Riverbank grape	<i>Juncus torreyi</i>	Torrey's rush
<i>Boehmeria cylindrica</i>	False nettle	<i>Leersia virginica</i>	Whitegrass
<i>Carex grayi</i>	Gray's sedge	<i>Leersia oryzoides</i>	Rice cut-grass
<i>Carex lupulina</i>	Hop sedge	<i>Rudbeckia laciniata</i>	Cut-leaf coneflower
<i>Carex muskingumensis</i>	Muskingum sedge	<i>Sium suave</i>	Water parsnip
<i>Carex stipata</i>	Stalk-grain sedge	<i>Polygonum pensylvanicum</i>	Penn. smartweed
<i>Carex typhina</i>	Cattail sedge	<i>Polygonum lapathifolium</i>	Nodding smartweed
<i>Cyperus strigosus</i>	Straw-color flatsedge	<i>Ranunculus septentrionalis</i>	Buttercup
<i>Eleocharis obtusa</i>	Blunt spikerush	<i>Elymus virginicus</i>	Virginia wild-rye
<i>Aster lateriflorus</i>	Calico aster	<i>Bidens cernua</i>	Nodding beggartick

²³ VIII., page 227, Eggers and Reed.

4. **Y N Are state or federally listed plant species, rare, threatened or of special concern, found or known to be found in the wetland recently?** If Special Features questions d or i [rare natural community, rare plant species] are answered yes, then this question is yes and Vegetative Diversity function is Exceptional.
5. **Y N Is the wetland or a portion of the wetland a rare natural community or habitat based on the Minnesota Natural Heritage Database or the County Biological Survey²⁴?** If yes, wildlife habitat functional level rating = exceptional. (If Special Features question d is answered yes, this question will also be affirmative.)

Guidance: Rare Natural Communities. The Minnesota Department of Natural Resources Natural Heritage and Nongame Research Program and the County Biological Survey collects, manages, and interprets information about nongame animals, native plants, and plant communities to promote the wise stewardship of these resources. A ranking system is intended to reflect the extent and condition of natural communities and species in Minnesota. These ‘state ranks’ have no legal ramifications; they are used by the Natural Heritage Program to set priorities for research and for conservation planning. They are grouped as follows:

State Element Rank:

- S1:** Critically imperiled in the state because of extreme rarity.
- S2:** Imperiled in state because of rarity.
- S3:** Rare or uncommon in state.
- S4:** Apparently secure in state.
- S5:** Demonstrably secure in state.

For this question, a rare natural community is defined as a wetland native plant community having a state element rank of S1, S2, or S3 that is mapped or *determined to be eligible for mapping* in the Natural Heritage Information System OR a wetland native plant community contained within an area mapped or determined to be eligible for mapping in the NHIS as a Site of Outstanding or High Biological Diversity.

If a special case is suspected, consider using a specific assessment tool in addition to MnRAM.

6. **Y N Does the wetland represent pre-European-settlement conditions? (e.g., MnDNR Native Plant Communities publication)** If yes, then Vegetation function is Exceptional (continue to answer subsequent questions). Created wetlands would not qualify, regardless of quality.

²⁴ These references are available at local Soil & Water Conservation District offices; some counties are online at the Minnesota Department of Natural Resources/Ecological Services website.

General information about the wetland site:

7. **Describe** the hydrogeomorphology of the wetland and associated topography (check those that apply):

- Depressional/Isolated (no discernable inlets or outlets)
- Depressional/Flow-through (apparent inlet and outlet)
- Depressional/Tributary (outlet but no perennial inlet or drainage entering from upstream subwatershed)
- Riverine (within the river/stream banks)
- Lacustrine Fringe (edge of deepwater areas)/Shoreland
- Extensive Peatland/Organic Flat
- Slope
- Floodplain (outside waterbody banks)
- Other _____

8. **Approximate maximum depth of standing water in the wetland (inches):** _____

Percent of wetland area inundated: _____%

~ 9. **What is the estimated area of the wetland's immediate drainage area in acres?** _____

~ 10. **Estimated size of existing wetland in acres:** _____

10. Guidance: Determining wetland size. The estimated size of existing wetlands can be calculated off aerial photos, preferably infrared, and/or in some cases calculating the size of the depressional hydric soil polygon. If available on a GIS system, these polygon areas can automatically be calculated.

~ 11. **General description of soil(s)** from Soil Survey and on site:

	Adjacent UPLAND Area (within 500 feet)	WETLAND Area
Soil Survey Classification(s):		

12. For depressional wetlands, describe the wetland surface and subsurface outlet characteristics as it relates to the wetland's ability to detain runoff and/or store floodwater.

A = No surface or subsurface outlet, or a restricted outlet at or greater than 2 feet higher than the wetland boundary

B = Swale, channel, weir, or other large, surface outlet (>18 inch pipe) with outflow elevation 0-2 feet above the wetland boundary, subsurface tile with no surface inlet.

C = Wetland outflow elevation below the wetland boundary with either a high capacity surface outlet (swale, channel, weir, pipe >18 inch diameter, etc...) or a subsurface outlet (drain tile) with a surface inlet.

N/A = Not applicable for floodplain, slope, lacustrine, riverine, and extensive peatland/flat wetlands.

13. Describe the wetland surface and subsurface outlet characteristics as it relates to the wetland hydrologic regime²⁵:

A = No outlet, natural outlet condition, or a constructed outlet at the historic outflow elevation; no evidence of subsurface drainage (drain tile).

B = Constructed, reduced capacity outlet below the top of the temporary wet meadow zone; moderate indications of subsurface drainage; outlet raised but managed to mimic natural conditions; watercourse has been recently ditched/channelized.

C = Excavated or enlarged outlet constructed below the bottom of the wet meadow zone; strong indications of subsurface drainage; outlet removes most/all long-term and temporary storage; or outlet changes hydrologic regime drastically.

12/13. Guidance: Outlet Characteristics. The ability of a wetland to maintain a hydrologic regime characteristic of the wetland type is somewhat dependent upon whether a natural outlet is present, or whether an outlet has been constructed or modified by humans. Constructed outlets can significantly diminish the ability of a wetland to provide temporary and long-term water retention, and thus its ability to maintain its characteristic hydrologic regime. Wetlands with natural outlets are functioning at the highest level possible for the type within the wetland comparison domain, and should be rated A [high]. Constructed outlets above the temporary wetland (wet meadow) zone are rated B [medium] if managed to mimic natural conditions. Constructed outlets, either surface or subsurface, below the top of the temporary wet meadow zone reduce the ability of the wetland to provide temporary and long-term water retention; if a constructed outlet is present below the top of the temporary wetland zone, but is such that the wetland is able to provide some temporary and long-term water retention (i.e. the wetland is only partially drained), the rating should be B [medium]. Constructed outlets, either surface or subsurface, which remove most or all temporary and long-term retention capabilities, significantly reduce the ability of the wetland to maintain its characteristic hydrologic regime; the rating should be C [low]. Constructed outlets that keep open water wetlands open water or keep saturated wetlands saturated are rated B [medium]. If the constructed outlet changes the wetland to non-wetland or to deepwater habitat or from saturated conditions to open water or from open water to saturated then it is rated C [low].

²⁵ Lee et al., 1997.

~ **14. Describe the dominant land use and condition of the immediate upland drainage area of wetland.²⁶ If the immediate upland drainage is not evident, then within 500 feet.**

A = Watershed conditions essentially unaltered; < 10% impervious (i.e. low density residential, >1 acre lots); land use development minimal, idle lands, lands in hay or forests or low intensity grazing.

B = Watershed conditions somewhat modified; e.g., 10–30 % impervious (i.e. medium density residential, 1/3 to 1 acre lots); moderate intensity grazing or haying with some bare ground; conventional till with residue management on moderate slopes, no-till on steep slopes.

C = Watershed conditions highly modified; e.g., >30 % impervious surfaces (i.e. high density residential, lots smaller than 1/3 acre, industrial, commercial, high impervious institutional) maximizing overland flow to the wetland; intensive agriculture or grazing with a high amount of bare ground, no residue management on moderate or steep slopes, intensive mining activities.

14. Guidance: Dominant upland land use²⁷. Overland flow affects wetland flood storage capabilities and overland flow is affected by changes in upstream vegetative communities. Upland land use within the watershed contributing to the wetland (as defined in Question #9) and the watershed size have a significant influence on the flow of runoff and sediments to the wetland, and thus the ability of the wetland to desynchronize flood flows and maintain its characteristic hydrologic regime. The more developed and intensively the watershed is used, the greater the delivery of runoff and sediments to the wetland is likely to be and the more likely the wetland will have the opportunity to minimize flooding downstream. With increased runoff and sediment delivery, the wetland will be less likely to maintain its characteristic hydrologic regime. As the proportion of the impervious watershed area increases, runoff volume and rate increases along with sediment concentrations.

15. Describe the conditions of the wetland soils:

A = There are no signs or only minor evidence of recent disturbance or alteration to the wetland soils; temporary wetland wet meadow zone intact; idle land, hayed or lightly to moderately grazed or logged. Minimal compaction, rutting, trampling, or excavation damage to wetland.

B = Moderate evidence of disturbance or alteration to the wetland soils. Temporary wet meadow zone tilled or heavily grazed most years. Zones wetter than temporary receive tillage occasionally. Some compaction, rutting, trampling, or excavation in wetland is evident.

C = Evidence of significant disturbance or alteration to the wetland soils. Wetland receives conventional tillage most (>75%) years; or otherwise significantly impacted (e.g., fill, sediment deposits, cleared, excavated). Severe compaction, rutting, trampling, or excavation damage to wetland.

15. Guidance: Condition of Wetland Soils. The condition of the soils in the wetland affects the vegetation within the wetland, and thus the relationships affecting ground-water discharge, recharge, and evapotranspiration. The more developed and intensively the wetland is used (i.e. tillage, excavation, vehicle traffic, pedestrian or livestock usage), the more likely these relationships are to be impacted, and the more likely the ability of the wetland to maintain its characteristic hydrologic regime will be reduced.

16. Enter the percentage of the wetland that is vegetated with woody, emergent, submergent, or

²⁶ Lee et al., 1997.

²⁷ The range of impervious proportions for various land uses is borrowed from Chow, Maidment, and Mays (1988)

floating-leaved vegetation.

_____ %

16. Guidance: Wetland Vegetation is assessed here for two related properties:

1) Water/Vegetation Proportions and Interspersion. Rooted vegetation in flow-through wetlands slows floodwaters by creating frictional drag in proportion to stem density, more or less according to vegetation cover type and interspersion. Flow-through wetlands with relatively low proportions of open water to rooted vegetation and low interspersion of water and rooted vegetation are more capable of altering flood flows. Dense stands of rooted vegetation, including trees, shrubs, and herbaceous emergent are more capable of slowing floodwater than open water alone. Ratings follow these categories: High (dense vegetative cover) >75%; Medium (combination some unvegetated open water and vegetative cover) = 25 - 75%; Low (primarily unvegetated open water) = <25%. Isolated wetlands, which are perfect containers of floodwaters, should be rated 100%.

2) Nutrient Uptake/Cycling. A wetland's ability to uptake, metabolize, sequester and/or remove nutrients and imported elements from the water is primarily dependent on wetland vegetative conditions. Microbial processing and bioaccumulation are associated with plant cover including floating, emergent or submergent vegetation.²⁸ Vegetative density can serve as an index of primary production, which is an indicator of nutrient assimilation. Forested wetlands retain ammonia during seasonal flooding and wetland environments are effective at denitrification. Wetlands take up metals both by adsorption in the soils and by plant uptake via the roots. They allow metabolism of oxygen-demanding materials and can reduce fecal coliform populations. These pollutants are often buried by deposition of newer plant material, isolating them in the sediments.

17. Describe the roughness coefficient of the potential surface floodwater flowpath in relation to wetland vegetation biomass, numeric density and plant morphology²⁹:

A = Dense bushy willow, heavy stand of timber with or without downed trees, or mature field crops with flow at half or less of crop height.

B = Dense grass with rigid stems, weeds, tree seedlings, or brushy vegetation where flows can be two to three times the height of the vegetation.

C = Primarily flexible turf grass or other supple vegetative cover or unvegetated.

N/A = Not applicable if wetland is isolated.

17. Guidance: Floodwater resistance. Forest cover and other woody stems increase surface roughness resulting in an increased detention of high flows. The cumulative effect is reduced peak flows downstream. A forest (i.e. ash, boxelder, red maple, conifers) with a dense understory is best for detaining high flows. Without a forest present, woody shrubs (i.e. alder, willow, red osier dogwood) can be extremely effective but lose effectiveness once high flows approach and exceed the woody shrub height. Dense, non-woody vegetation (i.e. cattails, reed canarygrass) are effective at detaining minor flood flows but lay down to higher flows and the surface roughness greatly diminishes. Turf grass and other supple vegetation has minimal effects on flood flows. Open water wetlands with submergent and scattered emergent vegetation are part of the channel characteristics and have minimal effect on detaining flood flows. The Manning's roughness coefficient decreases as water depth increases above the macrophytes and other surface roughness characteristics. Dense, robust, tall vegetation is best for

²⁸ Magee and Hollands, 1998; Lee et al., 1997.

²⁹ Adamus et al., 1991.

floodplains.

18. Describe the extent of observable/historical sediment delivery to the wetland from anthropogenic sources including agriculture:

A = No evidence of sediment delivery to wetland.

B = Minor evidence of accelerated sediment delivery in the form of stabilized deltas, sediment fans.

C = Major sediment delivery evidenced by buried detritus and/or vegetation along outer edge of temporary wetland (wet meadow) zone. Recent deltas, sediment plumes, etc. in areas of concentrated flow or sedimentation raising bottom elevation of wetland.

18. Guidance: Sediment Delivery. Wetlands filled by sediment from anthropogenic sources will have reduced capacity to store stormwater. Land use, ground slope, and erodibility characteristics of the soils affect the potential for sediment delivery to the wetland.

~ 19. Describe the predominant upland soils within the wetland's immediate drainage area that affect the overland flow characteristics to the wetland³⁰:

A = Sands (Hydrologic soil group A)

B = Silts or loams (Hydrologic soil group B)

C = Clays or shallow to bedrock (Hydrologic soil groups C, D, A/D, B/D, C/D)

19. Guidance: Watershed Soils. Use hydrologic grouping if available, otherwise, use soil texture from the soil survey [see chart in Guidance for Question #60]. Greater runoff and higher flood peaks occur in watersheds having primarily impermeable soils. These types of soils impede water infiltration and so produce increased runoff. Wetlands located downslope of more impermeable soils are more likely to provide flood attenuation.

20. Describe the characteristics of stormwater, wastewater, or concentrated agricultural runoff detention/water quality treatment prior to discharging into the wetland:

A = Receives significant volumes of untreated/undetained stormwater runoff, wastewater, or concentrated agricultural runoff directly, in relation to the wetland size.

B = Receives moderate volumes of directed stormwater runoff, wastewater, or concentrated agricultural runoff in relation to wetland size, which has received some treatment (sediment removal) and runoff detention.

C = Does not receive directed stormwater runoff, wastewater, or concentrated agricultural runoff; receives small volumes of one or more of these sources in relation to wetland size; or stormwater is treated to approximately the standards of the National Urban Runoff Program (NURP); and runoff rates controlled to nearly predevelopment conditions.

20. Guidance: Stormwater Runoff Pretreatment and Detention. These ratings apply to both Flood/Stormwater Storage and Attenuation *and* Downstream and Wetland Water Quality Protection. When used for determining water quality characteristics, the ratings are reversed (i.e. A=High shown

³⁰ See the Soil Data Mart on the NRCS/USDA website for help with soil characterization.

above will be counted as C=Low). Wetlands receiving undetained, directed stormwater from developed areas generally provide a higher functional level for flood/stormwater storage than do similar wetlands receiving stormwater at rates of, and with water quality equivalent to, that prior to development.

A NURP pond is most easily identified by having a 10-foot wide, nearly flat shelf just below the normal water level and will be 4 to 10 feet deep. Typically, these ponds will have a wet surface area (at the normal level) approximately equal to 1% of the watershed area (when the impervious percentage is less than 50), or 2% of the watershed impervious area (when the impervious percentage is >50). For example, a 0.5 acre pond will serve 50 acres of drainage area with 15% impervious surfaces or a 35 acre watershed containing 25 acres of impervious surfaces). Ponds that remove sediment only are typically smaller with a depth of 4 feet or less. The high rating equates with direct pipe discharge into the wetland and runoff rates, which will likely increase the water level in the wetland significantly (i.e. a pipe discharge from a short length of road or from several residential back yards to a 100 acre wetland complex does not constitute a significant impact).

~ **21. Describe the proportion of wetlands within the DNR minor watershed (5,600 DNR minor watersheds are defined in Minnesota by Minnesota Rules 8420.0110, Subp. 31—the definition of “minor watershed” may vary by state) and the opportunity for contributing to floodwater detention³¹:**

A = Wetlands make up less than 10% of the minor watershed area.

B = Wetlands make up 10-20% of the minor watershed.

C = Wetlands make up more than 20% of the minor watershed.

21. Guidance: Subwatershed Wetland Density. The density of wetlands in the minor watershed will determine the benefit each provides downstream. Wetlands reduce flood peaks up to 75 percent compared to rolling topography when they occupy only 20 percent of the total basin.²³ When wetland densities in the minor watershed exceed 20% total cover, the flood storage benefits of additional wetlands rapidly decrease.

22. Describe the functional level of the wetland in retarding or altering flows based on the surface flow characteristics through the wetland:

A = No channels present.

B = Channels present, but not connected, or meandering channels.

C = Channels connecting inlet to outlet.

22. Guidance: Channels/Sheet Flow. Channels are formed in the underlying substrate, not just as paths through emergent vegetation. Sheet flow, rather than channel flow, offers greater frictional resistance. The potential for floodflow desynchronization is greater when water flows through the wetland as sheet flow. Connecting channels will carry water directly from the inlet to the outlet preferentially in the channel. Channels not connected indicate that some channelized flow may occur within the wetland but not all the way through the wetland via a single channel; some sheet flow will occur. No channels present represents wetlands in which water from the inlet will spread out over the wetland to the outlet (e.g., unchannelized meadows, shallow marshes, deep marshes, ponds, typical floodplains without meander channels, etc.).

³¹ Verry, 1988; Wells et al., 1988; Flores et al., 1981; and Ogawa and Male 1983/MA:P.

23. **Adjacent Buffer width: Average width of the naturalized buffer: _____ feet [Within 500']**

23. Guidance: Upland Buffer. Vegetated buffers around wetlands provide multiple benefits including wildlife habitat, erosion protection, and a reduction in surface water runoff. A buffer is an unmanicured area immediately adjacent to the wetland boundary. For this question, do not include lawn areas. If the buffer varies from one side to another, take the average width over the entire perimeter.

Widths for Water Quality

- High = >50 feet
- Medium = 25 – 50 feet
- Low = <25 feet

Widths for Wildlife Habitat

- High = >300 feet
- Medium = 50 – 300 feet
- Low = <50 feet

TO SCORE THE NEXT THREE QUESTIONS, consider a 50-foot ring around the wetland or assessment area. Describe the condition (minimum 10%) of each category. Total must equal 100%.

24. **Adjacent Area Management:** average condition of vegetative cover for water quality.

- ____% Full vegetative cover
- ____% Manicured, primarily vegetated (i.e. short-grass lawn, clippings left in place)
- ____% Lacking vegetation: bare soil or cropped, unfenced pasture, rip-rap, impervious/pavement.

24. Guidance: Adjacent Area Management. This question refers to the 50 feet surrounding the wetland assessment area (unlike the shoreland wetland vegetation question, which refers to the vegetation within the wetland itself). Maintenance may include mowing, haying, spraying or burning.

25. **Adjacent Area Diversity & Structure** (composition of characteristics for habitat)

- ____% Full coverage of native non-invasive vegetation
- ____% Mixed native/non-native vegetation, moderate density coverage, OR dense non-native cover.
- ____% Sparse vegetation and/or impervious surfaces.

25. Guidance: Adjacent Area Diversity and Structure. Many wetland-associated wildlife utilize upland areas for breeding, nesting, and foraging activities. Quality of the upland will affect the diversity and stability of the wetland wildlife community. This question combines estimates of both diversity and density—most wetlands will fall in the middle.

26. **Adjacent Upland Slope**

- ____% gentle slopes, 0-6%
- ____% moderate slopes, >6-12%
- ____% steep slopes, >12%

26. Guidance: Adjacent Upland Slope. Gentle slopes are associated with greater use by wildlife and also are less likely to erode. This measurement is best estimated on site.

~ **27. Describe the proximity of the first recreational lake, recreational watercourse, spawning area or significant fishery, or water supply source down-gradient of the wetland³²:**

A = Isolated wetlands *or* wetland with one or more resource within 0.5 mile downstream via any form of channel, pipe.

B = One or more resource within 0.5 to 2 miles downstream.

C = No significant resources are located within 2 miles downstream.

27. Guidance: Downstream Sensitivity. The water quality function wetlands provide help disperse the physical, chemical, and biological impacts of pollution in downstream waters. Sensitive water resources located within 0.5 miles downstream of the wetland will realize the greatest benefit to water quality from the wetland. As discharges from the wetland move farther downstream, the benefits to water quality provided by the wetland will continue to diminish.

28. Does the wetland water quality and/or plant community exhibit signs of excess nutrient loading:

A = No evidence of excess nutrient loading or nutrient sources (e.g. evidence of diverse, native vegetative community, no pipes, etc.).

B = Some evidence of excess nutrient loading source and evidence in the plant communities such as dense stands of reed canary grass or narrowleaf, and/or blue (hybrid) cattail.

C = Strong evidence of excess nutrient loading by evident nutrient sources or evidence in the plant community such as algal mats present or evidence of excessive emergent, submergent and/or floating macrophyte growth.

28. Guidance: Nutrient Loading. Excessive nutrient loading to a wetland can cause nuisance algal blooms and the production of monotypic stands of invasive or weed species. Observed point source or nonpoint source of nutrients may include but is not limited to: fertilized lawns, agricultural runoff, manure storage or spreading, concentrated stormwater runoff, or pet waste inputs.

29. Y N Is the wetland fringing deepwater habitat, a lake, or within a watercourse? If NO, enter "not applicable" for this function in the Summary Table and skip to Question 35 [remove from computation of Shoreline Protection function.] If YES, answer the following questions.

29. Guidance: Shoreline Wetlands. The Shoreline Protection function only applies to wetlands that lie at the fringe of lakes, deepwater habitats, and within creeks, streams, rivers, and other watercourses. Typically, these include lacustrine wetlands i.e. fringing lakes which are defined as being situated in a topographic depression; lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30 percent areal coverage; and greater than 20 acres in size or fringing deepwater habitats which are defined as less than 20 acres in size, but either greater than 6.6 feet deep at the deepest, or has a wave-formed shoreline³³. The wetland portion is typically the area that is less than 6.6 feet deep. Also included as shoreline wetlands are floodplain/riverine systems (i.e. wetlands present between the active river channel and river banks that may experience frequent water level fluctuations and/or erosive forces).

³² Wells et al., 1988.

³³ Cowardin, 1979

30. Enter the percent cover of rooted shoreline wetland vegetation³⁴.

_____ %

30. Guidance: Rooted Shoreline Vegetation. The erosive strength of waves and currents can be greatly dissipated by a dense vegetation cover including submerged macrophytes. The greater the vegetation density, the greater the shoreline protection. (High = Macrophyte cover in the wetland >50%; Medium = Macrophyte cover in the wetland is 10% - 50%; Low = Macrophyte cover in the wetland <10%.)

31. Enter the average wetland width in feet between the shoreline/streambank and deep water/stream³⁵:

_____ feet

31. Guidance: Wetland Width. Wetlands with wide stands of vegetation are more likely to stabilize sediments than those with narrow stands. Knutson et al. (1981) found that wetlands wider than 30 feet reduced wave energy by 88% while emergent wetlands less than 6 feet wide were relatively ineffective in wave buffering. Measure width starting from the deepwater edge up to the normal water's edge, not to include the shore area up out of the water itself (the shore-area wetland is considered in Question #34). (High = Wetland width >30 feet; Medium = Wetland width 10-30 feet; Low = Wetland width <10 feet).

32. Describe the emergent vegetation type and resistance within the shoreline wetland³⁶:

A = Dominance of emergent species with strong stems present all year and/or dense root mats in the wash zone (e.g., cattails, shrubs) that are resistant to erosive forces.

B = Presence of some emergent species with strong stems or dominance of weak-stemmed emergent species persisting most of the year and/or moderately dense root mats in the wash zone (e.g., bulrushes, grasses) that are resistant to erosive forces.

C = Presence of some weak-stemmed emergent species and/or no dense root mats in the wash zone (e.g., rushes).

32. Guidance: Emergent Vegetation. The erosive strength of waves and currents can be greatly dissipated by a dense, emergent vegetation cover. In addition, species with stronger stems will provide greater protection than weak-stemmed species. The greater the vegetation density, the greater the shoreline protection. Some of the more common species with potentially high value for shoreline anchoring include: sweetflag (*Acorus calamus*), speckled alder (*Alnus incana* ssp. *rugosa*), blue joint grass (*Calamagrostis canadensis*), sedges (*Carex* spp.), red-osier dogwood (*Cornus stolonifera*), spike rush (*Eleocharis palustris*), scouring rush (*Equisetum fluviatile*), rice cutgrass (*Leersia oryzoides*), switchgrass (*Panicum virgatum*), reed canary grass (*Phalaris arundinacea*), common reed (*Phragmites australis*), smartweeds (*Polygonum* spp.), pickerelweed (*Pontederia cordata*), cottonwood (*Populus deltoides*), arrowhead (*Sagittaria* spp.), willows (*Salix* spp.), bulrushes (*Scirpus* spp.), cordgrass (*Spartina pectinata*), and cattails (*Typha* spp.).

³⁴ Wells et al., 1988.

³⁵ Adamus et al., 1991.

³⁶ Wells, et al., 1988.

33. Describe the shoreline erosion potential at the site³⁷:

A = Strong wave action or water current (greatest wind fetch on a lake or outside river bend); frequent boat traffic and restrictions that funnel boats into narrow passages; sandy soils or evidence of erosion or slope failure.

B = Moderate wave action or water current (small lakes or large ponds); moderate boat traffic with some evidence or potential for erosion or slope failure.

C = Negligible erosive forces (little open water or wave action or slow-moving, straight river); minimal to no boat traffic or no-wake zone; no evidence of past erosion or slope failure.

33. Guidance: Shoreline Erosion Potential. Wetlands located in areas with strong currents and wave action have the greatest potential for protecting shoreline. Shorelines composed of sandy or erodible soils will benefit the most from shoreline wetland protection.

34. Describe the shoreline/streambank vegetation conditions up slope from the water level in relation to the ability to protect the bank from erosion or slope failure:

A = Lack of vegetation; regularly manicured, short-grass lawn.

B = Full vegetative cover composed of shrubs receiving only moderate maintenance or grasses/understory vegetation that is not manicured.

C = Deep-rooted vegetation not actively manicured (e.g., trees, shrubs and grasses), or rip-rap.

34. Guidance: Bank Protection Ability. The potential for erosion and/or slope failure of shoreline or streambank areas is also dependent on the land use and condition on the slope above the water level and on top of the bank. Bare soils or those with shallow rooted grasses that are manicured on a regular basis provide less protection than deep-rooted grasses allowed to grow naturally. For this question, consider that part of the wetland starting at the water's edge up to the upland edge, to encompass the shore area up out of the water itself (the water-level wetland is considered in Question #31).

- ~ **35. Y N Is the wetland known to be used recently by rare wildlife species or wildlife species that are state or federally listed?** If yes, wildlife habitat functional level rating = exceptional. (If Special Features, question J is answered, the functional level will also be exceptional)

35. Guidance: Rare Wildlife. Rare wildlife species include any of those listed in the or are federally listed. This question is meant to address local conditions rather than statewide priorities. Although consulting the Minnesota Natural Heritage Database or County Biological Survey (see Question #5) will be helpful to guide the assessment, local considerations of scarcity or abundance must be applied.

- ~ **36. Y N Is the wetland plant community scarce or rare within the watershed?** If the wetland community has a High quality rating from Question #2 and this question is yes, then Vegetation function is Exceptional.

36. Guidance: Rare Community. This question is meant to address local conditions rather than statewide priorities. Although consulting the Natural Heritage Database and County Biological Survey

³⁷ Wells et al., 1988.

(see Question #5) will be helpful to guide the assessment, local considerations of scarcity or abundance must be applied here.

37. For deep and shallow marshes or shallow open water wetland types (types 3, 4, and 5) select the cover category that best illustrates the interspersion of open water and emergent, submergent, or floating-leaved vegetation within the wetland (See Interspersion Diagram Figure 1³⁸, Appendix Fig. 1 or the database *image*).

Enter the cover category based on the diagram: _____

N/A = Not applicable for wetland types 1, 2, 6, 7, 8.

37. Guidance: Vegetation Interspersion³⁹. Wetlands that contain vegetation interspersed with open water are more likely to support notably greater on site diversity and/or abundance of fish and wildlife species. Those with very dense vegetation and no channels or open water areas are less likely to support this function. Vegetation interspersion is a measure of the amount of edge between vegetation and open water, which is valuable to wildlife. Cover categories 5 and 7 rate High; 3, 4, and 6 rate Medium; 1, 2, and 8 rate Low.

38. For wetlands having more than one vegetative community (see Question 1), indicate the interspersion category that best fits the wetland (see Appendix Fig. 2 or database version *Image*).

Category = _____. (Category 3=High, 2=Medium, 1=Low)

N/A = Only one vegetative community is present.

38. Guidance: Vegetative Interspersion. For wetlands that are characterized by multiple vegetative communities, the increased structural diversity and amount of edge associated with greater interspersion is generally positively correlated with wildlife habitat quality. Interspersion is a modification based on the Wells et al., 1988, Page 67, Interspersion Diagram, Golet et al., 1976. The figures shown in the appendix are examples of complexity, not meant to be exact representations of any individual site. Choose the one that most closely approximates the degree of interspersion at your site, regardless of structural differences. "Site," in some instances, may mean a portion of a larger basin, if that is how the assessment area has been defined from the start.

39. A healthy wetland will have detritus (vegetative litter) in several stages of decomposition. Describe the wetland condition⁴⁰:

A = The presence of litter layer in various stages of decomposition.

B = Some litter with apparent bare spots, or dense litter mat (e.g., reed canary grass mat).

C = No litter layer.

N/A = Deep marshes, shallow open water and bog communities.

³⁸ Wells et al., 1988; Adamus et al., 1991.

³⁹ Interspersion is based on Wells et al., 1988, Page 180 Interspersion Diagram

⁴⁰ Lee et al., 1997

39. Guidance: Wetland Detritus. Detritus or vegetative litter in various stages of decomposition is a sign of a healthy wetland. Detrital biomass impacts nutrient cycling processes and disturbance regime and thereby influences plant assemblages. Detritus maintains thermal regulation of rhizomes and propagules, and is essential to nutrient cycling. The integrity of the system's vegetation components supplies the bulk of the faunal habitat requirements. When assessing a site, consider that the amount of detritus will vary with the time of year; floodplain forests may show no litter after spring flood events, for example.

~ **40. Describe the relative interspersion of various wetlands in the vicinity of the assessment wetland⁴¹:**

A = The wetland occurs in a complex of wetlands of various types (general guideline: at least 3 wetlands within 0.5 miles of assessment wetland, at least one of which has a different dominant plant community than the assessment wetland); or the assessment wetland is the only wetland within a 2 mile radius.

B = Other wetlands of the same plant community as the assessment wetland are present within 0.5 miles.

C = No other wetlands are present within 0.5 miles of the assessment wetland but are present within 2 miles.

40. Guidance: Wetland Interspersion. This question is best determined using GIS (except in forested areas where wetlands smaller than one to three acres may not appear). This question uses a 0.5-mile radius and rates wetlands higher for having more wetland neighbors. However, research indicates that the critical radius varies by species⁴². Wetlands that are isolated in the landscape may provide the last refuge for wetland dependent plant and animal species in an otherwise upland or developed area.

41. Habitat value diminishes when fragmented by barriers, which restrict wildlife migration and movement. Describe barriers present between the wetland and other habitats⁴³:

A = No barriers or minimal barriers present; i.e. low traffic; uncurbed roads, low density housing (> 1 acre lots), golf courses, utility easements, or railroads.

B = Moderate barriers present; i.e. moderately traveled; curbed roads, moderate density housing (1/3 to 1 acre lots), residential golf courses, low dikes, row crops.

C = Large barriers present; i.e. 4-lane or wider, paved roads, parking lots, high-density residential (<1/3 acres), industrial and commercial development.

41. Guidance: Wildlife Barriers. This variable is defined as a measure of habitat fragmentation of the wetland relative to other wetlands and native plant communities to indicate the ecosystem connectivity. It identifies barriers to wildlife migration ranging from very small barriers such as unpaved roads and low-density housing to large hydrologic barriers such as regional canals and levied roads. Reference area will affect this rating: "other habitats" includes upland areas usable as wildlife resting or reproductive habitat. Because agricultural use can vary in intensity, use Best Professional Judgment to determine if cropland could be considered "habitat."

⁴¹ Wells et al., 1988; Adamus et al., 1991

⁴² Whited et al., 2000

⁴³ Rheinhardt et al., 1997

42. Amphibian breeding potential – hydroperiod (check one)

___ Adequate—the wetland is inundated long enough in most years to allow amphibians to successfully breed (Cowardin et al. water regimes A, C, F, H, G) (Score = 1.0)

___ Inadequate—the wetland is not inundated long enough in most years to allow amphibians to successfully breed (Cowardin et al. water regimes B, D, E, J) (Score = 0)

42. Guidance: Amphibian Breeding/Hydroperiod. Frogs, toads and salamanders reproduce at different times from late March to June, depending on the species⁴⁴. Early breeders (such as spring peepers, wood frogs, chorus frogs, salamanders) typically reproduce in shallow, seasonal wetlands. Green frogs and mink frogs reproduce in larger more permanent wetlands. For breeding to be successful, the wetland must remain inundated long enough for the larval stages to metamorphose into adults. This period varies depending on the species, but a rough guide is that the wetland should remain inundated at least through June 1 for the portion of the state south of I-94 and at least through June 15 north of I-94. This period of inundation will not accommodate all species, but is reasonably likely to ensure that the wetland is suitable for breeding by some amphibians.

The Cowardin et al. water regimes listed above are approximate indicators—more direct evidence of hydroperiod should be used when possible. Direct evidence of amphibian breeding **may** be an indication of a sufficient hydroperiod. Such evidence would include observations of frogs calling, egg masses in the water, presence of tadpoles or presence of young, newly metamorphosed frogs, toads or salamanders at the wetland. Note however, that some species are opportunistic and will lay eggs in temporary pools that will not remain inundated long enough for successful reproduction. Exercise caution when using this indicator.

43. Amphibian breeding potential – fish presence

A = The wetland is isolated so that predatory fish (e.g., bass, northern pike, walleye, bluegill, perch, etc...) are never present.

B = The wetland may occasionally be connected to other waters so that predatory fish may be present in some years.

C = The wetland is connected with a lake or river so that predatory fish are always present or the wetland is used for rearing of game fish.

43. Guidance: Amphibian Breeding/Predators. Optimal amphibian breeding habitat is characterized by a lack of predatory fish⁴⁵. These habitats are wetlands that winterkill, dry periodically, are periodically anoxic, and are not connected to waters bearing predatory fish. The wetland should not be used to rear bait or game fish. This question utilizes observable characteristics of the wetland to infer about the status of fish. Direct observation or knowledge about fish presence should be substituted where possible.

44. Amphibian and reptile overwintering habitat

A = The wetland is normally more than 1.5 meters deep (never or rarely winterkills).

B = The wetland is normally around 1 meter deep (may occasionally winterkill).

C = The wetland is normally less than 1 meter deep and often freezes to the bottom.

N/A = The wetland never or rarely contains standing water or is nearly always dry in winter.

⁴⁴ Oldfield and Moriarty, 1994

⁴⁵ Lannoo, 1998

44. Guidance: Amphibian Habitat. Wetlands that are deep and well oxygenated provide over-wintering habitat for leopard, green and mink frogs, as well as turtles⁴⁶. Evidence of over-wintering would be observations of migrations of frogs to the wetland in fall and away from the wetland in spring and basking turtles in the spring. Recent evidence of Blandings turtles overwintering in Type 6 wetlands may alter this assessment.

45. List any noteworthy wildlife species observed or in evidence (e.g., tracks, scat, nest/burrow, calls, viewer reports), including birds, mammals, reptiles, and amphibians. (*Note: This list is for documentation only and is not necessarily an indication of habitat quality.*)

46. Is the wetland contiguous or intermittently contiguous with a permanent waterbody or watercourse such that it may provide spawning/nursery habitat for native fish species? Choose the condition from the following list that best describes the wetland in relation to fish habitat:

Exceptional = The wetland is a known spawning habitat for native fish of high importance/interest or the wetland is part of or adjacent to a trout fishery as identified by the DNR.

A = The wetland is lacustrine/riverine or is contiguous with a permanent water body or watercourse and may provide spawning/nursery habitat, refuge for native fish species in adjacent lakes, rivers or streams, or provides shade to maintain water temperature in adjacent lakes, rivers or streams.

B = The wetland is intermittently connected to a permanent water body or watercourse that may support native fish populations as a result of colonization during flood events, or the wetland is isolated and supports native, non-game fish species.

C = The wetland is isolated from a permanent water body or watercourse or has exclusive, high carp populations, which cause degradation to the wetland.

N/A = None of the above. The wetland does not have standing water during most of the growing season. The site is not capable of supporting fish.

46. Guidance: Fish Habitat Quality. Generally, the value of a wetland for fish habitat is related to its connection with deepwater habitats. In the north central region, spawning habitat for warm water species can be an important function of a wetland, and northern pike are among the most valuable warm water species spawning in wetlands⁴⁷. Cold-water species are relatively rare and wetlands (according to traditional definition) do not provide habitat for spawning trout, but have an indirect effect through improving water quality⁴⁸.

Northern pike wetland spawning habitat will have several characteristics including: 1) A semi-permanent or permanent connection to a lake or stream that has a population of northern pike; 2) The wetland is vegetated primarily with reeds, grasses, or sedges; or secondarily with cattails, rushes, arrowhead, water lilies, submerged plants, and shrubs or lowland hardwoods with grass and low emergents; 3) The wetland is flooded during the early spring at least once every 3 years for at least 20 days and remains connected to the lake or stream during that time; 4) Lacustrine areas should have 4 to 8 acres of actual spawning area for each 100 littoral acres of lake⁴⁹; and 5) Shallow or deep marsh wetland spawning areas are typically located on the upstream side of the lake or stream⁵⁰.

⁴⁶ Oldfield and Moriarty, 1994

⁴⁷ Adamus et al., 1991.

⁴⁸ Adamus et al., 1991.

⁴⁹ MIDNR, 1981; Adamus et al., 1991.

⁵⁰ Personal communication, D. Ellison, MnDNR.

A wetland should be rated as having high value for fish if it provides spawning/nursery habitat, or refuge for *native* fish species in adjacent lakes, rivers or streams. Some isolated deep marshes may intermittently support populations of sunfish and northern pike as a result of colonization during flood events. Permanently flooded isolated wetlands that support native populations of minnows provide moderate value. Wetlands with exclusive, high carp populations provide low value for fish habitat because carp cause extreme degradation of the wetland. Isolated wetlands that are not permanently flooded do not generally support fish populations.

47. List any fish species observed or evidenced. *Note: This list is for documentation only and is not necessarily an indication of habitat quality* (database drop-down list: northern pike, perch, sunfish, bass, minnows, carp).

48. Y N Does the wetland provide a unique or rare educational, cultural, or recreational opportunity (e.g., located in an outdoor learning park focused on wetland study)? (If yes this function rates exceptional)

48. Guidance: Unique Opportunity.

The wetland must provide a rare or unique opportunity within the ecoregion, wetland comparison domain, or study area, such as a wetland associated with a school environmental program or public education institution (University of Minnesota's Cedar Creek, Landscape Arboretum's Spring Peeper Wetland), cultural experience (wild rice areas), or a pristine-reference site for another assessment tool⁵¹.

49. Is the wetland visible from vantage points such as: roads, waterways, trails, houses, and/or businesses?

A = The wetland is highly visible and can be seen from several public vantage points.

B = The wetland is somewhat visible and can be seen from a few vantage points.

C = Very limited visibility.

49. Guidance: Visibility. While dependent on accessibility, a wetland's functional level could be evaluated by the view it provides observers. Distinct contrast between the wetland and surrounding upland may increase its perceived importance. Multiple vantage points increase the likelihood and number of people that may view the wetland.

50. Y N Is the wetland in/near a city, town, or village so as to generate aesthetic/recreation/ educational/cultural use?

50. Guidance: Population Centers. Accessibility of the wetland is key to its aesthetic or educational appreciation. Thus, proximity to population centers may increase its perceived importance. However, proximity to population centers and locations in public areas may have associated noise and/or pollution factors that could degrade the aesthetic and educational functional level.

~ **51. Is any part of the wetland in public or conservation ownership?**

A = Completely contained within publicly owned land or entirely within a conservation easement.

B = Partially within publicly owned land or partially within a conservation easement.

C = Privately owned or not within a conservation easement.

⁵¹ Minnesota's Index of Biologic Integrity uses several wetlands as reference-standard sites for both high- and low-functioning sites.

51. Guidance: Public Ownership. Wetlands located on lands in public ownership inherently will provide open accessibility. Wetlands being on lands within a conservation easement provides some certainty that the wetlands will not be subject to impact pressures.

52. Does the public have access to the wetland from public roads or waterways?

A = Direct access through a public facility with an established parking area or boat access.

B = Cumbersome access from a public facility (i.e. no established trails to or near wetland) or no public parking or boat access available.

C = No public access available.

52. Guidance: Public Access. Accessibility of the wetland is key to its aesthetic or educational appreciation. Wetlands located on private lands are not likely to provide aesthetic or educational opportunities to the general public.

53. What are the obvious human influences on the wetland itself, such as:

A = No structures, pollution, trash, or other alteration present in the wetland.

B = Wetland only moderately disturbed by structures, pollution, trash, or alteration.

C = Wetland has signs of extensive pollution/trash, severe vegetative alteration, or multiple structures.

53. Guidance: Human Disturbances in Wetland. Wetlands subject to direct human disturbances/impacts are not likely to provide aesthetically pleasing natural environments.

54. What are the obvious human influences on the viewshed of the wetland, such as:

A = No or minimal buildings, roads, or altered land uses surrounding the wetland.

B = Surrounding area composed of mostly open space with a few buildings or roads, low intensity agriculture.

C = Wetland surrounded by residential, other intensively developed land uses, or intensive agriculture.

54. Guidance: Wetland Viewshed. This question requires a judgment as to the dominant land use visible at the primary viewing locations within the wetland. This method assumes that the most appealing views of wetlands are from other areas of natural beauty such as an upland forest⁵². Wetlands occurring in densely developed urban areas equate with lower ratings. Excessive noise from nearby highway or factories could be considered an intrusive human influence.

55. Does the wetland and buffer area provide a spatial buffer between developed areas?

A = Spatial buffer more than 500 feet wide.

B = Spatial buffer between developed areas less than 500 feet wide.

C = Does not provide a spatial buffer—no developed land near the wetland.

55. Guidance: Spatial Buffer. Views of open water and open space in general are considered to be

⁵² Ammann and Stone, 1991.

aesthetically appealing⁵³. Distinct contrast between the wetland and surrounding upland may increase its perceived importance. Expansive wetlands and associated buffer areas provide open space and a feeling of a natural environment while reducing the visibility of adjacent human development. If the wetland is surrounded by undeveloped land within its immediate viewshed, the wetland has little value as a spatial buffer. Developed lands across any portion of the wetland will benefit from the spatial buffering of the wetland. Spatial buffer is measured from the edge of the developed area, across the wetland, to the edge of the next developed area. The edge may be considered the end of manicured lawn or golf course, sidewalk or paved area, or up to a wall or fence.

56. Is the wetland and immediately adjacent area assumed to be currently used for (or does it have the potential to be used for) recreational activities such as the following: education, cultural, scientific study, hiking, biking, skiing, hunting, fishing, trapping, boating, canoeing, wildlife observation, exploration, play, photography, or food harvest.

A = Evidence or a high probability for multiple recreational uses.

B = Evidence of or a high probability for a few recreational uses.

C = Low probability or potential for recreational use

56. Guidance: Activities. Wetlands can provide recreational and educational opportunities that enhance their value. Use Best Professional Judgment to decide the likelihood and value of multiple uses from the list above, or of others not noted.

57. Is the vegetation or hydrology currently controlled or modified to sustain a commercial product?

A = Highly Sustainable Use: commercial use of the wetland does not permanently alter the wetland characteristics.

B = Somewhat Sustainable Use: wetland characteristics have been altered but vegetation is still hydrophytic.

C = Hydrology dramatically altered to produce a commercial product such as row crops or peat.

N/A = This wetland is not used for commercial products.

57. Guidance: Commercial Quality. Is the wetland being used for a commercial product that does not sustain the wetland? If so, consider the nature of the use. Sustainable uses of the wetland would not require modifying a natural wetland. Products in this category would include collection of botanical products, wet native grass seed, floral decorations, wild rice, black spruce, white cedar, and tamarack. Other sustainable uses may require modification of the natural hydrology, such as for wetland-dependent crops that rely on the wetland hydrology for part of their life cycle (rice, cranberries). Haying and grazing are less intrusive agricultural activities utilized more or less casually when hydrologic conditions permit; light pasture and occasional haying might be considered highly sustainable [A], whereas heavier use would result in a rating of [B]. Row crops such as corn and soybeans can be planted in some wetlands after spring flooding has ceased and still have adequate time to grow to maturity. Like peat-mining, cropping is an unsustainable use of the wetland as it results in severe alterations of wetland characteristics (soil, vegetation, hydrology).

⁵³ Ammann and Stone, 1991.

The following questions (#58-63) relate to the movement of groundwater into and out of the wetland. Base your answers on the best available information. Classification of a given site as a primarily recharge or discharge wetland will be based on how a majority of the questions are answered and does not offer a definitive result as to the actual movement of groundwater in the assessment area. When the primary hydrology comes from ground-water, wetlands are labeled discharge, whereas recharge wetlands are those whose hydrology is primarily supported by surface-water that then seeps into a ground-water system.

~ **58. Describe the soils within the wetland⁵⁴:**

Recharge = Mineral soils with a high organic content (all soils not included in discharge system).

Discharge = Organic/peat soils, formed due to more continuous wetness associated with a ground water discharge system

58. Guidance: Wetland Soils. Wetlands with mineral hydric soils typically represent drier hydrologic regimes where groundwater recharge is more likely (i.e. saturated, seasonally flooded, and temporarily flooded) where the wetness does not significantly limit oxidation of organic materials. Groundwater discharge wetlands represent more stable and permanent hydrologic regimes where excessive wetness limits the oxidation of organic matter resulting in the accumulation of peat and/or muck. In addition, coarser-grained mineral hydric soils may have higher permeabilities allowing groundwater recharge, while histosols generally have low permeabilities, reducing groundwater discharge. Disturbed soils in excavated wetlands or stormwater ponds are subject to best professional judgement for this question.

~ **59. Describe the land use/runoff characteristics in the local subwatershed upstream of the wetland⁵⁵:**

Recharge = Land is primarily developed to high-density residential, commercial, industrial and road land uses (equivalent to lots 1/4 acre or smaller) indicating impervious surfaces (>38%), which result in more runoff to wetlands and lowered water tables creating a gradient for recharge under wetlands.

Discharge = Upland watershed primarily undeveloped or with low to moderate density residential development (i.e. lots larger than 1/4 acre) with low percentage of impervious surfaces (<38%) so upland recharge (to groundwater) and higher water table will be more likely to contribute discharge to wetlands.

59. Guidance: Land Use/Runoff. The local subwatershed boundary, smaller still than the DNR minor watershed, is available from the local Soil and Water Conservation District office. Watersheds with extensive paved surfaces, topographic disruptions, and the presence of wells are associated with human development that lowers the potentiometric contours. Lowered or diversified potentiometric contours enhance the likelihood of recharge, not discharge⁵⁶. Wetlands with unpaved watersheds are more likely to allow groundwater discharge to occur.

⁵⁴ R.P. Novitzki, 1998 personal communication in MnRAM 2.0; Magee and Garrett, 1998.

⁵⁵ Adamus et al., 1991.

⁵⁶ Fetter, 1980.

~ **60. Indicate conditions that best fit the wetland based on wetland size and the hydrologic properties of the upland soils within 500 feet of the wetland⁵⁷.**

Recharge = Wetland is <200 acres and surrounding soils (within 500 feet) are primarily in the C or D hydrologic groups.

Discharge = Wetland is >200 acres in size or wetland is <200 acres and the surrounding soils (within 500 feet) are primarily in the A or B hydrologic groups.

60. Guidance: Wetland Size and Surrounding Soils. The size or area of the wetland and the soil texture in the surrounding upland are two factors controlling the wetland's water budget. A large wetland with a proportionately small watershed may indicate subsidization of its water budget by groundwater discharge. The probability of groundwater discharge occurring may thus increase as the wetland/watershed ratio increases. The wetland size also controls the amount of recharge potential. The more fine-grained the soil texture in the surrounding uplands, the more water will flow to the wetland via overland flow and less likely water is to flow to the wetland via groundwater discharge. Williams (1968) observed that a small wetland situated in a large watershed favored groundwater recharge, because surface water inflow from a large watershed was sufficient to create a water mound conducive to recharge. Sandy and loamy upland soils allow more infiltration of precipitation than clayey soils. The infiltrated water will percolate downward vertically and/or flow laterally becoming groundwater discharge where wetlands intersect the water table.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms. The four hydrologic soil groups are as follows⁵⁸:

Runoff Potential (lower → ← higher)	Soil Group	Infiltration rate	Depth and drainage characteristics	Water Transmission Rate
	A	High	Deep, very well drained to excessively drained sands or gravelly sands.	high
	B	Moderate	Moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture.	moderate
	C	Slow	Soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture.	slow
	D	Very slow	Clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material.	very slow
	A/D B/D C/D	The first letter (for drained areas) should be used for the determination of recharge/discharge; if unsure, the second letter (D) would be used for undrained areas and therefore put it into the recharge category.		

61. Indicate the hydroperiod of the wetland⁵⁹:

⁵⁷ Adamus et al., 1991; Magee and Garrett, 1998.

⁵⁸ USDA Natural Resources Conservation Service Hennepin County Soil Survey – Issued 2004.

⁵⁹ Adamus et al., 1991; Lee et al., 1997.

Recharge = Cowardin et al. water regimes: A, C, D, E, and J (i.e. temporarily flooded, seasonally flooded, seasonally flooded/well drained, seasonally saturated, and intermittently flooded as well as wetlands with the B regime (saturated) that: (1) are on flats; and/or (2) are acid bogs (indicates precipitation-driven systems).

Discharge = Cowardin et al. water regimes: F, G, H, (i.e. semi-permanently flooded, intermittently exposed, and permanently flooded), as well as wetlands with the B water regime (saturated) that: (1) consist of sloping organic soils; (2) are on a river valley terrace or at the toe of a bluff or beach ridge, etc.; or (3) have any observed springs or seepages.

61. Guidance: Hydroperiod. Permanently flooded, semi-permanently flooded, and saturated water regimes, especially in regions having high evaporation rates, often indicate groundwater discharge to a wetland. Exceptions are saturated wetlands on flats and/or bogs that are precipitation-driven systems. Wetlands that are seasonally- or temporarily-flooded are more likely to recharge groundwater.

62. Describe the inlet/outlet configuration that best fits the wetland⁶⁰:

Recharge = No outlet or restricted outlet in natural wetlands and lacustrine wetlands.

Discharge = Perennial outlet but no perennial or intermittent stream inlet; perennial stream riverine or floodplain wetland.

62. Guidance: Inlet/Outlet for Groundwater. A wetland with a permanent stream inlet but no permanent outlet is more likely to recharge groundwater than one with an outlet. Several factors support this ranking. First, a higher hydraulic gradient will likely be present in an area with no outlet, especially if an inlet is present. Second, the longer water is retained in an area, the greater the opportunity for it to percolate through the substrate. Third, wetlands without outlets generally experience more water-level fluctuations, resulting in inundation of unsaturated soils. Finally, lack of an outlet suggests that water is being lost either through recharge or evapotranspiration, especially if an inlet is present. A wetland with a permanent outlet and no inlet is more likely to discharge groundwater than one with other combinations of inlets and outlets. Continuous discharge of water (i.e. permanent outlet) without surface water feeding the wetland through an inlet suggests an internal source of groundwater (e.g., springs or seeps). Flow-through wetlands would be considered discharge wetlands for the purposes of this question.

~ 63. Characterize the topographic relief surrounding the wetland⁶¹:

Recharge = Land slopes away from (below) the wetland (wetland is elevated in the subwatershed).

Discharge = Topography characterized by a downslope toward the wetland around the majority of the wetland (wetland is found lower in the subwatershed).

63. Guidance: Topographic Relief. This question refers to landscape-level topography at a large, subwatershed scale. Groundwater discharge is more likely to occur in areas where the topographic relief is characterized by a sharp downslope toward the wetland (i.e. wetland is located at the toe of a slope). Groundwater recharge is more likely in wetlands where the topographic relief is characterized by a sharp downslope away from most of the wetland. The slope of the water table with respect to the wetland influences the hydraulic gradient for groundwater movement. The water table usually slopes roughly parallel to the land surface topography. Thus, when local topography slopes sharply toward the

⁶⁰ Adamus et al., 1991; Lee et al., 1997.

⁶¹ Adamus et al., 1991.

(Issued 9/15/10)

wetland, the result is typically a hydraulic gradient favorable for groundwater discharge.

END OF PRIMARY QUESTION SET FOR MnRAM 3.1

Optional Evaluation Information

64. Y N Does the wetland have the potential for hydrologic restoration without flooding: roads, houses, septic systems, golf courses or other permanent infrastructure (active agricultural fields are acceptable uses within potential restoration areas) within the restoration area? If yes, answer the following questions. If no, skip to question 71.

64. Guidance: Hydrologic Restoration Potential. The purpose of this question is to identify opportunities for restoration of drained or partially drained wetlands. Generally, this question applies to wetlands that have been ditched or tiled for agricultural or other purposes. Some drained or partially drained wetlands will not have the potential for restoration because of altered land uses that rely on continued drainage of surface and/or subsurface water. It is important to look at land uses upstream of the drained wetland to determine if any of the features mentioned could be flooded by plugging a ditch, breaking drain tiles or creating an impoundment.

65. Indicate the number of landowners that would be affected by the wetland restoration project:

- Completely within public ownership
- 1
- 2
- 3 or more

65. Guidance: Landowners. The number of landowners of the drained or partially drained wetland and any obvious upstream areas that would be flooded by hydrologic restoration of the wetland directly affects the feasibility of a restoration project. Typically, as the number of private owners of a potential restoration site goes up the project becomes more complex and the probability of success is reduced due to conflicting desires among the landowners. All public=Exceptional, 1=High, 2=Medium, 3 or more=Low.

~ **66. Enter the existing wetland area and estimated size of the total wetland if effectively drained or filled areas were restored (not including any buffer area).** Two characteristics will be computed from the following information: 1) total restored wetland size, and 2) percentage of historic wetland effectively drained.

Programming the overall restoration potential will assign the rank based on size.

- A. Size of existing wetland (acres) _____ (should be the same as Question #10)
- B. Total wetland including restorable and existing wetland (acres) _____
- C. Calculated potential new wetland area (acres) _____

In the database, enter this at the General Information tab (first screen).
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66. Guidance: Wetland Restoration Area. The size of the potential wetland restoration will be determined partially by the extent of historic hydric soils mapped on the site, but must also take into consideration upstream land uses, current land uses on the site, methods of hydrologic alteration that have occurred, and the current topography of the site. Restoring the natural hydrology to partially drained wetlands will restore the historic wetland type. Restoration of existing wetlands that had some ditching or tiling that did not effectively drain the entire wetland may result in some new wetland and some hydrologically restored wetland. Some wetland laws may allow for wetland replacement credit for hydrologically restored wetlands as well as restoration of drained wetlands. Two ratings will be determined for this question;

- 1) **Total restored wetland size (acres):** (High >10 acres, Medium = 2 to 10 ac, or Low = less than 2 ac.)
- 2) **Percent of historic wetland effectively drained:** (High = >60%, Medium = 20 - 60%, or Low = < 20%)

67. Enter the average width of naturalized upland buffer that could potentially be established around the restored wetland:

_____ feet (High = more than >50' around the potential wetland restoration area;
Medium = between 25' and 50' around the potential wetland restoration area;
Low = less than <25' around the potential wetland restoration area)

67. Guidance: Restorable Buffer Width. Upland buffer protects wetland function.

68. Rate the potential ease of wetland restoration:

- A = Break tile line and/or plug ditch, discontinue pumping.
- B = Break multiple tile lines and/or ditch plugs.
- C = Diking, berming, excavation or grading.

68. Guidance: Restoration Ease. The easiest wetlands to restore are those that were drained by a single ditch or drain tile. Restoration of those wetlands will typically involve simply plugging the ditch or breaking the tile line. The most difficult situation for creating wetlands is by impoundment or excavation in uplands. This involves much more uncertainty and greater cost.

69. Indicate the type of hydrologic alteration:

- _____ Ditching
- _____ Drain Tiles
- _____ Ground Water Pumping
- _____ Lowered Outlet Elevation
- _____ Watershed Diversion
- _____ Filling

69. Guidance: Hydrologic Alteration. Alterations may include ditching or tiling which is typical in agricultural settings. Also important are ground water pumping activities that can lower local ground water levels and drain wetlands (i.e. dewatering for quarries, underground construction, or utility construction; ground water pumping for residential, commercial or municipal water use). In metro areas, the natural wetland outlet elevation may be lowered by the construction of an outlet structure (i.e. weir, culvert, lowered overland outflow elevation). Development activities occasionally result in the diversion of drainage away from a wetland, which can change the natural hydrology. This information is not used in calculations.

70. Indicate the potential restoration wetland classification according to Circular 39 (USFWS, 1956): Type 1, 2, 3, 4, 5, 6, 7, or 8. (Informational purposes only.)

71. The susceptibility of the wetland to degradation from stormwater input: wetland type classification (Question #1, Community Type and Question #3, Vegetative Diversity/Integrity) will be utilized to determine the best fit to the following categories based on the most sensitive, dominant wetland community:

Exceptional = Sedge meadows, open and coniferous bogs, calcareous fens, low prairies, wet to wet mesic prairies, coniferous swamps, lowland hardwood swamps, or seasonally flooded basins.

A = Shrub-carrs, alder thickets, diverse fresh wet meadows dominated by native species, diverse shallow and deep marshes and diverse shallow, open water communities.

B = Floodplain forests, fresh wet meadows dominated by reed canary grass, shallow and deep marshes dominated by cattail, reed canary grass, giant reed or purple loosestrife, and shallow, open water communities with moderate to low diversity.

C = Gravel pits, cultivated hydric soils, or dredge/fill disposal sites.

71. Guidance: Stormwater Sensitivity. Guidelines are taken from State of Minnesota, 1997, Section IV, Wetland Susceptibility.

72. The sustainability of the wetland with regard to stormwater treatment prior to discharge into the wetland. (This rating uses the calculated outcome from the Wetland Water Quality Protection Function (H, M, or L) and applies it as follows):

A = No additional stormwater treatment needed.

B = Additional stormwater nutrient removal needed.

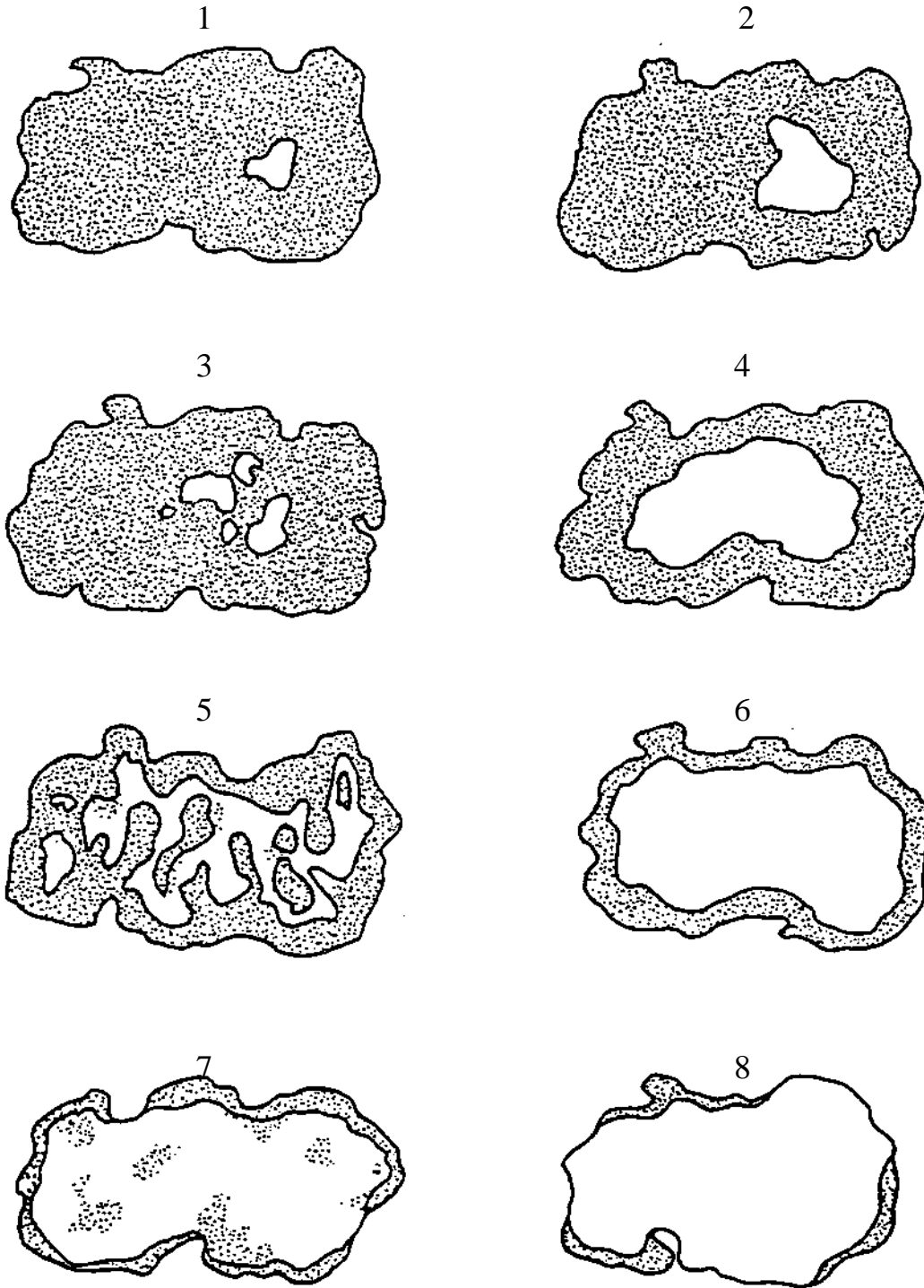
C = Additional sedimentation and nutrient removal needed.

72. Guidance: Nutrient Loading. Wetlands that receive untreated, directed stormwater containing sediment and nutrients will not be as sustainable as in a native landscape. Typically, wetlands receiving stormwater treated to approximately NURP standards will have a higher likelihood of sustainability. Wetlands receiving stormwater with just sediment removal will be subject to nutrient loading and excessive plant growth.

Appendix 1 – Figure 1

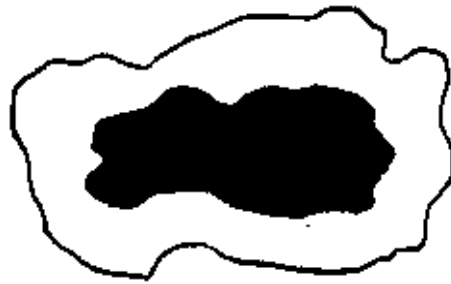
Open Water Types

White areas indicate open water (including floating and submerged plants). Stippled areas indicate emergents, shrubs, and trees.

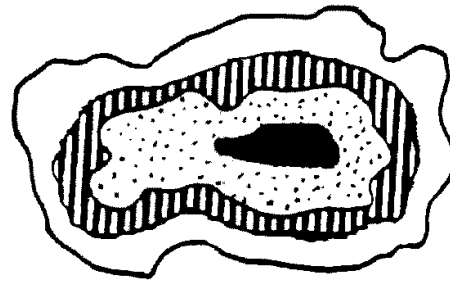


Appendix 2 – Figure 2

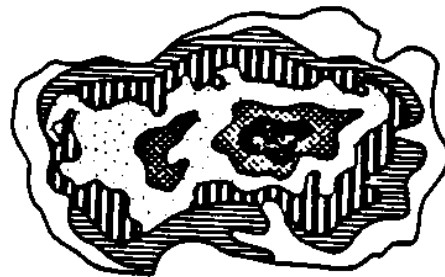
Source: Adapted from Golet, 1976



INTERSPERSION CATEGORY 1



INTERSPERSION CATEGORY 2



INTERSPERSION CATEGORY 3

INTERSPERSION CATEGORIES OF VEGETATIVE TYPES ADAPTED FROM GOLET, 1976

The figures shown here are examples of complexity, not meant to be exact representations of any individual site. Choose one that most closely approximates the degree of interspersion at your site, regardless of structural differences.