MICHIGAN RAPID ASSESSMENT METHOD FOR WETLANDS

MiRAM Version 2.1

User's Manual

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Michigan Department of Natural Resources and Environment

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Chapter I: Introduction and MiRAM Development

Introduction and Background

In Michigan, the Department of Natural Resources and Environment (DNRE) has the responsibility to review permit applications for activities proposed within wetland areas regulated under the authority of Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). In addition, Michigan has assumed Section 404 authority of the Federal Clean Water Act (CWA) over most wetlands located inland of the Great Lakes, with all remaining wetlands regulated jointly by the DNRE and the United States Army Corps of Engineers (USACE). Both Part 303 and the CWA establish criteria for evaluating wetland condition (integrity) and the ecological functions and societal values of wetlands. The Michigan Rapid Assessment Method for Wetlands (MiRAM) evaluates the wetland's "functional value," which includes a wetland's ecological condition (integrity) and its potential to provide ecological and societal services (functions and values). This manual is intended to provide general guidance to DNRE staff and other wetland professionals in assessing a wetland's "functional value" using the MiRAM.

Due to statutory deadlines, DNRE field staff has limited time during the review of permit applications to fully document a wetland's functional value. Similarly, wetland consultants and other professionals typically document a wetland's functional value during a single site inspection, regardless of season or weather conditions. Documentation of wetland conditions for both DNRE field staff and many consultants is typically limited to a list of dominant plants, a general description of wetland community types, and a short evaluation of potential assumed functions (e.g., a wetland within a floodplain is typically assumed to have flood control functions). Although minimal documentation may be adequate for review of projects having minor ecological impacts, review of projects with potentially significant ecological impacts requires greater evaluation and documentation.

One of the goals in developing the MiRAM is to set a standard for documenting the functional value of wetlands regardless of wetland type or location. To ensure proper evaluation, MiRAM requires that the users have a thorough understanding of Michigan's ecology, wetland diversity, general habitats and landscapes. The MiRAM evaluator should be able to correctly identify the majority of plant species, basic wetland community types (e.g., emergent marsh, deciduous swamp, etc.), and be proficient at using a dichotomous key to determine the presence of a rare wetland community type. Use of the MiRAM requires basic knowledge of the fish and wildlife species that live and breed in wetlands and the ability to evaluate whether a wetland provides habitat for such species. In addition, the Evaluator should be knowledgeable of wetland identification and delineation methods used in Michigan. The MiRAM does not require that the Evaluator be an expert in field botany, although the Evaluator must be able to identify dominant plant species and highly-invasive species. The Evaluator should be familiar with the concept of "cover" and how to determine percent cover within a plant community. In general, persons trained to delineate wetlands in accordance with the *1987 Army Corps of Engineers Wetlands Delineation Manual* (hereafter *Corps Manual*) will typically have the necessary skills to use the MiRAM.

The MiRAM is not intended to modify the current regulatory process, but to aid in the permit application development and review phases. Typically, Michigan's regulatory process includes the following steps: wetland delineation; project planning; permit application; permit application review; and permit issuance, modification or denial. It is envisioned that MiRAM will be used by wetland professionals in project planning and development of permit applications and by DNRE field staff in the review of permit applications. Although use of MiRAM is not required by Part 303 or the CWA, it is a tool to aid in assessing wetland functional value. The MiRAM can provide supplemental information within the existing regulatory process by providing additional ecological information during the development and review of permit applications. MiRAM was developed to assess most wetland functions and values identified in Part 303. However, MiRAM is not a tool for determining if a project is "permittable" or not. As outlined in Part 303, among other criteria, a permit applicant must provide a detailed analysis of feasible and prudent alternatives and minimization of wetland impacts in addition to reviewing wetland functions and values. Therefore, the score obtained in the MiRAM evaluation cannot be used as the sole factor in determining whether a wetland fill should be permitted. In cases where the DNRE has determined that no feasible and prudent alternative exists that minimizes wetland impacts, the MiRAM can be used to provide supplemental information in regard to the extent and importance of the wetlands functions and values. The MiRAM is a tool to assess functions and values of wetlands and is different from a determination of whether a particular location *is* a wetland (i.e., jurisdictional wetland). In some instances, a wetland's jurisdictional boundary (i.e., delineated boundary) may be different than the MiRAM Wetland Evaluation Boundary.

The MiRAM is a rating system meant for comparing a wetland's functional value to other wetlands in Michigan, regardless of ecological type. The MiRAM is not intended to replace more detailed quantitative measures of ecosystem function, such as Indices of Biological Integrity (IBI), Floristic Quality Assessments (FQA) or other detailed ecological studies.

This manual is intended to explain the underlying scientific rationale for the MiRAM, provide a detailed explanation and examples for the Narrative and Quantitative Rating metrics, and aid in consistent use of the MiRAM. Although one of the goals in developing the MiRAM has been to reduce inconsistencies between users, it is expected that there will be a degree of variation in the MiRAM scores between users, due to varied levels of ecological training and understanding. We are confident that any dispute in MiRAM scores can be resolved by applying basic ecological principles to any disputed metrics.

The most recent version of the *MiRAM User's Manual* and evaluation forms are posted at: **www.michigan.gov/wetlands**

Development of the MiRAM Narrative Rating and Quantitative Rating Criteria

Development of the MiRAM included review of existing wetland assessment methods from across the United States. Because of its wide acceptance in the Upper Midwest, the Ohio Rapid Assessment Method (ORAM) Version 5.0 (Mack 2001) was chosen as the most appropriate template for initial development of the MiRAM. In addition to ORAM, portions of the Washington State Wetland Rating System (Hruby and McMillian 1993, Hruby 2004) and the Minnesota Routine Assessment Method (Minnesota Board of Water and Soil Resources 2007) were adopted and modified for use within the MiRAM. The ORAM Narrative Rating and Quantitative Rating metrics were modified to address the range of wetland sizes, configurations, and ecological types present throughout Michigan.

The initial step of the MiRAM is the proper identification of the Wetland Evaluation Area (also referred to as "Wetland" in this document) using the MiRAM Boundary Guidelines in Chapter III. The MiRAM evaluation contains two rating systems, the Narrative Rating (Chapter V) and the Quantitative Rating (Chapter VI). First, the Evaluator is required to complete the Narrative Rating, which relies on accurate identification of several types of wetlands with exceptional ecological value, which automatically rates the Wetland as high functional value. If the Wetland is not identified as having high functional value by the Narrative Rating, the Evaluator must complete the Quantitative Rating. For data collection purposes, those Wetlands rated as high functional value in the Narrative Rating can be scored using the Quantitative Rating, but these wetlands will be considered to have high functional value regardless of the results of the Quantitative Rating.

The Quantitative Rating is a series of metrics regarding the Wetland. It is designed to provide a numerical score that reflects the total functional value of a wetland, which includes a wetland's ecological condition (integrity) and its potential to provide ecological and societal services (functions and values).

Michigan wetland laws and rules exist to guide and control regulatory decisions pertaining to Michigan's wetlands. Although the development of MiRAM metrics has greatly benefited from nearly a decade of evolution and testing and the development of ORAM, Part 303 provides the framework for all metrics used in the MiRAM. The functions and values recognized in Part 303 are addressed throughout the Narrative and Quantitative Ratings, with many of the criteria addressed in multiple metrics. Table 1 outlines Part 303 functions and values and the MiRAM submetric(s) that address each. There has also been a significant effort in the development of the MiRAM to link all metrics to peer-reviewed, scientific literature.

Table 1. Functions and values recognized in Part 303 and associated MiRAM Quantitative Rating submetrics. A mark of "X" denotes an association between the MiRAM submetric and Part 303 review criteria and wetland function.

	Part 303 Wetland Functions and Values							
MiRAM Submetric	**Flood and Stormwater Control**	**Protection of Subsurface Water Resources**	**Pollution Treatment and Erosion Control**	**Ecological: Wildlife & Fish Habitat, Food Cycles**	**Scenic, Recreational, Cultural**	**Wetland Size**	**Amount of Remaining Wetland in General Area**	**Proximity to any Waterway**
1a. Wetland Size	X	X	X	X	X	X		
1b. Wetland Scarcity	X	X	X		X		X	
2a. Average Buffer Width around the Wetland	X	X	X	X	X			
2b. Intensity of Surrounding Land Use				X	X		X	
3a. Sources of Water	X	X	X	X	X			X
3b. Connectivity	X	X	X	X	X			X
3c. Duration of Inundation/Saturation	X	X	X	X	X			X
3d. Alterations to Natural Hydrologic Regime	X	X	X	X	X	X	X	
4a. Substrate/Soil Disturbance	X	X	X	X	X			
4b. Habitat Alteration				X	X			
4c. Habitat Structure Development				X	X			
5a. High Ecological Value				X	X			
5b. Forested Wetland	X	X	X	X	X			
5c. Urban/Suburban Wetland	X		X	X	X		X	
5d. Low-Quality Wetland	X	X	X	X	X	X		X
6a. Wetland Vegetation Components		X	X	X	X			
6b. Open Water Component	X	X	X	X	X			X
6c. Coverage of Highly-Invasive Plant Species	X			X	X			
6d. Horizontal (Plan View) Interspersion		X	X	X	X			
6e. Habitat Features	X	X	X	X	X	X	X	
7. Scenic, Recreational, and Cultural Value					X			

Chapter II: How to Use the MiRAM

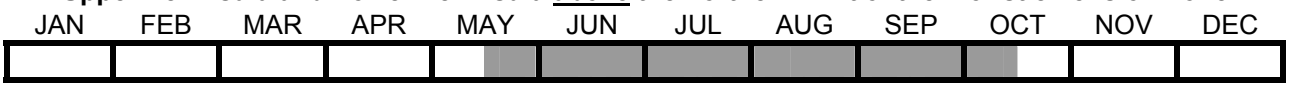
MiRAM evaluations should be performed after the start of the growing season and prior to the first vegetation (i.e., forbs) killing frost. This time period varies throughout Michigan, from approximately May through October, depending on geographic location. For a particular Michigan county, growing season begin and end dates may be approximated by the median dates (i.e., 5 years in 10 or 50 percent probability) of 28°F (−2.2°C) air temperatures in spring and fall, based on long-term records gathered at National Weather Service meteorological stations (USACE 2005). These dates are reported in WETS tables available from the Natural Resources Conservation Service (NRCS) National Water and Climate Center (http://www.wcc.nrcs.usda.gov/climate/wetlands.html).

The chart below indicates the approximate timeframes on a regional basis in Michigan when it is expected that the MiRAM can be effectively used. The most accurate MiRAM evaluations will be obtained when the majority of herbaceous plants can be correctly identified (i.e., mid to late growing season). However, in instances where the MiRAM is performed outside of the growing season, 10 points should be added to the Quantitative Rating score, and in some instances, a follow-up inspection during the growing season may be necessary, especially in sites where an accurate evaluation is necessary. **The MiRAM should never be used during times of snow cover (i.e., the ground surface must be visible)**. Additional problem situations (e.g., flooding, drought) are further discussed in Chapter VII.

Approximate MiRAM Season Chart

Lower Peninsula <u>below</u> the northern limit of the Floristic Tension Zone

Upper Peninsula and Lower Peninsula <u>above</u> the northern limit of the Floristic Tension Zone



The time necessary to conduct a MiRAM evaluation of a particular wetland will vary from approximately one hour to several hours, depending upon wetland size and complexity. The MiRAM Quantitative evaluation includes an initial in-office review followed by an on-site review of the Wetland. The following are the steps involved in the Quantitative Rating process.

Steps to a MiRAM Wetland Evaluation:

In-Office Review:

1. Obtain aerial photographs, National Wetland Inventory (NWI) maps, United States Geological Survey Topographic maps, NRCS Soil Survey maps and data, and other useful resource information.
2. Using all the available resource information and any on-site delineations, determine the approximate MiRAM Wetland, following the guidelines in Chapter III of this manual.
3. Complete the MiRAM Evaluation Background Information form.

On-Site Review:

4. Walk the entire Wetland and complete the Field Datasheet (modification of the MiRAM Boundary may be necessary based on field observations).
5. Complete the Narrative Rating (if the Wetland is identified as high functional value, the Quantitative Rating does not need to be completed).
6. Complete the Quantitative Rating. Carefully follow the instructions listed for each metric and submetric. *Failure to properly consider all Quantitative Rating metrics and submetrics may result in an incorrect evaluation.*
7. Complete the MiRAM Summary.

Chapter III: MiRAM Boundary Determination Guidelines

The MiRAM Boundary, which encompasses the Wetland, can be determined after accurately identifying the Proposed Project Site. The Proposed Project Site can be any point of interest, including, but not limited to, the location of a proposed impact, use or specific interest/concern. Examples of a Proposed Project Site include sites of proposed residential or commercial development construction, corridors where utility construction/maintenance will occur, etc. For non-impact (or very low impact) activities, such as scientific studies, the Proposed Project Site will typically be the location within a wetland where the study will commence.

Prior to field inspection, the MiRAM Boundary should be preliminarily identified using current remote sensing technologies and Geographic Information System tools to ensure consideration of all existing landscape features. During field inspection the Evaluator should attempt to gain access to the entire Wetland. If the entire Wetland cannot be accessed, the Evaluator should note on the field datasheet the approximate percentage of the Wetland reviewed.

Wetland connectivity and size are the primary criteria used to determine the location of a MiRAM Boundary. Often, a MiRAM Boundary will be identical to a jurisdictional wetland delineation boundary. However, for wetlands within a complex, wetlands adjacent to large bodies of water or wetlands greater than 50 acres, utilize the guidelines described on the following pages to properly determine the MiRAM Boundary. Use of these guidelines is mandatory to ensure consistency among Evaluators.

A wetland may not fall neatly into any one of the situations presented within the following guidelines. In these instances the Evaluator should utilize a combination of applicable guidelines. Property lines and political boundaries should *never* be used to determine MiRAM Boundaries. Artificial structures, such as roads and railroad embankments, should generally *not* be used to establish MiRAM Boundaries unless the feature exceeds an average width of 100 feet.

Difficult or Unusual Circumstances

For difficult or unusual circumstances not covered in the following guidelines and/or where the Evaluator is unsure of how to properly determine a MiRAM Boundary, it is recommended that the Evaluator contact the DNRE, Water Resource Division, Wetlands Program staff for guidance.

The 100-Foot Guidelines

(The "X" shown on the following diagrams represents the Proposed Project Site. Shading represents the Wetland Evaluation Area, encompassed by the MiRAM Boundary.)

1) Substantial Upland Break (Width Exceeding 100 feet) see figure 1.

- A MiRAM Boundary shall be placed wherever a substantial (exceeding 100 feet wide) upland break separates existing wetland areas.
- A MiRAM Boundary shall be placed for roadways exceeding an average width of 100 feet, such as multi-lane boulevards, freeways, and multi-track railroad grades.
- For situations involving areas of numerous small wetlands within a wetland complex (mosaic including narrow upland areas), all wetlands within 100 feet of each other should be included in the Wetland Evaluation Area.

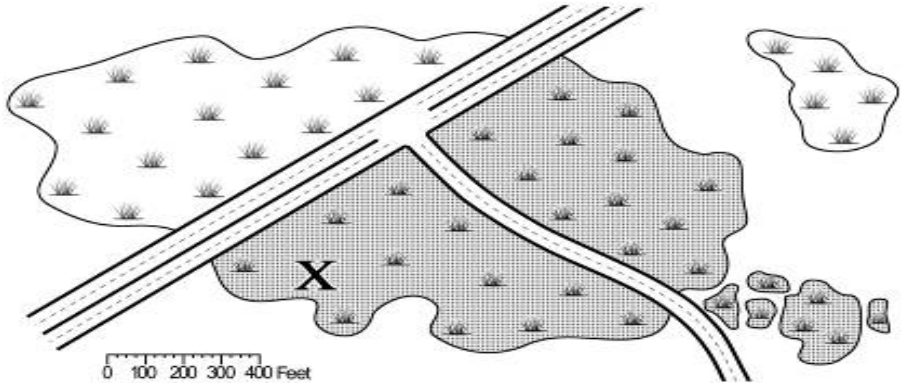


Figure 1. Proposed Project Site is identified by the X. A typical two-lane road and slender areas of upland are too narrow (less than 100 feet wide) to qualify as MiRAM Boundaries. The multi-lane boulevard is wide enough to qualify as a MiRAM Boundary. All wetlands within 100 feet of each other are included in the Boundary.

2) Narrow Wetland Corridor (Length Exceeding 100 feet and Width Less than 100 feet)

The MiRAM Boundary is where the wetland narrows to less than 100 feet wide for a distance exceeding 100 feet. See Figure 2.

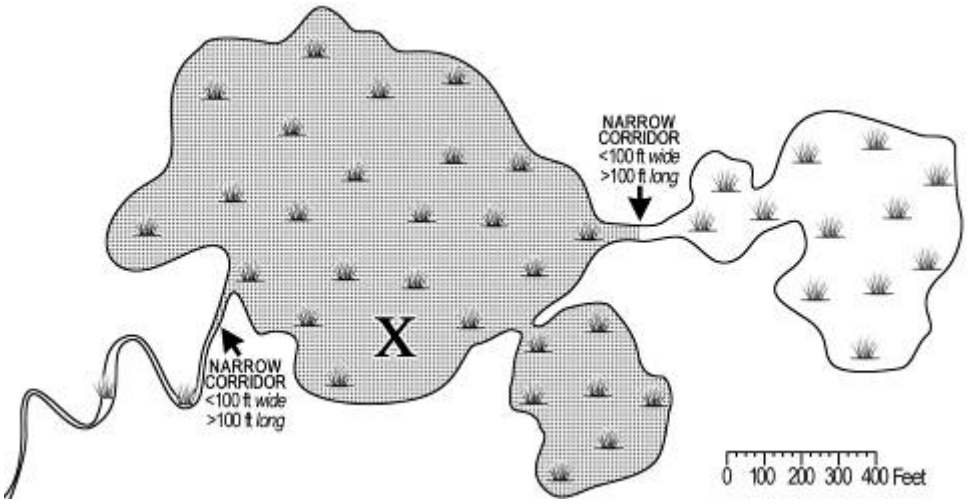


Figure 2. Two of the three wetland corridors depicted in this figure are long and narrow, warranting MiRAM Boundary placement at both constriction areas.

3) Proposed Project Site (X) Associated with Narrow Wetland Corridor

a) If the Proposed Project Site is located within a wetland corridor that is narrower than 100 feet and the corridor is more than 100 feet long, set the MiRAM Boundary at the location where the narrow wetland corridor widens to substantially more than 100 feet or narrows to less than 25 feet wide. See Figure 3.

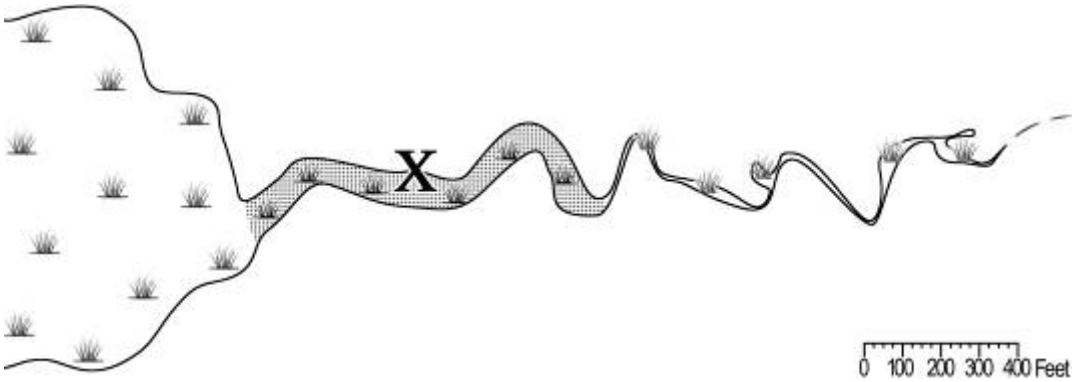


Figure 3. The Proposed Project Site (X) is located within a narrow wetland corridor. A MiRAM Boundary is placed where the narrow wetland widens or narrows substantially.

b) Extremely narrow (width averaging less than 25 feet) linear stream/ditch wetlands, are not typically evaluated using the MiRAM. See Figure 4.

Figure 4. The Proposed Project Site (X) is adjacent to an *extremely narrow* (width averaging less than 25 feet) linear wetland.

4) Rivers and Lakes

A MiRAM Boundary should be placed wherever a substantial area of open water that exceeds 100 feet in width separates wetland areas. See Figures 5 and 6.

- Areas dominated by aquatic bed (submerged aquatic vegetation) are included within the MiRAM definition of open water.
- If a wetland borders a lake or large river, place the MiRAM Boundary 100 feet out into the open water and parallel with the water's edge, so that a 100-foot wide "wetland band" is included within the Wetland Evaluation Area. This is important for proper scoring in several of the Quantitative Rating metrics.
- Minor open water features (such as small streams and ponds) do not affect the MiRAM Boundary placement.

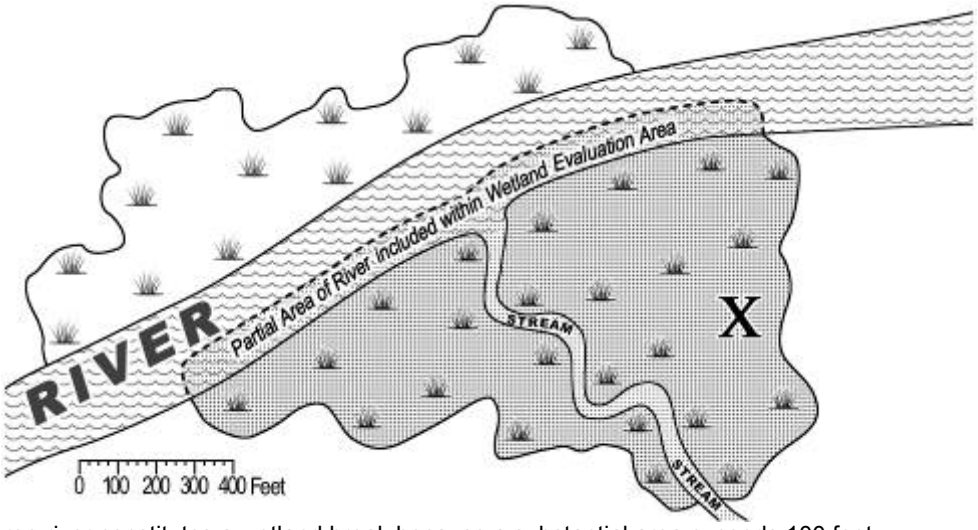


Figure 5. The large river constitutes a wetland break because a substantial area exceeds 100 feet. A 100-foot wide strip of river (approximately four acres) is included within this Wetland Evaluation Area. The open water area of the small stream is also included.

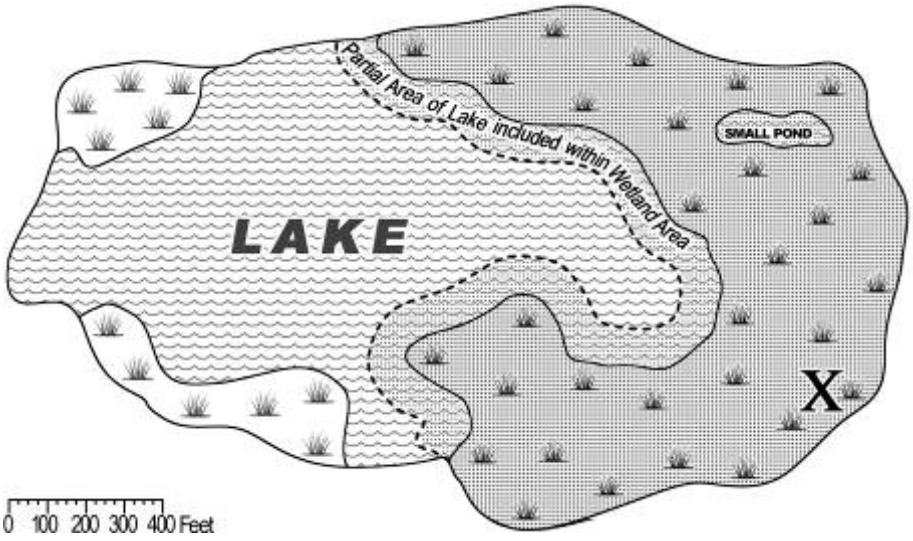


Figure 6. Wide (exceeding 100 feet) areas of open water constitute wetland breaks. A100-foot wide strip of open water (approximately six acres) is included within this Wetland Evaluation Area. The open water area of the small pond is also included within the Wetland Evaluation Area.

The 50-Acre Guideline: Large Wetlands

(The "X" shown on the following diagrams represents the Proposed Project Site. Shading represents the Wetland Evaluation Area, encompassed by the MiRAM Boundary.)

Wetland Evaluation Area

When other breaks, as described above, do not allow the Evaluator to draw a boundary, limit the Wetland Evaluation Area and boundary placement to approximately 50 acres of wetland adjacent to the Proposed Project Site. See Figures 7, 8, and 9. Shading represents a 50-acre Wetland Evaluation Area with the Proposed Project Site identified by the X.

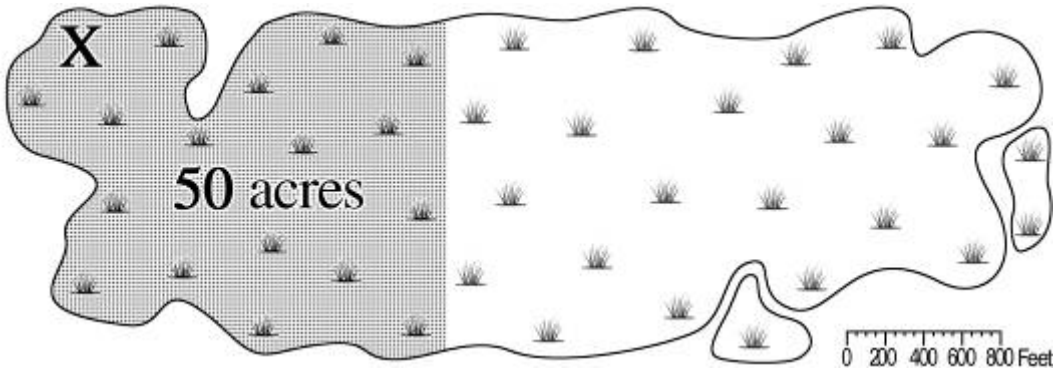


Figure 7. In this example, the Proposed Project Site (X) is located at an extreme end of a large wetland. The Wetland Evaluation Area includes only the 50 acres of wetland adjacent to the Proposed Project Site.

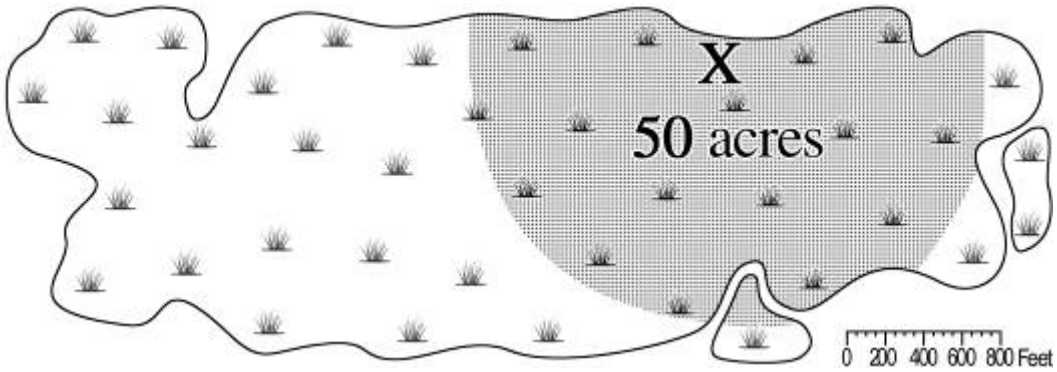


Figure 8. The Wetland Evaluation Area includes only the 50 acres of wetland (or wetland complex) adjacent to the Proposed Project Site (X). In this example, part of a small wetland within the complex is also included.

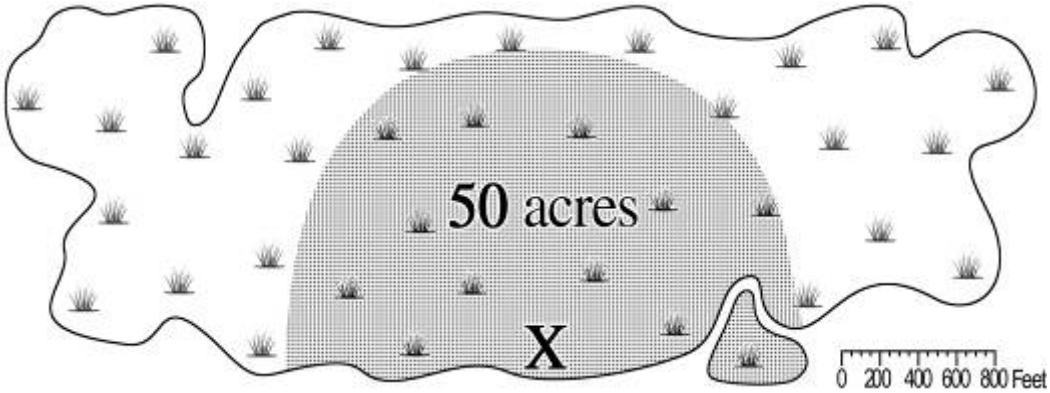


Figure 9. The Wetland Evaluation Area includes only the 50 acres of wetland (or wetland complex) adjacent to the Proposed Project Site (X). In this example, all of a small wetland within the complex is also included.

Chapter IV: MiRAM Rating Form

Background Information

First, the site must be properly identified by determining the Proposed Project Site and Wetland Evaluation Area on available maps and aerial photographs. Complete the Background Information page, making sure to provide all of the required information. For the Wetland, provide the Proposed Project Site Name or DNRE File Number, Date of Evaluation, County, Town, Range, Section, Township, and Latitude and Longitude (decimal coordinates). Also, provide the Name, Address, City, State, Zip Code, Phone Number and Email address of the Evaluator. If a Wetland Delineation Report is available, the date the report was completed and the report's author should be indicated.

Before conducting the field inspection the following items must be checked off and attached to the MiRAM Rating Form: determination of the MiRAM Boundary, size of the Wetland Evaluation Area, Location Map, and Landscape Sketch or Aerial Photograph.

The landscape sketch or aerial photograph must:

1. Clearly label the Proposed Project Site and Wetland Evaluation Area. Indicate location of MiRAM Boundary.
2. Label and indicate the extent of all general wetland community types identified within the Wetland. Examples include marsh, wet meadow, hardwood swamp, conifer swamp, shrub swamp, etc. Wetland types are indicated on the NWI layer used to identify the wetland. Some wetland communities may be further classified as natural communities. Natural communities are predominantly structured by natural processes rather than modern anthropogenic (human-caused) disturbances. Examples include bog, prairie fen, muskeg, wet prairie, southern wet meadow, etc.
3. Identify and label all hydrologic features, such as streams, 100-year floodplains, ponds, vernal pools, and small patches of open water within a marsh or swamp.
4. Identify and label surrounding upland features.
5. Include a north arrow and map scale information.
6. Attach the landscape sketch or aerial photograph to the end of the Rating Form.

The last box on the Background Information page provides space to write comments about disturbance events occurring within or near the Wetland Evaluation Area. This box may be filled out during the in-office review, if appropriater or during the field inspection. Examples of disturbance events may include, but are not limited to, drain construction/maintenance, recent or past construction activities (roads, subdivisions, malls, etc.), filling, etc.

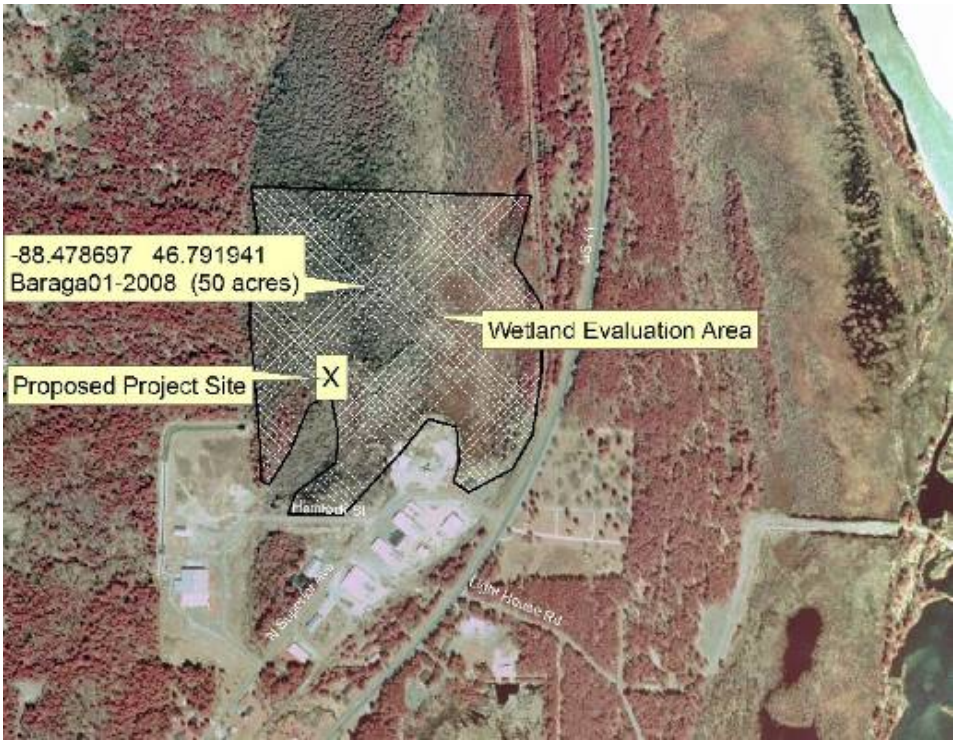


Figure 10. Aerial photograph of the Wetland and labeled features.

Field Datasheet

Use the Field Datasheet, page 3 of the MiRAM Rating Form, to list plant species, by stratum, observed within the Wetland Evaluation Area. Nomenclature shall follow Voss (1972, 1985, 1996) or Gleason and Cronquist (1991). This is meant to be a general list that provides a fairly accurate representation of the species present. A plant list is helpful as a reference when identifying any of Michigan's wetland community types and in completing the Narrative Rating and the Quantitative Rating. The plant list will also be useful in review of the completed MiRAM Rating Form.

Page 3 of the MiRAM Rating Form also includes a checklist of components to observe throughout the field inspection. The Field Datasheet should be reviewed regularly during the inspection.

Checklist of features and conditions to observe during the field inspection:

- ☐ Hydrologic Condition and Interactions
- ☐ Hydrologic Alterations
- ☐ Substrate/Soil Disturbances
- ☐ Habitat Structure Development
- ☐ Habitat Alterations
- ☐ Habitat/Wetland Condition
- ☐ Amphibian Breeding Pools
- ☐ Vegetation Diversity
- ☐ Vegetation Condition
- ☐ Amount of Open Water
- ☐ Percent of Invasive/Non-native Species
- ☐ Community Interspersion
- ☐ Vertical/Horizontal Structure
- ☐ S1, S2, or S3 Natural Community present

Note how much of the Wetland was reviewed during the field inspection and whether vegetation within the Wetland has been altered and/or buffer areas affected within the past 5 years.

Chapter V: Narrative Rating

The Narrative Rating consists of a series of four questions. Completion of the Narrative Rating allows the Evaluator to quickly identify whether the Wetland is one of several wetland types that have *exceptional ecological value* and, therefore, are automatically considered *high functional value*. If any of the metrics are answered affirmatively (i.e., "YES"), then the Wetland has high functional value and completion of the Quantitative Rating is not necessary. If none of the questions are answered affirmatively, proceed to the Quantitative Rating. For data collection purposes, those Wetlands rated as high functional value in the Narrative Rating can be scored using the Quantitative Rating, but their rating will remain high functional value regardless of the results of the Quantitative Rating. It is very important to properly and thoroughly answer each of the questions in the Narrative Rating.

Narrative Rating Metric 1:
U.S. Fish and Wildlife Service (USFWS) Critical Habitat

Is any part of the Wetland located within an area designated as Critical Habitat <u>and</u> does the Wetland actually contain habitat suitable for either species listed below?

Federally listed species are protected under the Endangered Species Act of 1973. Critical Habitat is defined by the USFWS as specific geographic area(s) containing physical or biological features essential to the conservation of a federally listed Threatened or Endangered species that may require special management considerations or protection. Currently in Michigan, the USFWS has designated Critical Habitat for only two species: the piping plover (*Charadrius melodus*) and the Hine's emerald dragonfly (*Somatochlora hineana*). This Narrative Rating question recognizes the fact that the USFWS Critical Habitat Unit boundaries may not be exact, and may include large tracts of habitat that are considered unsuitable for the species. Therefore, if any part of the Wetland is contained within the legal description of a Critical Habitat Unit, but an Evaluator has determined, based on field observations and habitat descriptions, that the Wetland does not contain suitable habitat for the species in question, then this metric can be answered "No." In some instances, a detailed evaluation of the habitat may be required to ensure proper identification of the Critical Habitat.

If any part of the Wetland is located within a Critical Habitat Unit <u>and</u> actually contains habitat suitable for either the piping plover or the Hine's emerald dragonfly, then the Wetland has high functional value.

Michigan Piping Plover Critical Habitat is designated only within the following counties:
Alger, Benzie, Charlevoix, Cheboygan, Chippewa, Emmet, Iosco, Leelanau, Luce, Mackinac, Mason, Muskegon, Presque Isle, and Schoolcraft. See the USFWS Final Rule documents for locations and legal descriptions of all identified units. *(The link provided was broken and has been removed)*

Michigan Hine's Emerald Dragonfly Critical Habitat is designated only within the following counties: Alpena, Mackinac, and Presque Isle. See the USFWS Final Rule document's URL for locations and legal descriptions of all Units. *(The link provided was broken and has been removed)*

See the following URL for more information pertaining to Critical Habitat within the Midwest Region:
www.fws.gov/midwest

Contact Information: U.S. Fish and Wildlife Service
East Lansing Field Office
2651 Coolidge Road, Suite 101
East Lansing, MI 48823
517-351-2555

U.S. Fish & Wildlife Service

Figure 11. Currently in Michigan, the USFWS has designated Critical Habitat for only two species: the Hine's emerald dragonfly (*Somatochlora hineana*) and the piping plover (*Charadrius melodus*)

Narrative Rating Metric 2:
Threatened or Endangered (T/E) Species

Do federal or state-listed T/E plant or animal species occur within the Wetland?

To determine if T/E species are present within the Wetland, the following set of questions should be answered.

a. ☐YES ☐NO Has an approved T/E survey been completed? If "Yes" go to question b; if "No" go to question c.

b. ☐YES ☐NO Does the T/E survey indicate T/E species present within the Wetland? If "Yes," answer "Yes" to this metric. If "No," answer "No" to this metric.

c. ☐YES ☐NO Has the Evaluator (or others known to the Evaluator) observed any T/E species within the Wetland? If "Yes" answer "Yes" to this metric. If "No," go to question d.

d. ☐YES ☐NO Does the DNRE Endangered Species Assessment (ESA) web site interactive map, **mcgi.state.mi.us/esa**] indicate that there is a potential for unique natural features at or near your site of interest? If "No," answer "No" to this metric. If "Yes", request a DNRE formal review by submitting the online form. Type "MiRAM" within the "Project Information" field on the form. Go to question e.

e. ☐YES ☐NO Did the DNRE review confirm potential T/E occurrence in the Wetland?
If "Yes," answer "Yes" to this metric. If "No," answer "No" to this metric.

The purpose of this metric is to identify those wetlands with exceptional ecological value that actually contain or potentially contain T/E species. Michigan's T/E species are protected under Part 365, Endangered Species Protection, of the NREPA, and federally listed species are protected under the Endangered Species Act of 1973. If the Evaluator (or other person) does not observe a T/E species within the Wetland and no T/E species field survey results are available, the Evaluator must consult the DNRE ESA web site to determine if the DNRE has a record of any federal/state-listed T/E species occurring within the Wetland. The interactive web site can be used to quickly determine if federal/state-listed T/E species have been documented in or near the Wetland. Go to **mcgi.state.mi.us/esa** and follow the directions provided there. After locating the Wetland on the ESA web site's interactive map, the ESA query result will indicate that either "no unique natural features are known to occur at or near your site of interest," or "there is potential for endangered or threatened species to occur at or near your site of interest."

Narrative Rating Metric 2 cannot be answered if the ESA web site search result indicates "potential T/E," unless any of the following are true:

- The Evaluator (or others) has observed T/E species.
- A DNRE formal review has been conducted.
- A T/E field survey has been conducted and the report is attached to the MiRAM Rating Form.

The Evaluator may proceed with the Narrative Rating and Quantitative Rating, while waiting for a formal response from the DNRE.

Sabrina Miller

Figure 12. If a state-threatened species, such as Cup Plant (*Silphium perfoliatum*), is observed growing in the Wetland, the Wetland is rated as having high functional value. Monroe County, Michigan.

Narrative Rating Metric 3:
Rare Wetland Natural Community Type

Are more than 5 acres or more than 25% of the Wetland comprised of a Rare Wetland Natural Community Type?

For the purposes of the MiRAM Narrative Rating, state-ranked S1 and S2 natural communities (S3 natural communities are considered rare wetland communities in the Quantitative Rating), southern bogs, and old-growth/mature forested wetlands qualify as rare wetland community types. To aid in the identification and rating of natural communities, the Evaluator should consult the *Natural Communities of Michigan: Classification and Description* (Kost et al. 2007), community abstracts, and other information available at https://mnfi.anr.msu.edu/.

If the rare wetland community type is greater than 5 acres in size or comprises more than 25 percent of the Wetland, this metric should be answered affirmatively (i.e., "YES") and the Wetland has high functional value.

However, if the rare natural community is less than 5 acres and less than 25 percent of the overall Wetland, then the rare natural community may be "split off" from the rest of the Wetland and scored separately. In these cases, the split-off rare community will still receive the high functional value rating.

S1 and S2 Natural Wetland Community Types

Utilize the State Rank list in *Natural Communities of Michigan: Classification and Description* (Kost et al. 2007) to determine if any wetland community types within the Wetland have a state rank of S1 or S2 (S3 communities, having high ecological function, receive 10 points in Metric 5 of the Quantitative Rating).

The State Ranks for vegetation communities are:

S1 = critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s), such as very steep declines, making it especially vulnerable to extirpation from the state.

S2 = imperiled in the state because of rarity due to very restricted range, very few occurrences (often 20 or fewer), steep declines or other factors making it very vulnerable to extirpation from the state.

S3 = vulnerable in the state due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines or other factors making it vulnerable to extirpation.

S4 = uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 = common and widespread in the state.

SX = community is presumed to be extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

S? = incomplete data.

Keto Gyekis

Figure 13. Wet mesic prairie, Washtenaw County, is rated as an S2 community. This Wetland is considered to have exceptional ecological value and is rated as having high functional value.

Southern Bog

While bogs are somewhat common throughout northern Michigan, they are relatively rare within the southern portion of the state. If the Wetland contains a bog*, as defined by Kost et al. (2007), and it is below Michigan's Floristic Tension Zone (see figure 10), then the bog is considered by the MiRAM to be a rare Southern Bog and has high functional value.

*A bog is a nutrient-poor peatland characterized by acidic, saturated peat and the prevalence of sphagnum mosses and ericaceous shrubs.

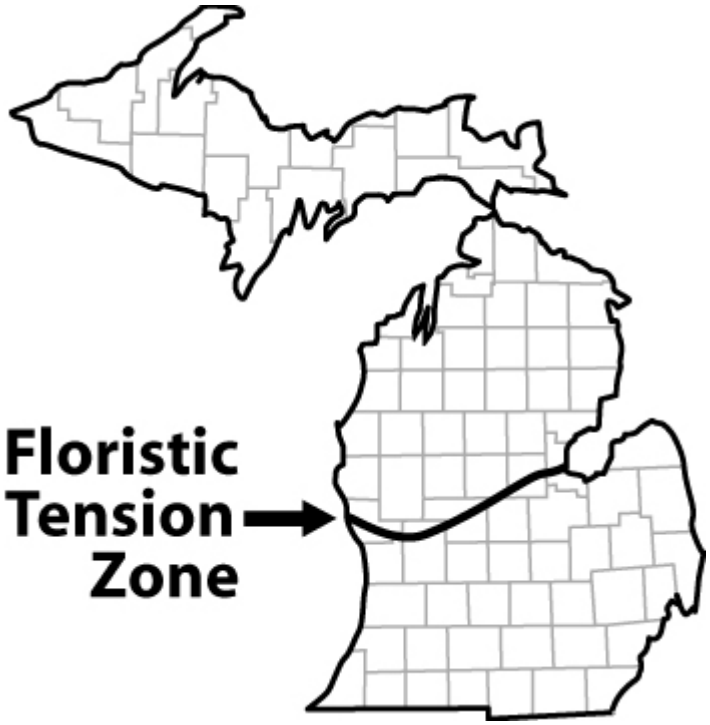


Figure 14. Michigan's Floristic Tension Zone (adapted from Barnes and Wagner 1981).

Old-Growth/Mature Forested Wetland

Although not specifically addressed within Kost et al. (2007), old-growth/mature forested wetlands are a rare and ecologically important wetland community type in Michigan (Frelich 1995, Schmidt et al. 1996, DNRE 2001).

The term "old-growth/mature" describes a rare, successional state dominated by forest vegetation in the mature stages of its life cycle (Parker 1989). These ecosystems approximate the structure, composition, and functions of heterogeneous, native climax forests (Michigan Department of Natural Resources (MDNR 2001)), with conditions that include abundant large trees and standing snags, multiple foliage layers, abundant canopy gaps, gap saplings of various sizes and ages, high native species diversity, large nursery logs, tip-up mounds, and extensive dead organic material. These systems involve more complex ecological processes and undergo more gradual change than do young or intensively-managed forests. Some easily measurable characteristics of Michigan's old-growth/mature forests include: mean overstory diameter at breast height (DBH) of at least 20 inches, and at least 2 trees per acre having DBH ≥28 inches (Lorimer et al. 1994, Tyrrel and Crow 1994, McGee et al. 1999). While an Evaluator may never see a true old-growth forested wetland, the Evaluator may encounter relatively old, mature second-growth forested wetlands that look and function very similar to true old-growth ecosystems (MDNR 2001). The MiRAM treats old-growth and mature second-growth forests as the same rare wetland community type with high functional value.

Although some forested wetlands might be classified as old-growth forests according to some definitions of the term, they often have non-diverse tree communities generally characterized by conditions of extremely low growth rates, poor productivity, and are dominated by relatively small, stunted trees (Kost 2001, Cohen 2006a, Cohen 2006b). Many nutrient-depauperate muskegs, bogs, and northern fen communities historically escaped timber harvesting because of stunted timber size, low timber volume, and extraction difficulty. For the scope of the MiRAM, these forested wetland communities are not classified as old-growth forests, but rather as other types of rare natural communities, including muskegs, bogs, northern fen communities, etc.

To answer this metric correctly, the Evaluator may need to obtain and review historic aerial photographs or county records for the area of the Wetland to determine logging and disturbance history. To qualify as old-growth/mature for the purposes of the MiRAM, a forested wetland must exhibit the following characteristics:

1) Lack evidence of any significant harvesting (relatively old second-growth may qualify).
2) Forest is dominated by large overstory trees (mean overstory DBH of at least 20 inches and at least 2 trees per acre having DBH ≥28 inches).

3) Multi-aged and multi-layered canopy.
4) Aggregations of canopy trees are interspersed with canopy gaps and large snags.
5) Large nursery logs and tip-up mounds litter the forest floor.
6) Old-growth/mature forested wetlands are rated as having high functional value.

Narrative Rating Metric 4:
Great Lakes Coastal Wetland

Is any part of the Wetland within 1,000 feet of the ordinary high water mark of any of the Great Lakes, including Lake St. Clair?

Wetlands of the Laurentian Great Lakes have undergone extensive anthropogenic fragmentation, severe degradation, and extensive losses in the past two centuries (Maynard and Wilcox 1996). Two-thirds of the Great Lakes coastal wetlands have been lost overall, with many regions having lost 90 percent or more (Mitsch and Bouchard 1998). Comparison of historic maps to present aerial photographs shows that wetlands in regions such as Saginaw Bay and Lake St. Clair have been especially devastated (Comer et al. 1993, Comer et al. 1995, Comer 1996). These wetland losses have resulted in significant ecological changes to the Great Lakes and its biota (Albert 2003). Signs of wetland degradation include sharp declines in the coastal fisheries and waterfowl populations, chemical and physical degradation of the lakes, loss of vegetation leading to shoreline erosion, and loss of aesthetics and green space. Great Lakes coastal wetlands are unique, relatively rare systems that provide immensely valuable functions to the entire region, regardless of a long history of anthropogenic degradation (Mitsch and Gosselink 2000a, Albert 2003). Benefits include flood control, shoreline protection, nutrient-cycle control, sediment retention, fish spawning and nursery grounds, and water fowl habitat (Keddy 2000, Mitsch and Gosselink 2000a, Albert 2003).

Answer “YES” to this Narrative Rating metric if any part of the Wetland is within 1,000 feet of the ordinary high water mark of any of the Great Lakes, including Lake St. Clair. All Great Lakes Coastal Wetlands have high functional value.

DNRE Staff

Figure 15. A coastal wetland within 1,000 feet of Lake Huron, Iosco County, Michigan.

Chapter VI: Quantitative Rating

Table 2. List of Metrics/Submetrics and the Assigned Maximum Value of Each.

Metric No.	Metric Name	Submetric	Submetric Maximum	Metric Maximum
1	Wetland Size and Distribution	*1a.* Wetland Size	6	9
		1b. Wetland Scarcity	3	
2	Upland Buffers and Intensity of Surrounding Land Use	*2a.* Average Buffer Width around the Wetland's Perimeter	6	12
		2b. Intensity of Surrounding Land Use within1,000 feet of the Wetland	6	
3	Hydrology	*3a.* Sources of Water	8	26*
		3b. Connectivity	8	
		3c. Duration of Inundation/Saturation	4	
		3d. Alterations to Natural Hydrologic Regime	8	
4	Habitat Alteration and Habitat Structure Development	*4a*. Substrate/Soil Disturbance	4	20
		4b. Habitat Alteration	9	
		4c. Habitat Structure Development	7	
5	Special Situations	*5a.* High Ecological Value	10	10*
		5b. Forested Wetland	5	
		5c. Urban/Suburban Wetland	5	
		5d. Low Quality Wetland	-10	
6	Vegetation, Interspersion, and Habitat Features	*6a.* Wetland Vegetation Components	9	20*
		6b. Open Water Component	3	
		6c. Coverage of Highly-Invasive Plant Species	1	
		6d. Horizontal (Plan View) Interspersion	5	
		6e. Habitat Features	12	
7	Scenic, Recreational, and Cultural Value	7a. Scenic	1	3
		7b. Recreational	1	
		7c. Cultural/Historical	1	
			Total	**100**

*** Some Wetlands may score higher in these categories.**

Completion of the Quantitative Rating assists the Evaluator in recognizing the functional value of the Wetland. Complete all metrics by answering all questions correctly. In addition to completing the metrics, the Evaluator should verify all boundaries, buffer widths, and extent of wetland community types, estimated from aerial photography when conducting the field inspection. Aerial imagery may not match the conditions found at the time of the field inspection.

Metric 1: Wetland Size and Distribution

Historically, in addition to small wetland areas, Michigan had many large wetlands and wetland complexes, e.g., the St. Johns Marsh, Saginaw Bay, Lower Muskegon River, Bear Swamp, Munuscong River Delta, Harsens Island, Great Black Swamp, and Remy Chandler Marsh. Many of these larger wetland systems have been destroyed or fragmented into small, relict wetlands (Albert 1995, Comer et al. 1995, Comer 1996). Where large wetlands and wetland complexes remain, they often represent the best examples of wetland remaining in the state. Section 324.30311(f) and (g) of Part 303 requires an evaluation of wetland size and extent of wetland remaining in the area of a proposed project.

Submetric 1a: Wetland Size

Overall, large wetlands are generally more resistant to disturbance and are typically more biologically diverse than small wetlands. Large wetlands have a lower ratio of perimeter length to interior area and, as a result, have a greater resistance to disturbance (Saunders et al. 1991, Hooftman et al. 2003, Gyekis 2006). Large wetlands are typically highly valued by society because they often provide more ecological services than smaller wetlands (Mahan et al. 2000).

Submetric 1a requires that the Evaluator estimate the size of the Wetland encompassed by the MiRAM Boundary (i.e., Wetland Evaluation Area) up to a size limit of 50 acres. Refer to the MiRAM Boundary Determination Guidelines when determining the Wetland Evaluation Area.

Submetric 1a: Scoring Options

Points	Wetland Size
6	≥50 acres
5	25 acres to <50 acres
4	10 acres to <25 acres
3	3 acres to <10 acres
2	¼ acre to <3 acres
0	<¼ acre

Scoring: Select the appropriate size class. Maximum 6 points.

Submetric 1b: Wetland Scarcity

Wetland scarcity is often directly proportional to the relative value that society places on a remaining wetland within the general geographic area. Remaining isolated wetlands in an area are often the higher quality cores of historical wetland complexes (Keddy 2000, Mitsch and Gosselink 2000a). These wetland remnants escaped destruction because of historical recognition of valuable wildlife habitat, aesthetic reasons or, in most cases, because they were simply too inaccessible and difficult to drain. In many regions of Michigan where historical wetland complexes have been decimated, isolated wetlands are the only remaining refugia and habitat suitable and available for many species of wildlife. Isolated wetlands can provide immense ecological and economic benefits. Comer et al. (2005) reports that half of isolated wetland types within a 20-state study area support species listed under the U.S. Endangered Species Act, harboring a total of 66 federally listed species. Of those federally listed species, nearly two thirds are completely dependent on isolated wetland habitats for their survival. Niemuth et al. (2006) found that widely-scattered wetlands provide critical habitat to migrating birds. Section 324.30311(g) of Part 303 identifies wetland scarcity (the amount of remaining wetland in the general area) as an important project evaluation criterion.

Utilize the USFWS's NWI maps to estimate the percentage of wetland area remaining within a 2-mile radius from the Wetland's center. For the purpose of this submetric, areas of open water within the Great Lakes, inland lakes, streams, etc., should be excluded from the wetland percentage.

Submetric 1b: Scoring Options

Points	Wetland Scarcity
3	0 to 20% of surrounding 2-mile radius is wetland
2	>20 to 80% of surrounding 2-mile radius is wetland
1	>80% of surrounding 2-mile radius is wetland

Scoring: Select the most appropriate percentage category. Maximum 3 points.

Metric 2: Upland Buffers and Intensity of Surrounding Land Use

Wetlands are transitional areas between upland and aquatic environments. Although many types of wetlands can function to protect the physical and chemical characteristics of watersheds, they, like many terrestrial and aquatic natural systems, are sensitive to direct and indirect human disturbances (Euliss and Mushet 1999, Houlahan and Findlay 2003). Nutrient enrichment, toxins, and sediment from urban or agricultural runoff can degrade wetlands, just as these disturbances can degrade the open water areas of streams and lakes (Crosbie and Chow-Fraser 1999). Wetlands without upland buffers or wetlands located in areas of intensive land use are often subject to greater degrees of disturbance and degradation. However, wetlands located in areas with intensive human land use are not necessarily degraded and may continue to exhibit high functional value.

Submetric 2a: Average Buffer Width around the Wetland's Perimeter

For the purposes of the MiRAM, a "buffer" is defined as a landscape feature that has the capability of protecting the biological, physical, and/or chemical integrity of a wetland from the effects of surrounding disturbances. Buffer vegetation can screen wetland wildlife from light pollution, human noise, domestic pets, and human presence (Castelle et al. 1992). A buffer can provide organic matter to the wetland (Environmental Law Institute 2008), detoxify contaminants (Sheldon et al. 2005), remove nutrients (Wenger 1999), and protect the wetland from destructive sedimentation pulse events (Dillaha et al. 1989, Schoonover et al. 2006). A wetland with an upland buffer is more effective than either is alone at removing nutrients and attenuating surface runoff (Lowrance and Sheridan 2005), and the combination provides superior habitat (Fischer 2000, Semlitsch and Bodie 2003) and aesthetic value. Wide buffers are ideal, but even narrow (25 to 75 feet) buffers surrounding wetlands can provide at least some protection from anthropogenic activities in adjacent uplands (Cooke 1992, Environmental Law Institute 2008).

To determine a score for this submetric, using an aerial photograph, sketch a 150-foot wide "buffer zone" around the Wetland. Estimate the buffer widths from the Wetland's edge to any non-buffer areas (up to 150 feet). Keep in mind that examples of buffers and non-buffers include, but are not limited to:

Buffers Include:	Non-Buffers Include
shrubland, young forest, natural grassland, prairie	lawns, golf courses, manicured parkland
abandoned row crop field (vegetated & naturalizing)	residential, commercial, industrial
hay field (non-row crop), lightly grazed pasture	roadways (including shoulders), parking lots
lightly managed forest (selectively logged)	row crop field
designated wildlife area, lightly managed parkland	conservation tillage, heavily grazed pasture
other wetland, lake, river	clear-cutting, mining, construction activity

Submetric 2a: Scoring Options

Points	Buffer Rating	Buffer Width Distance
6	Wide	≥150 feet around the perimeter
4	Medium	75 to <150 feet around the perimeter
2	Narrow	25 to <75 feet around the perimeter
0	Very Narrow	0 (no buffer) to <25 feet around the perimeter

Scoring: Select the buffer width that is most appropriate. Maximum 6 points.

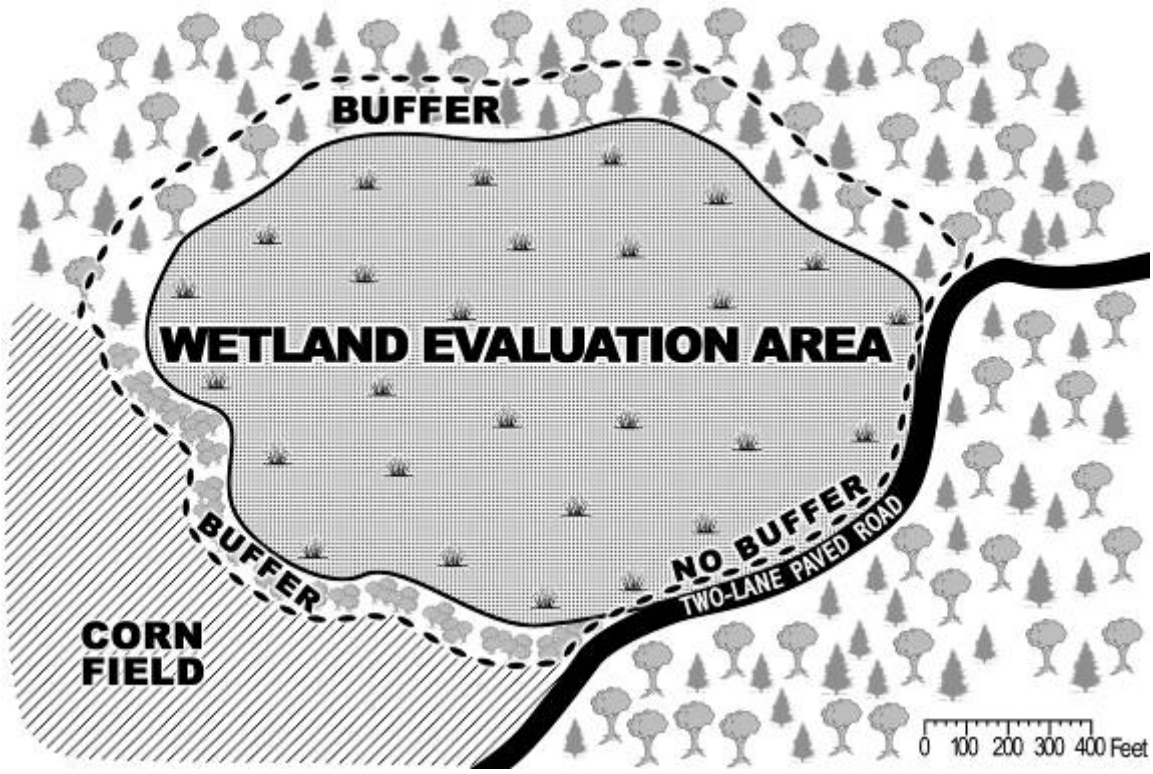


Figure 16. The forested area provides at least 150 feet of buffer for nearly half of the Wetland's perimeter. The shrub area provides 100 feet of buffer, protecting approximately a quarter of the Wetland's perimeter from the degrading effects of the row crop field. The two-lane roadway (and mowed shoulder) is not a buffer.

Example 1 (Figure 16): A large upland forest borders approximately one half of the Wetland's perimeter (>150 foot buffer width). Approximately one quarter of the Wetland's perimeter consists of a narrow, mixed strip of shrubland and meadow (100 foot buffer width) that buffers the Wetland from the effects of a nearby corn field. A narrow strip of mowed shoulder and two-lane paved road lies between approximately one quarter of the Wetland's perimeter and a large forest. The paved road and shoulder are not buffers, and separate the Wetland from a forested area, so one quarter of the Wetland's perimeter has no buffer. To find the average buffer width around the Wetland's perimeter, divide the Wetland's perimeter into quarters (for this example). Add each quarter's buffer widths and divide by 4. So, (150 feet + 150 feet + 100 feet + 0 feet) / 4 = 100 feet, which corresponds to a "Medium Buffer Width," and an overall score of 4 points. See Figure 11.

Example 2: Approximately 1/8 of the Wetland's perimeter is adjacent to unmanaged parkland (no mowing) that is at least 150 feet wide. The remainder of the Wetland is encompassed by residential structures and mowed lawns (no buffer). For this example, divide the Wetland perimeter into eighths. One-eighth of the perimeter has a buffer width of 150 feet and 7/8 has a buffer width of 0 feet. Buffer Calculation: (150 feet + 0 feet + 0 feet + 0 feet + 0 feet + 0 feet + 0 feet + 0 feet) / 8 = 18.75 feet, which corresponds to "Very Narrow Buffer Width," and an overall score of 0 points.

Submetric 2b: Intensity of Surrounding Land Use within 1,000 feet of the Wetland

Numerous investigators have found that wetland degradation is generally inversely related to the intensity of surrounding land use (Newcomb and MacDonald 1991, Crosbie and Chow-Fraser 1999, Houlahan and Findlay 2003). For this submetric, use an aerial photograph and sketch a 1,000-foot wide "land use zone" around the Wetland. Next, estimate percent coverages comprised by each of the four types of land use; very low intensity, low intensity, moderately high intensity, and high intensity. **For this submetric, any land use type comprising at least 25 percent of the total land use is considered to be a "dominant" land use type and will receive points.** It is possible for several land use types (or all four types) to be "co-dominant," if each type comprises at least 25 percent of the total land use. It should be noted that the Evaluator should verify all land use zones estimated from aerial photography when conducting the field inspection. Aerial imagery may not match the conditions found at the time of the field inspection.

Submetric 2b: Scoring Options

Points	Intensity	Examples of Land Use	
6	Very Low	maturing forest natural grassland, prairie	designated wildlife area other wetland, lake, river
4	Low	shrubland/young forest recent selective logging hay field (non-row crop)	lightly managed parkland old field, lightly grazed pasture one-lane road/two track
2	Moderate	residential & lawns manicured parkland golf course	conservation tillage recent clear-cut (<10 years) two-lane road
1	High	commercial, industrial high-density residential heavily grazed pasture row crop field	multi-lane paved roadway construction activity parking lot mining

Scoring: Sum the available points from all dominant land use types and then average the score. Round to the nearest 0.5 increment. Maximum 6 points.

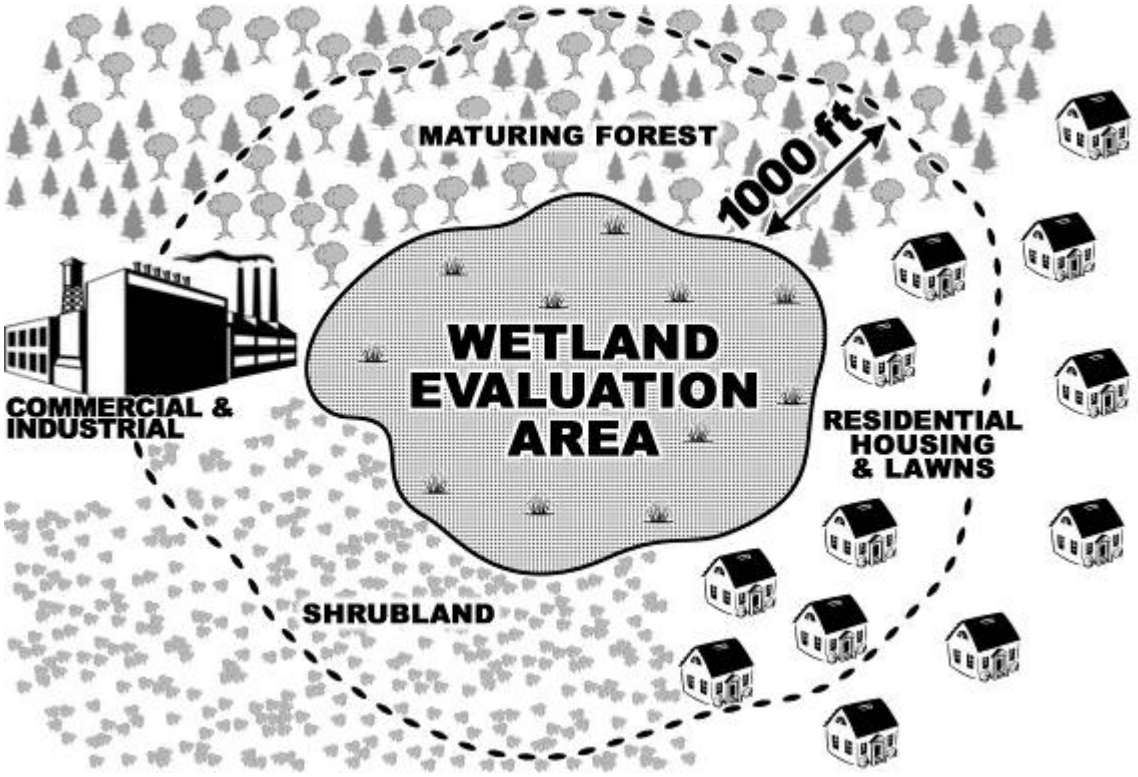


Figure 17. In this example there are three dominant land use types within the 1,000-foot land use zone surrounding the Wetland. The commercial/industrial "High Intensity" land use type represents less than 25 percent of the total, so is not a dominant land use.

Example 1 (See Figure 17): At least 25 percent of the surrounding land is comprised of maturing forest, so the "Very Low Intensity" land use type receives 6 points. At least 25 percent of the surrounding land is covered by a combination of shrubland and young forest which is "Low Intensity" and receives 4 pts. At least 25 percent of the surrounding land use is a combination of residential structures, lawns, and lightly trafficked driveways/roadways; all of these fall into the "Moderately High Intensity" land use type, which receives 2 points. The small area remaining is commercial/industrial, which is "High Intensity." However, we estimate that the "High Intensity" land use type represents less than 25 percent of the total, so it is not a dominant land use. In this example there are three dominant land use types. Sum the points available from the three dominant categories (6+4+2) and then average the score (12 points divided by 3 = 4 points). Assign 4 points.

Example 2: Approximately 90 percent of the surrounding land is comprised of high-density residential structures, driveways, mowed lawns, and several large soybean fields. All are "High Intensity" (1 point). The remainder is composed of other scattered wetlands, shrubland, and a river oxbow. Although these landscape features are "Very Low Intensity" (6 points), they make up well less than 10 percent of the surrounding landscape. Therefore, rate the surrounding land use as "High Intensity." Assign 1 point.

Metric 3: Hydrology

Hydrology is the most important determinant for the establishment and maintenance of wetland types and processes (Keddy 2000, Mitsch and Gosselink 2000a, Kost et al. 2007). Therefore, Metric 3 comprises 26 percent of the possible 100 points within the MiRAM Quantitative Rating. This metric incorporates the source(s) of water, the wetland's hydrologic connectivity, its hydroperiod, and the degree in which the wetland's hydrology has been altered by human activity. The maximum points allowable for Metric 3 is 26; however, some wetlands may score higher. In these cases, record the maximum 26 points and note in the comments the actual points received for Metric 3.

Submetric 3a: Sources of Water

The type and diversity of hydrological inputs and outputs directly affect aspects of a wetland's functional value (e.g., attenuation of floodwater, ecological richness) (Thibodeau and Ostro 1981, Thom et al. 2001). Submetric 3a requires the Evaluator to identify the Wetland's source(s) of water. All sources of water should be identified, even if the source is a minor component of the Wetland. For instance, a small headwater stream flowing through the Wetland would receive either 2 points (Seasonal) or 5 points (Perennial).

Precipitation - It is anticipated that all wetlands receive precipitation as a hydrologic input directly or from runoff from adjacent uplands. Some wetland community types, such as bogs and vernal pools, are more directly dependent on precipitation than any other hydrologic input.

Groundwater - Many wetland types receive periodic or constant inputs from groundwater as part of their annual water budget (Kost et al. 2007). However, points should not be awarded unless the Evaluator observes seeps or other evidence of groundwater flow or unless the Evaluator possesses detailed water budget data that confirms an input of groundwater. It is not expected that the Evaluator will normally obtain detailed hydrological data in order to complete this portion of the MiRAM. Evidence of groundwater flow can be inferred by the presence of significant amounts of plant species commonly associated with groundwater, e.g., skunk cabbage (*Symplocarpus foetidus*), sweet flag (*Acorus calamus*), fen species such as Kalm's lobelia (*Lobelia kalmii)*, shrubby cinquefoil (*Potentilla fruticosa)*, Virginia mountian-mint (*Pycnanthemum virginianum*), etc. The Evaluator should be aware that groundwater inputs may not be readily evident if the Wetland is observed at a time of year when it is acting as a net exporter of water *to* local groundwater. If the Evaluator suspects, but does not have evidence to support awarding the points for groundwater, this should be noted on the Rating Form's comments section.

Seasonal/Intermittent Surface Water - In order to receive these points, any part of the Wetland should have seasonal inundation from a lake, stream/river or pond. Examples of seasonal/intermittent surface water include seasonal flooding from lakes, streams or rivers or areas within or containing small ponds with seasonal water table fluctuations. Seasonal/intermittent surface water can also be inferred using the primary indicators of hydrology outlined in the *Corps Manual* (e.g., water marks, drift lines, sediment deposits, and drainage patterns). The Evaluator does not need to actually observe surface water within the Wetland at the time of the field evaluation. This metric identifies temporary streams, not upland channels, that flow after substantial rain events. Those types of surface water input are not the result of seasonal flood events and, therefore, are not seasonal/intermittent surface water. Some wetland community types (e.g., floodplain forest) receive a substantial portion of their annual hydrologic input from seasonal flooding of nearby streams (Kost et al. 2007). A Wetland can only receive points for either this source of water or the next (Perennial Surface Water), not both.

Perennial Surface Water - To be awarded points for perennial surface water, the Wetland must receive water from or have a perennial connection to a stream, lake or pond during most times of the year. Wetlands in actual contact with a perennial lake, stream or pond should receive these points. For example, a Wetland that contains a perennial stream, lake or pond within its boundaries should receive these points. Remember that the MiRAM Boundary extends up to 100 feet into the open water of a lake, stream or pond and, therefore, these areas are part of the wetland being evaluated. Some wetland community types (e.g., emergent marsh, various types of swamps, floodplain forests) may have perennial surface water connections with a lake, stream or pond (Cowardin et al. 1979, Kost et al. 2007).

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Figure 18. Skunk cabbage, *Symplocarpus foetidus*, is a reliable indicator of groundwater. Oakland County, Michigan.

Submetric 3a: Scoring Options

Points	Source of Water	Example
1	Precipitation	Directly and/or as runoff from upland areas.
2	Groundwater	Seeps or evidence, such as significant amounts of skunk cabbage (*Symplocarpus foetidus*) or other fen-adapted species.
2	Seasonal/Intermittent Surface Water	Seasonal inundation from a lake, pond or stream. (A Wetland can only receive points for this source of water or the next, not both).
5	Perennial Surface Water	Perennial inundation from a lake, stream or pond.

Scoring: Select all sources of water to the Wetland and sum the points. Maximum 8 points.

Submetric 3b: Connectivity

A wetland's functional value is influenced by its position in the landscape and its proximity to other hydrologic features. Section 324.30311(h) of Part 303 requires an evaluation of the proximity of a wetland to other waterways.

100-Year Floodplain - The 100-Year Floodplain is defined in the Floodplain Authority under Part 31, Water Resources Protection, of the NREPA. As in Part 31, the floodplain area must be associated with a stream having a minimum of a two-square mile drainage area. Typically, a floodplain is relatively level land that is periodically submerged by flood waters from a stream channel. It is typically composed of alluvium deposited during flooding. Flood boundary maps or floodway maps may be used to determine the extent of a floodplain, if they are available. Applicable flood insurance rate maps (FIRMs) can often be obtained from the local DNRE District Office or the Federal Emergency Management Agency (FEMA) Flood Map Distribution Center in Baltimore, Maryland. Guidance on using FIRMs is provided in the FEMA publication titled *How to Read a Flood Insurance Rate Map* (FEMA, 2003). Section 324.30302(i) of Part 303 recognizes and requires evaluation of the importance of wetlands for flood control and water storage capacity.

Between a Stream/Lake/Pond and Human Land Uses - Wetlands located between a waterbody (stream/lake/pond) and human land uses, such as parking lots, lawns, roads, and other impervious surfaces (see Submetric 2a for additional examples of non-buffers) help mitigate run-off rates and reduce sedimentation entering the waterbody. Wetlands can also buffer the impacts of more intensive land uses, such as agricultural, commercial, industrial, mining, and residential developments. To receive these points, the Wetland itself must be serving as a buffer to a stream/lake/pond from an adjacent human land use. For example, a wetland next to a lake may serve as a buffer from an adjacent residential development. However, a wetland between a lake and a paved roadway 1,000 feet away would not normally receive these points, since the wetland is too far away to be acting as a buffer between the lake and road. Sections 324.30302 of Part 303 recognize the importance of and the requirement to evaluate proposed projects for their potential impacts to the stormwater attenuation, pollution treatment, and erosion control capacities of wetlands.

Wetland/Upland Complex - To receive these points, the Wetland must be part of a large-scale (10+ acres), "non-linear" complex of wetlands, with small areas of unmanicured/undeveloped vegetated uplands that do not restrict the movement of organisms between the wetland areas. In some cases, the wetlands may also be interconnected hydrologically. Examples include forest systems with scattered vernal pools, wet-mesic flatwoods, and large mesic wet meadows or swamp systems located throughout the state. A large wetland should not receive these points simply because of its size. To be awarded these points, the Wetland must be part of a complex of *other* wetlands and uplands. Fennessy et al. (1998b) found strong positive correlations between a wetland's proximity to other wetlands and that wetland's "quality." Some wetlands can receive points for both this category and the next (Corridor) as there may be a linear component within the wetland/upland complex.

Riparian Corridor - To receive these points, the Wetland must be part of a linear riparian corridor that provides organism movement along a stream/river. Typically these corridors should exceed 100 feet in width and extend at least one-half mile. The corridor width should include the river or stream present within the corridor. Wetlands immediately adjacent to a river or stream can serve as important hydrological links throughout a landscape and watershed. Riparian wetlands also function as corridors that link various habitats throughout a landscape (Seburn et al. 1997, Adamus et al. 2001) and are important ecotones that often exhibit relatively high biodiversity (Inman et al. 2002). Section 324.30311(h) of Part 303 recognizes that wetlands in close proximity to other waterbodies are important. Some wetlands can receive points for both this category and the previous (Complex) as the linear riparian cooridor may be a part of the larger wetland complex.

Susan Jones

Figure 19. This wetland is located between the mowed lawn of a park and the Thunder Bay River in Montmorency County, Michigan.

Submetric 3b: Scoring Options

Points	Connectivity	Example
2	100-Year Floodplain	As defined in the Floodplain Authority under Part 31 of the NREPA.
2	Between a Stream/Lake/ Pond and Human Land Use	The Wetland is located between a surface waterbody and any human land use, such that run-off from the adjacent land use could flow through the Wetland before it discharges into the surface waterbody.
2	Wetland/Upland Complex	The Wetland is part of a large scale (10+ acres) non-linear complex of wetlands with small areas of unmanicured or undeveloped vegetated uplands that do not restrict movement of organisms between the wetland areas.
2	Riparian Corridor	The Wetland is part of a linear *riparian* corridor that provides organism movement along a stream/river. Typically, these corridors should exceed 100 feet in width and extend at least one half mile.

Scoring: Select all hydrologic connections within the Wetland and sum the points. Maximum 8 points.

Submetric 3c: Duration of Inundation/Saturation

Duration of standing water and soil saturation often correlate well with the use of a wetland's open water areas as breeding and nursery pools for many types of wildlife (Killgore and Baker 1996, Brooks 2000, Brooks 2004, Hoover 2006) and migratory habitat for birds (Niemuth et al. 2006). This submetric may be difficult to score if the Wetland is visited in late summer or early fall. The use of hydrology indicators, as outlined in the *Corps Manual,* may be of assistance in properly answering this question. The Evaluator does *not* need to actually observe the Wetland during the wettest time of the year in order to award the points for this question.

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Figure 20. These two photographs show the same wetland, just weeks apart, illustrating the need to utilize hydrologic indicators to properly judge the duration of inundation/saturation. Floodplain of the Kalamazoo River, Kalamazoo County.

Submetric 3c: Scoring Options

Points	Duration of Inundation/Saturation
4	Permanently Inundated
3	Permanently Saturated to Regularly Inundated
2	Regularly Saturated to Seasonally Inundated

1	Seasonally Saturated in the Upper 12 Inches of Soil

Scoring: Select the option(s) that best describes the dominant hydrologic characteristic of the Wetland. For the purposes of this submetric, "dominant" is defined as comprising at least 25 percent of the Wetland's area. If the Wetland contains several areas that have distinctly different hydrologic characteristics, select all that apply and average the points. Round to the nearest 0.5 increment. Maximum 4 points.

Example 1: At least 25 percent of the Wetland is riverine emergent marsh (permanently inundated, 4 points), at least 25 percent of the Wetland is low-lying floodplain forest (permanently saturated to regularly inundated, 3 points), and at least 25 percent of the Wetland is a wet meadow that is regularly saturated to seasonally inundated (2 points). The resulting average score is (4+3+2) / 3 = 3 points. Assign 3 points.

Example 2: The Wetland is primarily a wet meadow that has only evidence of seasonal saturation (i.e., hydric soils). Assign 1 point.

Submetric 3d: Alterations to Natural Hydrologic Regime

This submetric evaluates the intactness or lack of disturbance to the natural hydrologic regime of the Wetland. Hydrology is one of the fundamental determinants of wetland function, and hydrologic disturbances can lead to degradation of wetlands (Wilcox et al. 1984, Wilcox 1995, Brinson and Malvarez 2002). The Evaluator should begin scoring this submetric by using field evidence to determine if any hydrologic alterations occurred more than 20 years ago. If the Evaluator is unable to determine the time frame of the hydrologic alterations based on the field evaluation, then the Evaluator may need to obtain historic aerial photographs to aid in the determination. The checklist provided on the scoring form should be used to note all possible types of past or ongoing hydrologic alteration that are observed and/or are potentially influencing the Wetland's hydrology. A hydrologic alteration occurring in or near a wetland can greatly affect a wetland's hydrology. A hydrologic alteration may also impact the Substrate/Soil (Submetric 4a) and/or Habitat (Submetric 4b).

This question does not discriminate between wetlands with different types of hydrologic regimes (e.g., marsh versus bog). Rather, it asks the Evaluator to determine the intactness of the hydrologic regime attributable to that type of wetland. For instance, a surface water dependent marsh and a precipitation-dependent bog can both receive the maximum score of 8 points, if there are no apparent alterations to the natural hydrologic regimes.

The checklist provided on the Rating Form lists only some of the common hydrologic alterations. These include, but are not limited to the following:

- ☐ ditch(es) in or near the wetland
- ☐ tile(s) in or near the wetland
- ☐ dike(s) in or near the wetland
- ☐ weir(s) in or near the wetland
- ☐ stormwater inputs (addition of water)
- ☐ stream channelization
- ☐ point source discharge(s) (non-stormwater)
- ☐ filling/grading activities in or near the wetland
- ☐ road beds/RR grade(s) in or near the wetland
- ☐ dredging activities in or near the wetland
- ☐ other (specify)
- ☐ other (specify)

Once the Evaluator has identified all possible past and ongoing hydrologic alteration(s), the Evaluator should determine whether an alteration is significant or minor in relation to the Wetland's overall area and hydrologic regime. **For this submetric, "significant" is defined as affecting approximately 10 percent or more of the Wetland. "Minor" is defined as affecting less than approximately 10 percent of the Wetland.** Some alterations may have only a trivial impact on a Wetland's hydrologic regime. Others may have occurred so far in the past that current hydrology should be considered to be "recovered."

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Figure 21. Ditching can alter a wetland's hydrology and may also have an impact to the substrate/soil. St. Clair County, Michigan.

Submetric 3d: Scoring Options

Points	Alterations to Natural Hydrologic Regime	Example
8	No Hydrologic Alterations Apparent	There has been no significant alteration(s) to the Wetland's natural hydrologic regime, and/or ongoing minor alteration(s) is/are rare.
6	Recovered	Significant hydrologic alteration(s) occurred more than 20 years prior to the assessment, and/or ongoing minor hydrologic alteration(s) is/are only occasional.
4	Recovering	A single significant hydrologic alteration occurred within 20 years prior to the assessment, and/or ongoing minor hydrologic alteration(s) is/are frequent.
1	Recent or No Recovery	Multiple significant hydrologic alterations have occurred in the 20 years prior to the assessment, and/or significant alteration(s) is/are ongoing.

Scoring: Select an option that best describes the extent of (or lack of) alteration(s) to the Wetland's natural hydrologic regime. If uncertain, select adjoining options and average the available points. Round to the nearest 0.5 increment. If the Wetland's natural hydrologic regime has been significantly altered, it shall receive no more than 6 points. Maximum 8 points.

Example 1: The Wetland is a 50-acre complex of emergent marshes located around half of a small, natural kettle lake. Over 20 years ago, a weir was installed to deepen the lake by several feet and reduce amplitude of water level fluctuations, which affected the entire marsh complex. The past alteration of the lake and Wetland hydrology significantly impacted this surface water driven wetland system. Although a considerable amount of the Wetland was probably impacted when the lake level was raised, enough time (more than 20 years) has passed to allow the Wetland to recover (and reach a new ecological equilibrium) from this disturbance. Select "Recovered" (6 points).

Example 2: The Wetland is a 10-acre inundated shrub swamp with areas of maturing forest overstory. Many of the trees appear to be stressed or are dying. High watermarks on the tree trunks are apparent, and the bases of most of the trunks are inundated even though it is late summer. Large mats of filamentous algae are apparent in the pools. No significant outflows are observed, although a ditch bringing run-off from a corn field is observed. The ditch is relatively narrow, but erosion and lack of vegetation on the bottom of the channel indicates that a large amount of water is frequently conveyed

into the swamp from the adjacent corn field. Archival aerial photographs and the numerous dying trees indicate that the ditch was installed within the past few years (less than 20 years). Most of the ditch (except for one end) lies outside of the Wetland. However, hydrologically the ditch appears to affect the entire Wetland (is a significant alteration to hydrology). Within a few years, most of the trees and many of the shrubs will likely drown. Over time, much of the swamp may develop into a pond/marsh. Without canopy shade and with the infusion of nutrients from the corn field, invasive and weedy emergents (e.g., *Typha angustifolia)* will likely dominate the community within the degraded Wetland system. Because the ditch is significantly altering hydrology on an ongoing basis, and the system has not begun to recover, select "Recent or No Recovery" (1 point).

Example 3: The Wetland is a 10-acre riverine emergent marsh and southern shrub-carr. It is evident from aerial photographs and field inspection that a relatively small amount of fill (30 feet long by 16 feet wide) was placed within the shrubby edge of the Wetland to construct a driveway. The driveway fill is far from the stream and, therefore, does not alter the natural flow of surface water into the Wetland. Although a minor amount of the Wetland has been filled, it was done on the edge of the Wetland and the hydrology of the remainder of the Wetland was unaffected. Select "No Hydrologic Alterations Apparent" (8 points).

Example 4: Aerial photographs and/or permit records indicate that a road was constructed near several small, natural outlets at the edge of a 35-acre hardwood swamp. It appears that the permanent flooding caused by the roadbed dike has killed most of the trees, except for some around the edges. Emergent marsh and wet meadow communities comprised of mostly native vegetation now dominate much of the shallower areas. Definitely significant in scale, this single hydrologic disturbance occurred less than 20 years ago. Although now comprised of completely different wetland community types, the Wetland is recovering. Select "Recovering" (4 points).

Metric 4: Habitat Alteration and Habitat Structure Development

Habitat is an important wetland function that may be negatively impacted by disturbance-related factors and activities. Section 324.30302 of Part 303 recognizes that wetlands can provide habitat for breeding, nesting, rearing young, protective cover, and feeding for many forms of wildlife including fish, resident waterfowl, migratory waterfowl, and rare, threatened or endangered species. In addition, Section 324.30311(e) of Part 303 requires an evaluation of potential wetland wildlife habitat alteration for projects proposed in wetlands.

Submetric 4a: Substrate/Soil Disturbance

This submetric evaluates the intactness or lack of disturbance to the Wetland's substrate and soil. The Evaluator should utilize field evidence to determine if any substrate disturbance occurred prior to approximately 20 years ago. If the Evaluator is unable to determine the time frame of the substrate disturbance based on the field evaluation, then the Evaluator may need to obtain historic aerial photographs to aide in the determination. Use the checklist provided on the Rating Form to note all possible types of past or ongoing substrate/soil disturbances that are observed within the Wetland. These include, but are not limited to;

- ☐ human-induced erosion or exposure
- ☐ human-induced sedimentation or burial
- ☐ filling
- ☐ grading
- ☐ dredging
- ☐ plowing, disking
- ☐ intensive grazing (hooves)
- ☐ off-road vehicle use
- ☐ construction vehicle use
- ☐ other (specify)

A substrate disturbance may also be an alteration to the Natural Hydrologic Regime (Submetric 3d) and/or an alteration to the Wetland's Habitat (Submetric 4b). In a case where there have been alterations of hydrology, substrate, and habitat, the Evaluator should score each metric accordingly (i.e., each metric will be scored as an alteration).

This submetric does not discriminate between wetlands with different types of substrate (e.g., between the muck bottom typical of an emergent marsh and the peat substrate typical of a bog). Rather, it asks the Evaluator to determine the intactness of the substrate attributable to that type of wetland. An emergent marsh and a bog, for example, can score the maximum points (4), if there has been no disturbance to the natural substrate.

The checklist provided on the Rating Form lists only some of the common substrate disturbances. There may be others that are not on the list. Once the Evaluator has identified all possible past and ongoing disturbances to the substrate, the Evaluator should determine if each disturbance is significant or minor in relation to the Wetland's overall area. **For this submetric, "significant" is defined as affecting approximately 10 percent or more of the Wetland area. "Minor" is defined as affecting less than approximately 10 percent of the Wetland area.** Some disturbances may have only a trivial impact on the Wetland's substrate. Others may have occurred so far in the past that the Wetland should be considered to be "recovered."

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Figure 22. Signs of substrate/soil disturbance can include off-road and/or construction vehicle use. Chippewa County, Michigan.

Submetric 4a: Scoring Options

Points	Substrate/Soil Disturbance	Example
4	No Substrate Disturbance Apparent	There has been no significant disturbance to the Wetland's substrate and/or ongoing *minor* disturbance events are rare.
3	Recovered	Significant substrate disturbance occurred more than 20 years prior to the assessment, and/or ongoing minor substrate disturbance events are only occasional (e.g., light sedimentation from a nearby dirt road).
2	Recovering	A single significant substrate disturbance event occurred within 20 years prior to the assessment, and/or ongoing minor substrate disturbance events are frequent.
1	Recent or No Recovery	Multiple significant substrate disturbance events have occurred in the 20 years prior to the assessment, and/or significant disturbance is ongoing.

Scoring: Select an option that best describes the extent (or lack) of disturbance to the Wetland's substrate. If uncertain, select adjoining options and average the points. Round to the nearest 0.5 increment. If the Wetland's substrate has been significantly altered, it should receive no more than 3 points. Maximum 4 points.

Example 1: The Wetland is a 50-acre emergent marsh. It is evident during the field inspection that a relatively small amount of fill (30 feet long by 16 feet wide) was recently placed along the Wetland's edge to construct a driveway. Proper erosion control procedures were apparently utilized (siltation is not evident within the Wetland). Based on aerial photographic evidence, no other modifications have occurred in the Wetland. The substrate disturbance was minor (less than 10 percent) compared to the size of the Wetland. Select "No Substrate Disturbance Apparent" (4 points).

Example 2: A paved state road bisects a 30-acre wet meadow. Aerial photographs and field evidence indicate that approximately 20 percent of the Wetland's historical area had been filled during road construction. The fill occurred decades ago and there is no evidence of contemporary erosion. Although a significant substrate disturbance (more than 10 percent of the Wetland), the road fill occurred so far in the past (more than 20 years) that the Wetland's substrate can now be considered to be "Recovered" (3 points).

Example 3: Portions of a 10-acre emergent marsh/wet meadow are subject to varying intensity of grazing cattle and horses throughout the growing season. Although occasional hoof tracks are evident throughout the Wetland, most of the substrate is not disturbed. It appears that disturbance frequently occurs only in the drier, non-marsh areas of the Wetland. Although frequently overgrazed, each of the several disturbed areas is only a small fraction of the entire Wetland. Select "Recovering" (2 points).

Example 4: Archival aerial photographs indicate that the 1-acre Wetland was an inundated shrub swamp until the past several years. The lack of proper erosion control management during construction of a shopping center and massive parking lot nearby has resulted in burial of the entire Wetland's original substrate. The buttonbush (*Cephalanthus occidentalis*) shrubs have been smothered in sediment. Now, several weedy herbaceous species dominate the vegetation. Select "Recent or No Recovery" (1 point).

Submetric 4b: Habitat Alteration

This submetric evaluates the intactness of the natural habitat within the Wetland. Field evidence should be used to determine the type and extent of habitat alteration(s) that have occurred within the past 20 years. If the Evaluator is unable to determine the time frame of the habitat alteration(s) based on the field evaluation, then the Evaluator may need to obtain historic aerial photographs to aid in the determination. The checklist provided on the Rating Form should be used to note all possible types of past or ongoing habitat alteration(s) observed within the Wetland. These include but are not limited to:

- ☐ barriers such as road bed(s)/RR grade(s)
- ☐ selective cutting
- ☐ clearcutting
- ☐ mowing or shrub removal
- ☐ coarse woody debris (CWD) removal
- ☐ Intensive grazing
- ☐ nutrient enrichment, e.g., nuisance algae
- ☐ herbicide/chemical treatment
- ☐ sedimentation
- ☐ dredging
- ☐ filling/grading
- ☐ plowing/disking/farming
- ☐ other (specify)

If possible, the Evaluator should determine the approximate pre-disturbance habitat attributes that existed within the Wetland. Disregard changes that can be attributed to natural wetland community succession or other natural processes. Habitat alteration may also be an alteration of the Natural Hydrologic Regime (Submetric 3d) and/or a Substrate/Soil disturbance (Submetric 4a).

This question does not discriminate between wetland types. Rather, it asks the Evaluator to determine the intactness of the habitat typical for that type of wetland. For example, an emergent marsh and a bog could both score the maximum points for this submetric (9), if no apparent habitat alterations have occurred.

Once the Evaluator has identified all possible past and ongoing habitat alterations, the Evaluator should determine if each alteration is significant or minor in relation to the Wetland's overall area. **For this submetric, "significant" is defined as affecting approximately 10 percent or greater of the Wetland area, while "minor" is defined as affecting less than approximately 10 percent of the Wetland area.** Some alterations may have only a trivial impact on the Wetland's overall habitat. Others may have occurred so far in the past that current habitat should be considered to be "recovered."

Susan Jones

Figure 23. Logging of this wetland has altered the habitat. Presque Isle County, Michigan.

Submetric 4b: Scoring Options

Points	Habitat Alteration	Example
9	No Habitat Alterations Apparent	There has been no significant alteration to the Wetland's natural habitat, and/or ongoing minor alteration(s) is/are rare.
6	Recovered	Significant habitat alteration(s) occurred more than 20 years prior to the assessment, and/or ongoing minor habitat alteration(s) is/are only occasional.
3	Recovering	A single, significant habitat alteration occurred within 20 years prior to the assessment, and/or ongoing minor habitat alteration(s) is/are frequent.
1	Recent or No Recovery	Multiple significant habitat alteration events have occurred in the 20 years prior to the assessment, and/or significant alteration(s) is/are ongoing.

Scoring: Select an option that best describes the extent of (or lack of) alteration(s) to the Wetland's habitat. If unclear, select adjoining options and average the available points. Round to the nearest 0.5 increment. Maximum 9 points.

Example 1: The Wetland is a 30-acre southern hardwood swamp surrounded by residential housing and lawns. Aerial photographs indicate that the Wetland's size and configuration has not been altered. Large trees, extensive woody debris, and evidence of vernal ponding are noted during spring field inspection. Although the surrounding upland habitat has been extensively modified and degraded, the habitat within the Wetland has remained unchanged. Select "No Habitat Alterations Apparent" (9 points).

Example 2: Much of a forested Wetland has been selectively logged during the winter months when the ground was frozen. During field inspection, it is noted that many large trees were left standing. All the tops and coarse woody debris were left within the Wetland. Although the habitat was significantly altered, the selective logging was done in accordance with Best Management Practices and much of the structure of the forest is still functionally intact. Select "Recovering" (3 points) and "Recovered" (6 pts), then average the scores (4.5 points).

Example 3: A 25-acre strip of shoreline along a small inland lake is dominated by emergent marsh and southern wet meadow community types. Several owners of lakefront cottages occasionally mow vegetation during the summer when the Wetland becomes drier. During the summer field inspection it is noted that this activity — although frequent and ongoing — encompasses less than 10 percent of the entire Wetland. Select "Recovering" (3 points).

Example 4: The entire extent of a 20-acre southern wet meadow has been repeatedly overgrazed by livestock. Most of the quality vertical habitat (e.g., hummocks, organic debris, diverse plant height ranges) has been destroyed by the livestock. Because of the intense grazing pressure and abundant nutrients from livestock waste, weedy plant species such as Canada thistle (*Cirsium arvense*) and reed canary grass (*Phalaris arundinacea*) now dominate the plant community. Other than invasive starlings, few birds or mammals are evident. Select "Recent or No Recovery" (1 point).

Submetric 4c: Habitat Structure Development

This submetric allows the Evaluator to determine an overall qualitative rating of how well-developed the Wetland is in comparison to the pristine example of the same wetland community type. For this submetric, a wetland's type is defined as any ecologically and/or hydrogeomorphically similar wetland typical of the region of the state. Well-developed communities, regardless of successional state, often exhibit many of the following habitat characteristics:

- Quality vertical habitat such as hummocks, organic debris, and diverse plant height ranges.
- Quality horizontal habitat, such as varying vegetation density and patchiness, moderate ratios of open space to cover, plant species diversity, and a wide range of plant ages. The number of plant species present in a wetland is typically directly proportional to the number of potential niches available for invertebrates, birds, and mammals (Hruby, et al. 1999, Knops et al. 1999). Therefore, the total number of animal species in a wetland is expected to increase as the number of plant species increases.
- Other ecological attributes, such as a diverse assortment of breeding areas, rearing areas, feeding areas, niche space, etc.

Susan Jones

Figure 24. Diverse plant heights and vegetation densities can be seen in this Wetland. Arenac County, Michigan.

Submetric 4c: Scoring Options

Points	Habitat Structure Development	Example
7	Excellent	Wetland appears to represent the best of its type.
5	Good	Wetland appears to be a good example of its type but because of past or present disturbance or other reasons, is not excellent.
3	Fair	Wetland appears to be a moderately good example of its type but because of past or present disturbance or other reasons, is not good.
1	Poor	Wetland is a poor example of its type because of past or present disturbance or other reasons.

Scoring: Select an option that best describes the Wetland's habitat structure development. If unclear, select adjoining options and average the points. Round to the nearest 0.5 increment. Maximum 7 points.

Metric 5: Special Situations

Assign or deduct points if the Wetland has any of the features described within this section. Refer to Chapter V, Narrative Rating, for further guidance on identifying natural communities. The maximum points allowable for Metric 5 is 10; however, some wetlands may score higher. In these cases, record the maximum 10 points and note in the comments the actual points received for Metric 5.

Submetric 5a: High Ecological Value

For scoring this submetric refer to the Narrative Rating. If "YES" was selected for <u>any</u> of the Narrative Rating questions or an S3 community is present (the Narrative Rating only rates S1 and S2 as automatically high functional value), then assign 10 points to this submetric.

1. Contains USFWS-designated Critical Habitat

Is any part of the Wetland located within an area designated as Critical Habitat <u>and</u> does the Wetland actually contain habitat suitable for either species listed below?

Federally-listed species are protected under the Endangered Species Act of 1973. Critical Habitat is defined by the USFWS as specific geographic area(s) containing physical or biological features essential to the conservation of a federally-listed T/E species that may require special management considerations or protection. Currently in Michigan, the USFWS has designated Critical Habitat for only two species: the piping plover (*Charadrius melodus*) and the Hine's emerald dragonfly (*Somatochlora hineana*). This Narrative Rating question recognizes the fact the USFWS Critical Habitat Unit boundaries may not be exact, and may include large tracts of habitat that are considered unsuitable for the species. Therefore, if any part of the Wetland is contained within the legal description of a Critical Habitat Unit but an Evaluator has determined based on field observations and habitat descriptions, that the Wetland does not contain suitable habitat for the species in question, then this submetric can be answered "No." In some instances, a detailed evaluation of the habitat may be required to ensure proper identification of the Critical Habitat.

If any part of the Wetland is located within a Critical Habitat Unit and actually contains habitat suitable for either the piping plover or the Hine's emerald dragonfly, then the Wetland has high functional value and will receive 10 points for this submetric.

Michigan Piping Plover Critical Habitat is designated only within the following counties: Alger, Benzie, Charlevoix, Cheboygan, Chippewa, Emmet, Iosco, Leelanau, Luce, Mackinac, Mason, Muskegon, Presque Isle, and Schoolcraft. See the USFWS Final Rule documents for locations and legal descriptions of all identified units.
(The link provided was broken and has been removed)

Michigan Hine's Emerald Dragonfly Critical Habitat is designated only within the following counties: Alpena, Mackinac, and Presque Isle. See the USFWS Final Rule document's URL for locations and legal descriptions of all Units.
(The link provided was broken and has been removed)

See the following URL for more information pertaining to Critical Habitat within the Midwest Region: **www.fws.gov/midwest**

Contact Information: U.S. Fish and Wildlife Service
East Lansing Field Office
2651 Coolidge Road, Suite 101
East Lansing, MI 48823
517-351-2555

U.S. Fish & Wildlife Service

Figure 25. Currently in Michigan, the USFWS has designated Critical Habitat for only two species: the Hine's emerald dragonfly (*Somatochlora hineana*) and the piping plover (*Charadrius melodus*).

2. Federal or State-listed T/E Plant or Animal Species

Do federal and/or state-listed T/E plant or animal species occur within the Wetland?

To determine if T/E species are present within the Wetland area, the following set of questions should be answered.

a. ☐ YES ☐NO Has an approved T/E survey been completed? If "Yes," go to question b; if "No" go to question c.

b. ☐ YES ☐NO Does the T/E survey indicate T/E species present within the Wetland? If "Yes," answer "Yes" to this submetric. If "No," answer "No" to this submetric.

c. ☐ YES ☐NO Has the Evaluator (or others known to the Evaluator) observed any T/E species within the Wetland? If "Yes" answer "Yes" to this submetric. If "No," go to question d.

d. ☐ YES ☐NO Does the DNRE ESA web site interactive map, **mcgi.state.mi.us/esa** indicate that there is a potential for unique natural features at or near your site of interest? If "No," answer "No" to this submetric. If "Yes", request a DNRE formal review by submitting the on-line form. Type "MiRAM" within the "Project Information" field when completing the on-line form. Go to question e.

e. ☐ YES ☐NO Did the DNRE review confirm potential T/E occurrence in the Wetland?
If "Yes," answer "Yes" to this submetric. If "No," answer "No" to this submetric.

If the DNRE ESA web site indicates a potential occurrence and the Evaluator is waiting for a formal response, this submetric should be scored both with and without the occurrence of T/E species, which should be noted, and both scores reported on the MiRAM summary page of the Rating Form.

The purpose of this submetric is to identify those wetlands with exceptional ecological value that actually contain or potentially contain T/E species. Michigan's T/E species are protected under Part 365, Endangered Species Protection, of the NREPA. Federally-listed species are protected under the Endangered Species Act of 1973. If the Evaluator (or other person) does not observe a T/E species within the Wetland and no T/E species field survey results are available, the Evaluator must consult the DNRE ESA web site to determine if the DNRE has a record of any federal/state-listed T/E species occurring within the Wetland.

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Figure 26. If a state threatened species, such as the American lotus (*Nelumbo lutea*), is observed within the Wetland, then the Wetland is considered to have exceptional ecological value and scores 10 points under Submetric 5a. Monroe County, Michigan.

3. S1, S2 or S3 Natural Community Type

In addition to the S1 and S2 communities automatically assigned high functional value in the Narrative Rating, this submetric also recognizes S3 communities as having high ecological function. As defined in Kost et al. 2007, the State Ranks for vegetation communities are:

S1 = critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state.

S2 = imperiled in the state because of rarity due to very restricted range, very few occurrences (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state.

S3 = vulnerable in the state due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 = uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 = common and widespread in the state.

SX = community is presumed to be extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

S? = incomplete data.

To receive the points for this submetric, the rare natural community type must be more than 5 acres in size or more than 25 percent of the entire Wetland. If the rare natural community is less than 5 acres and less than 25 percent of the overall Wetland, then the rare natural community may be "split off" from the rest of the Wetland and scored separately.

To aid in the identification and rating of natural communities, the Evaluator should consult the *Natural Communities of Michigan: Classification and Description* (Kost et al 2007), community abstracts, and other information available at: **https://mnfi.anr.msu.edu/**. Southern bogs and old-growth/mature forests are defined below. If the rare wetland community type is greater than 5 acres in size or comprises more than 25 percent of the Wetland, this submetric should be answered "YES," and the Wetland has high functional value.

Keto Gyekis

Figure 27. Wet mesic prairie, Washtenaw County, is an S2 community. This Wetland is considered to have exceptional ecological value and is rated as having high functional value by the Narrative Rating. It also scores 10 points in the Quantitative Rating under Submetric 5a.

4. Southern Bog

While bogs are somewhat common throughout northern Michigan, they are relatively rare within the southern portion of the state. Therefore, bogs located south of Michigan's Floristic Tension Zone (Barnes and Wagner 1981), as depicted in figure 28, should be awarded 10 points for this submetric.

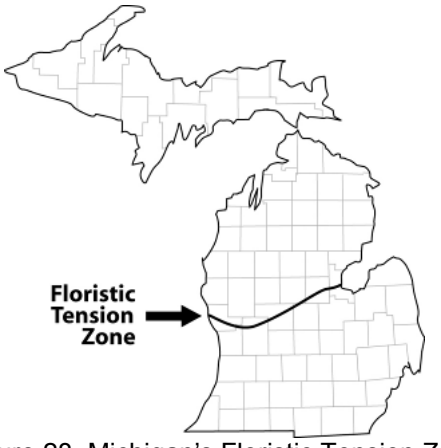

Figure 28. Michigan's Floristic Tension Zone (adapted from Barnes and Wagner 1981).

To aid in the identification of bogs, the Evaluator should consult the *Natural Communities of Michigan: Classification and Description* (Kost et al. 2007), community abstracts, and other information available at **https://mnfi.anr.msu.edu/**. Southern bogs need to be greater than 5 acres in size or comprise more than 25 percent of the Wetland to receive the 10 points for this submetric.

5. Old-Growth/Mature Forested Wetland

Old-Growth/Mature Forested Wetland

Although not specifically addressed within Kost et al. (2007), old-growth/mature forested wetlands are a rare and ecologically important wetland community type in Michigan (Frelich 1995, Schmidt et al. 1996, MDNR 2001).

The term "old-growth/mature" describes a rare successional state dominated by forest vegetation in the mature stages of its life cycle (Parker 1989). These ecosystems approximate the structure, composition, and functions of heterogeneous, native climax forests (MDNR 2001), with conditions that include abundant large trees and standing snags, multiple foliage layers, abundant canopy gaps, gap saplings of various sizes and ages, high native species diversity, large nursery logs, tip-up mounds, and extensive dead organic material. These systems involve more complex ecological processes and undergo more gradual change than do young or intensively-managed forests. Some easily measurable characteristics of Michigan old-growth/mature forests include the following: mean overstory diameter at breast height (DBH) of at least 20 inches and at least two trees per acre having DBH ≥28 inches (Lorimer et al. 1994, Tyrrel and Crow 1994, McGee et al. 1999). While an Evaluator may never see a true old-growth forested wetland, the Evaluator may encounter relatively old, mature second-growth forested wetlands that look and function very similar to true old-growth ecosystems (MDNR 2001). The MiRAM treats old-growth and mature second-growth forests as the same rare wetland community type with high functional value.

Although some forested wetlands might be classified as old-growth forests according to some definitions of the term, they often have non-diverse tree communities, generally characterized by conditions of extremely low growth rates, poor productivity, and are dominated by relatively small, stunted trees (Kost 2001, Cohen 2006a, Cohen 2006b). Many nutrient-depauperate muskegs, bogs, and northern fen communities historically escaped timber harvesting because of stunted timber size, low timber volume, and extraction difficulty. For the scope of the MiRAM, these forested wetland communities are not classified as old-growth forests, but rather as other types of rare natural communities, including muskegs, bogs, northern fen communities, etc.

To answer this submetric correctly, the Evaluator may need to obtain and review historic aerial photographs of the Wetland to determine logging and disturbance history. To qualify as old-growth/mature for the purposes of the MiRAM, a forested wetland must exhibit the following characteristics:

1) Lack evidence of any significant harvesting (relatively old second-growth may qualify).
2) Forest is dominated by massive overstory trees (mean overstory DBH of at least 20 inches and at least two trees per acre having DBH ≥28 inches).
3) Multi-aged and multi-layered canopy.
4) Aggregations of canopy trees are interspersed with canopy gaps and large snags.
5) Large nursery logs and large tip-up mounds litter the forest floor.

6. Great Lakes Coastal Wetland

Great Lakes coastal wetlands are defined as any wetland with any portion located within 1,000 feet of the ordinary high water mark of any of the Great Lakes, including Lake St. Clair.

Wetlands of the Laurentian Great Lakes have undergone extensive anthropogenic fragmentation, severe degradation, and extensive losses in the past two centuries (Maynard and Wilcox 1996). Two-thirds of the Great Lakes coastal wetlands have been lost overall, with many regions having lost 90 percent or more (Mitsch and Bouchard 1998). Comparison of historic maps to present aerial photographs shows that wetlands in regions such as Saginaw Bay and Lake St. Clair have been especially devastated (Comer et al. 1993, Comer et al. 1995, Comer 1996). These wetland losses have resulted in significant ecological changes to the Great Lakes and its biota (Albert 2003). Signs of wetland degradation include sharp declines in the coastal fisheries and waterfowl populations, chemical and physical degradation of the lakes, loss of vegetation leading to shoreline erosion, and loss of aesthetics and green space. Great Lakes coastal wetlands are unique, relatively rare systems that provide immensely valuable functions to the entire region, regardless of a long history of anthropogenic degradation (Mitsch and Gosselink 2000a, Albert 2003). Benefits include flood control, shoreline protection, nutrient-cycle control, sediment retention, fish spawning and nursery grounds, and water fowl habitat (Keddy 2000, Mitsch and Gosselink 2000a, Albert 2003).

Ten points should be awarded for this submetric if any part of the Wetland is within 1,000 feet of the ordinary high water mark of any of the Great Lakes or Lake St. Clair.

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Figure 29. Wetland is located within 1,000 feet of a Great Lake. Mackinaw County, Michigan.

Submetric 5a: Scoring Options

Points	High Ecological Value
10	Contains USFWS-designated Critical Habitat
10	Federal or State-listed T/E Plant or Animal Species
10	S1, S2 or S3 Natural Community Type (at least 5 acres or 25% of the Wetland)
10	Southern Bog (at least 5 acres or 25% of the Wetland)
10	Old-Growth/Mature Forested Wetland (at least 5 acres of 25% of the Wetland)
10	Great Lakes Coastal Wetland

Scoring: Assign points if the Wetland has High Ecological Value. Maximum 10 points

Submetric 5b: Forested Wetland

Forested wetlands are often associated with valuable ecological functions and benefits (Lowrance et al. 1984, Kuenzler 1989). Forested wetlands have been impacted more than any other wetland type, accounting for over one half of all wetland losses in the United States (Wilen and Frayer 1990). When these systems are destroyed or damaged severely by anthropogenic activities, they may take decades to recover to their previous state (Mitsch and Wilson 1996).

The MiRAM defines a “forested wetland” as any wetland where the forest overstory component (any group of trees) exhibits a combined canopy cover that comprises at least 5 acres or 25 percent of the wetland. The wetland does not qualify as a forested wetland if most of the trees are ungrouped and widely scattered (e.g., a savanna) or located only thinly along the wetland’s margin or if it is clear that most of the trees are actually located on upland around the perimeter of the wetland. A tree is defined as any plant with a stem DBH of at least 3 inches (USACE 1987).

DNRE Staff

Figure 30. A forested wetland exhibits a combined canopy cover that comprises at least 5 acres or 25 percent of the Wetland. Eaton County, Michigan.

Submetric 5b: Scoring Options

Points	Wetland Type	Example
5	Forested	Exhibits combined canopy cover from any group(s) of trees. Stem DBH must be at least 3 inches to qualify as a tree. Total area must comprise at least 5 acres or 25% of the Wetland. Does not qualify if most of the trees are ungrouped and widely scattered (e.g., a savanna) or located only thinly along the Wetland's margin.

Scoring: Assign points if the Wetland is a forested wetland. Maximum 5 points

Submetric 5c: Urban/Suburban Wetland

Wetlands in urban or suburban watersheds can provide highly valuable services (Thibodeau and Ostro.1981, Mahan et al. 2000). For example, in urban/suburban areas with low permeability landscapes, wetlands buffer stream and drainage systems against intense surface runoff events, while removing hydrocarbons, metals, and other pollutants from surface runoff (Herson-Jones et al. 1995, Wenger 1999). Section 324.30302 of Part 303 recognizes the importance of wetlands for stormwater attenuation and in providing services, such as biological and chemical oxidation, filtering, and absorption of silt and organic matter. Section 324.30311(g) of Part 303 recognizes the importance of the amount of remaining wetland in the general area.

Susan Jones

Figure 31. Urban wetlands provide highly valuable services, such as buffering drainage systems against pollutants and intense surface runoff events typically associated with low-permeability landscapes. Marquette County, Michigan.

Submetric 5c: Scoring Options

Points	Wetland Type	Example
5	Urban/Suburban	Greater than 50% of the surrounding landscape (1,000 foot radius) is comprised of low-permeability surfaces, such as roads, lawns, parking lots, buildings, sidewalks, etc.

Scoring: Assign points if the Wetland is an Urban/Suburban wetland. Maximum 5 points.

Submetric 5d: Low-Quality Wetland

The MiRAM recognizes that the functional value of very small, isolated wetlands and artificial (i.e., manmade) stormwater ponds may be severely diminished when completely dominated by highly-invasive species. These include, but are not limited to:

- common reed (*Phragmites australis*)
- purple loosestrife (*Lythrum salicaria*)
- reed canary grass (*Phalaris arundinacea*)
- common buckthorn (*Rhamnus cathartica*)
- glossy buckthorn (*Rhamnus frangula*)
- narrow-leaved cattail (*Typha angustifolia)*
- hybrid cattail (*Typha x glauca*)
- marsh thistle (*Cirsium palustre*)
- multiflora rose (*Rosa multiflora*)
- non-native honeysuckle (*Lonicera spp*.)

Submetric 5d: Scoring Options

Points	Wetland Type	Example
Negative 10	Low-Quality	The Wetland is less than 1 acre and non-contiguous as defined in Part 303 and either: 1) a stormwater pond that was excavated from upland and constructed for stormwater treatment in conjunction with a development project or 2) more than 75% covered by highly-invasive vegetation.

Scoring: Assign points, if the Wetland is a low-quality wetland. Maximum negative 10 points.

Metric 6: Vegetation, Interspersion, and Habitat Features

Horizontal and vertical complexity of vegetation components, interspersion (horizontal patchiness), and microtopographic relief are typically correlated with wetland functional value (Fennessy et al. 1998a and 1998b, Mack et al. 2000). The maximum points allowable for Metric 6 is 20; however, some wetlands may score higher. In these cases, record the maximum 20 points and note in the comments the actual points received for Metric 6.

Submetric 6a: Wetland Vegetation Components

Vertical complexity can be based, in part, on the complexity of the dominant vegetation in each vegetative layer. Submetric 6a requires the Evaluator to determine the Qualitative Cover Score of each basic vegetation component (herbaceous, shrub/sapling, forest overstory) by using the Qualitative Cover Table (see below). To define the basic vegetation components, the MiRAM uses the strata definitions found in the *Corps Manual*. In many wetlands, vegetation components exist in overlapping layers (strata). For example, significant areas of shrub/sapling and/or herbaceous vegetation may exist under a forest canopy. Only *groups* of trees, *clusters* of shrubs or *dense patches* of herbaceous stems may count toward area coverage. Do not include widely-scattered trees, lone shrub/saplings or sparse patches of herbaceous stems. To aid in the determination of plant origin (i.e., native versus non-native) the Evaluator should consult the *Floristic Quality Assessment with Wetland Categories* (Herman et al. 2001). See Appendix C for a key to aid in proper identification of broad-leaved cattail (*Typha latifolia*), a non-invasive, native species. For the purposes of this submetric, "diversity" and "richness" may be regarded as synonymous.

Table 3: Qualitative Cover Scoring Table

Vegetation Component ► is >¼ acre	>25% of Wetland area ►	Native species dominate the coverage ►	High native diversity ►	3 pts
			Moderate to low native diversity ►	2 pts
		Invasive or non-native species dominate the coverage ►	Moderate to high native diversity ►	2 pts
			Low native diversity ►	1 pt
	<25% of Wetland area ►	Native species dominate the coverage ►	Moderate to high native diversity ►	2 pts
			Low native diversity ►	1 pt
		Invasive or non-native species dominate the coverage ►	Moderate native diversity ►	1 pt
			Low native diversity ►	0 pt
Vegetation Component is <¼ acre ►	>25% of Wetland area ►	Native species dominate the coverage ►	Moderate to high native diversity ►	2 pts
			Low native diversity ►	1 pt
		Invasive or non-native species dominate the coverage ►		0 pt
	<25% of Wetland area ►			0 pt

Scoring: Follow the guidelines provided in the Qualitative Cover Scoring Table (see Table 3) and assign points for each vegetation component present. Maximum 3 points for each component present, 9 points total.

Forest Overstory Qualitative Cover Score (0 to 3 points). Forested wetland areas are characterized by a group of trees at least 3 inches in DBH, regardless of height. The Wetland does not have a forested component if the trees are widely scattered (e.g., a savanna), located only thinly along the Wetland's margin or if it is clear that most of the trees are actually located on upland around the perimeter of the Wetland.

Example 1: The combined coverage of several groups of trees is 10 acres (of a 50-acre Wetland). There are no invasive or non-native tree species present, and the native species present include silver maple (*Acer saccarhinum*), red maple (*Acer rubrum*), American elm (*Ulmus americana*), red ash (*Fraxinus pennsylvanica*), swamp white oak (*Quercus bicolor*), pin oak (*Quercus palustris*), bur oak (*Quercus macrocarpa*), black ash (*Fraxinus nigra*), black willow (*Salix nigra*), yellow birch (*Betula allegheniensis*), tamarack (*Larix laricina*), and white cedar (*Thuja occidentalis*). This is actually a large percentage of the wetland tree species native to Michigan, so native diversity within the forest overstory is relatively high. Using the Qualitative Cover Scoring Table, start on the left and proceed to the right, until a point value is obtained. For this example, the Forest Overstory component is greater than ¼ acre. The Evaluator should proceed to the "*<25 percent of Wetland area"* option because the Forest Overstory component is only 10 acres of the 50-acre total (or 20 percent). Then, "native species dominate the coverage" and lastly, "moderate to high native diversity." Assign 2 points to the Forest Overstory component.

Example 2: The combined coverage of several groups of trees is 15 acres (of a 20-acre Wetland). Non-native tree species such as crack willow (*Salix fragilis*) and white willow (*Salix alba*) dominate the forest overstory. The only native tree species present in the overstory are sugar maple (*Acer saccarhinum)*, red maple (*Acer rubrum*), and red ash (*Fraxinus pennsylvanica*). So, the Forest Overstory component is greater than ¼ acre, greater than 25 percent of the Wetland, is dominated by non-native species, and has relatively low native diversity. 1 point is assigned to the Forest Overstory component.

Shrub/Sapling Qualitative Cover Score (0 to 3 points). Shrub/Sapling wetland areas are dominated by clusters of woody plants less than 3 inches in DBH and greater than 3.28 feet in height. Species include true shrubs, young trees, and stunted trees. Wetlands dominated by sapling-size tree species and a shrub understory may represent a successional stage leading to a forested wetland. Wetlands dominated by shrub species (less than or greater than 3.28 feet in height) may, in some situations, represent a relatively stable plant community.

Example 1: The combined coverage of many small groups of shrub/sapling vegetation is 5 acres (of a 35-acre Wetland). Invasive/non-native buckthorn (*Rhamnus spp.*) is widespread throughout the Wetland, but does not dominate coverage. Native species, such as speckled alder (*Alnus incana*), native viburnums (*Viburnum spp.)*, native willows (*Salix spp.*), dogwoods (*Cornus spp.*), meadowsweet (*Spirea spp.)*, blueberries (*Vaccinium spp.*), winterberry (*Ilex verticillata*), buttonbush (*Cephalanthus occidentalis*), and swamp rose (*Rosa palustris*) are all found within the Wetland. The Shrub/Sapling component is greater than ¼ acre, less than 25 percent of the Wetland, dominated by native species, and dominated by a moderate to high diversity of native plants. Using the Qualitative Cover Scoring Table, 2 points are assigned to the Shrub/Sapling component.

Example 2: Several small southern shrub-carrs cover approximately 40 percent (combined) of the Wetland. These shrub areas are dominated by dogwood and willow species such as red-osier dogwood (*C. stolonifera*), gray dogwood (*C. foemina*), silky dogwood (*C. amomum*), Bebb's willow (*Salix bebbiana*), pussy willow (*S. discolor*), sandbar Willow (*S. exigua*), and slender willow (*S. petiolaris*), along with other common shrubs, such as bog birch (Betula pumila), winterberry (Ilex verticillata), and swamp rose (*Rosa palustris*). Only a few invasive/non-native buckthorns (*Rhamnus spp.)* are observed. So, the Shrub/Sapling component is greater than ¼ acre, more than 25 percent of the Wetland, native species dominate the coverage, and there is moderate to high native diversity. Using the Qualitative Cover Scoring Table, 3 points are assigned to the Shrub/Sapling component.

Herbaceous Qualitative Cover Score (0 to 3 points). Herbaceous wetlands are areas dominated by dense patches of erect, non-woody plants, regardless of size, and woody plants less than 3.28 feet in height. The MiRAM includes the robust-stemmed yellow pond lily (*Nuphar advena*) and American lotus (*Nelumbo lutea*) within the herbaceous component because of their tendency to hold their stems and leaves well above the water. All floating-leaf species (including *Nymphaea* spp.) are excluded from the herbaceous component, and are instead included within the open water component (see Submetric 6b).

Example 1: The combined coverage of many small herbaceous patches is 5 acres (of a 10-acre Wetland). A few invasive/non-native species are present, but coverage is dominated by a wide array of native species. So, the Herbaceous component is greater than ¼ acre, more than 25 percent of the Wetland, dominated by native species, and has high native diversity. Using the Qualitative Cover Scoring Table, 3 points are assigned to the Herbaceous component.

Example 2: The Wetland was farmed for many years. Now it is entirely covered by reed canary grass (*Phalaris arundinacea*). Only a few, scattered native species are observed. So, the Herbaceous component is greater than ¼ acre, more than 25 percent of the Wetland, is dominated by invasive or non-native species, and has relatively low native diversity. Using the Qualitative Cover Scoring Table, 1 point is assigned to the Herbaceous component.

Submetric 6b: Open Water Component

Open water is an unobstructed area of water containing few or no rooted emergent or woody plant species. It can occur as a distinct zone along a river or lake. It can also occur as a combination of small ponds, streams or patches (e.g., within a marsh or swamp) and below a forested canopy (e.g., a forested vernal pool).

Open water includes combined acreage from any of the following areas:

- **Small ponds, streams, and pools.**
- **Seasonal standing water areas** (e.g., mudflats and dried-down vernal pools) that were inundated long enough during the growing season to support aquatic life. Look for evidence (e.g., water marks, drift lines, sediment deposits, nonvegetated understory) that may indicate a pool(s) was present at some time during the growing season. For more information, consult the *Corps Manual*.
- **Aquatic bed areas**, also known as submergent marsh or submerged aquatic vegetation (SAV). Aquatic bed is dominated by plants that grow at or below the surface of the water for most of the growing season in most years. Time and expertise needed to analyze taxa composition of aquatic bed areas is often lacking; therefore, qualitative determinations of the same aquatic bed area can vary extensively among different Evaluators. Because it is below the water's surface and, thus, often obscured, an aquatic bed can be difficult to accurately distinguish from unvegetated open water, even during the height of the growing season. Therefore, the MiRAM includes aquatic bed within the definition of open water due to potential difficulty in differentiating the two entities. For the purposes of the MiRAM, all floating-leaf aquatic taxa, such as water lilies (*Nymphaea* spp.), are included in the definition of aquatic bed and, therefore, also included in the definition of open water.
- **100-foot wide strip of open water along a lake or river** (See MiRAM Boundary guidelines). When the Wetland is adjacent to a lake or large river, calculate the acreage of the 100-foot wide strip of open water that is included within the Wetland (see MiRAM Boundary Determination Guidelines). Simply divide the linear feet of shoreline length by 400. For example, if the vegetated portion of the Wetland interfaces with 200 linear feet of a lake, then the extent of the lake's open water included within the Wetland would be calculated as: 200/400 = 0.5 acre.
- **Shallow pools free of dense shrub canopy** (e.g., open area within an inundated shrub swamp).
- **Shallow pools free of densely-packed herbaceous vegetation** (e.g., open area within a marsh or bog).

Susan Jones

Figure 32. Open water component with bog fringe. Luce County, Michigan.

Submetric 6b: Scoring Options

Points	Open Water	Criteria
3	High	2.5 acres or more
2	Moderate	1.0 acre to <2.5 acres
1	Low	0.25 acre to <1.0 acre
0	Virtually Absent	<0.25 acre

Scoring: Estimate the total acreage of open water and select only one option. Maximum 3 points.

Example 1: The Wetland is located along the floodplain of a large river. The evaluation is being conducted in late summer. The acreage of the 100-foot wide strip of open water that should be included within the Wetland is calculated by dividing the 600 linear feet of river shoreline by 400 (600 feet of shoreline/400 feet = 1.5 acres.) The Evaluator observes a large, sparsely vegetated, drying oxbow mudflat that appears to be connected to the river during annual flooding events. The Evaluator estimates that the oxbow mudflat would be approximately 0.25 acre of open water during the early part of the growing season. The 1.5 acres of open water (strip included along river) is added to the 0.25 acre mudflat. The total is 1.75 acres, which falls into the "Moderate" Open Water component (assign 2 points).

Example 2: The Wetland is primarily an emergent marsh that has numerous patchy areas of shallow open water (apparently opened and maintained by muskrats). All the patchy areas are added together for an Open Water component total of approximately 4 acres. This falls within the "High" category (assign 3 points).

Submetric 6c: Coverage of Highly-Invasive Plant Species

Estimate the combined total coverage of any of the species listed below. Assign points based on a range from virtually absent (1 point) to extensive (negative 5 points). Other species may be added to the list, if identified as non-native invasive species by the Evaluator and confirmed by either the MNFI or the DNRE. See the key provided below as an aid to the proper identification of broad-leaved cattail (*Typha latifolia*), a non-invasive native species.

- common reed (*Phragmites australis)*
- purple loosestrife (*Lythrum salicaria*)
- reed canary grass (*Phalaris arundinacea*)
- common buckthorn (*Rhamnus cathartica*)
- glossy buckthorn (*Rhamnus frangula*)
- narrow-leaved cattail (*Typha angustifolia*)
- hybrid cattail (*Typha x glauca*)
- marsh thistle (Cirsium palustre)
- multiflora rose (*Rosa multiflora*)
- non-native honeysuckle (*Lonicera spp.*)

Field Key to Aid in Identification Cattail (Typha) Species*

Native, Non-invasive: Male and female portions of the flower spike are not separated (or only slightly separated) on most of the stems within the same local stand. Female flower spikes are light brown and are 0.8-1.2 inches thick at maturity (before expanding when dried). Most leaf blades are approximately 0.5 to1 inch wide at widest part. Typically, not tightly packed into an area (non-invasive). .....**broad-leaved cattail (*T. latifolia)***

Non-native, Invasive: Male and female portions of the flower spike are separated on most of the stems within the same local stand. Female flower spikes are dark brown and less than 0.8 inch thick at maturity (before expanding when dried). Most leaf blades are less than 0.5 inch wide at widest part. Typically, tightly packed within an area, crowding out other plant species (invasive). .....**narrow-leaved cattail (*T. angustifolia)***

Non-native, Invasive: Hybridization may have occurred if most plants within the same local stand do not cleanly fit the characteristics of either pure species described above. The gap between the male and female portions of the flower spikes is highly variable, with many plants within the same local stand having no gap, and many having relatively wide gaps. Typically, extremely vigorous and often tightly packed within an area, crowding out other plant species (invasive). .....**hybrid cattail (*T. x glauca)***

- Identifying the cattails (*Typha spp*.) in Michigan can be difficult due to the occurrence of the hybrid cattail (*T. xglauca*) (Rezicek, personal communication). In most cases, species of cattail can be identified using additional floral characteristics that require examination under a microscope. Those interested in detailed floral keys should consult Voss (1972).

DNRE Staff

Figure 33. This wetland has extensive coverage of highly invasive common reed (*Phragmites australis*). Saginaw Bay, Michigan.

Submetric 6c: Scoring Options

Points	Total Coverage	Criteria
1	Virtually Absent	<1% aerial coverage of highly-invasive species
0	Nearly Absent	1% to <5% aerial coverage of highly-invasive species
Negative 1	Low	5% to <25% aerial coverage of highly-invasive species
Negative 3	Moderate	25% to <75% aerial coverage of highly-invasive species
Negative 5	Extensive	≥75% aerial coverage of highly invasive species

Scoring: Estimate the total coverage of highly-invasive species present and select only one option. Maximum 1 point.

Submetric 6d: Horizontal (Plan View) Interspersion

This submetric requires the Evaluator to estimate the degree of interspersion between different community types (emergent, scrub/shrub, forested, open water, etc) within the Wetland. Wetlands with more community type interspersion (heterogeneity) are typically more ecologically complex and exhibit higher biodiversity (Mitsch and Gosselink 2000a, Rehm and Baldassarre 2007). Using an aerial photograph, determine which of the hypothetical wetland examples in the adjacent diagrams (Figure 34) is the best approximation of the Wetland's degree of interspersion. Look for contrasts among forested areas, patches of shrubs, areas dominated by herbaceous plants, and any open water component.

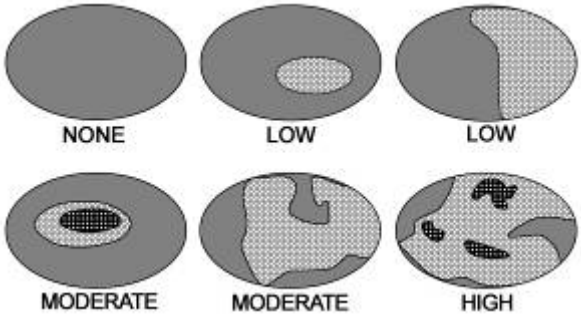

Figure 34. Hypothetical wetlands showing various degrees of horizontal interspersion.

Submetric 6d: Scoring Options

Points	Degree of Interspersion
5	High
3	Moderate
1	Low
0	None

Scoring : Select only one option and assign up to 5 points.

Example 1: The Wetland has many patchy areas of open water intermixed with emergent marsh. A forested wetland component juts into the Wetland from three sides. Dense shrub areas are scattered throughout the Wetland. Interspersion is "High" (5 points).

Example 2: Approximately one half of the 10-acre Wetland is prairie fen. A dense shrub-carr encircles the prairie fen irregularly, reaching into the fen in multiple locations. Interspersion is "Moderate" (3 points).

Example 3: The Wetland is an emergent marsh that is completely dominated by herbaceous vegetation. Only a few small areas of open water and patches of shrubs are evident. Interspersion is Low (1 point).

Example 4: The Wetland is a small swale completely covered by reed canary grass (*Phalaris arundinacea*). The Wetland has no interspersion (0 points).

Submetric 6e: Habitat Features

A wetland's microtopography can influence many of its functions, such as attenuation of water (Tweedy and Evans 2001) and ecological diversity (Bruland and Richardson 2005). To obtain the score for this submetric, determine whether each of the following habitat features is present in the Wetland:

1. Hummocks/Tussocks/Tree Mounds
2. Coarse Woody Debris (CWD)
3. Large Standing Trees, Living or Dead (≥12 inches DBH)
4. Amphibian Breeding/Nursery Habitat

If present, determine the extent or density of the feature within the Wetland, score each feature separately, then total the score for all the features to obtain the overall submetric score.

1. Hummocks/Tussocks/Tree Mounds - Examples include sedge/grass tussocks, sphagnum hummocks, decaying nursery logs (remnants of large logs), and root tip-up mounds (created by large, uprooted trees). These features add an important vertical dimension to wetland habitat, creating heterogeneous niches that enable a higher diversity of flora and fauna to utilize a wetland (Vivian-Smith 1997, Moser et al. 2007). Percent coverage is based on total area of all raised features and includes the depressional matrix within any group of raised features.

Susan Jones

Figure 35. Hummocks in foreground mixed in with shrubs and sedges. Ogemaw County, Michigan.

Susan Jones

Figure 36. Root tip-up from wind blown tree. Roscommon County, Michigan.

Submetric 6e(1): Hummocks/Tussocks/Tree Mounds, Scoring Options

Points	Habitat Coverage	Criteria
0	Virtually Absent	<5% of the Wetland
1	Sparse	5% to 10% of the Wetland
2	Moderate	11% to 50% of the Wetland
3	Dense	>50% of the Wetland

Scoring: Estimate the total coverage and select only one option. Maximum 3 points.

Example 1: A 5-acre prairie fen has numerous *Carex spp.* tussocks dominating approximately 3 acres. The total coverage of the tussocks, combined with the depressional areas within the tussock groups, is greater than 50 percent of the entire Wetland area (3 points).

Example 2: A rich conifer swamp has a few scattered tip-up mounds, each with an associated depression (where the tree roots and soil were ripped from the ground). It is estimated that the total area of all the combined mounds and depressions is less than 5 percent of the Wetland's total area (1 point).

2. Coarse Woody Debris (CWD) - Large, downed woody debris is utilized as important cover and forage habitat by invertebrates, amphibians, reptiles, birds, and mammals (Hruby et al. 1999). The MiRAM defines CWD as any logs or large branches that are at least 10 feet long and that have an average width (per log) of greater than 6 inches.

David Dortman

Figure 37. Dense CWD in a forested wetland in Saginaw County, Michigan.

Submetric 6e(2): Coarse Woody Debris (CWD), Scoring Options

Points	Habitat Coverage	Criteria
0	Virtually Absent	<1 per acre
1	Sparse	1 to 5 per acre
2	Moderate	6 to 10 per acre
3	Dense	>10 per acre

Scoring: Estimate the total coverage and select only one option. Maximum 3 points.

Example 1: Much of a 10-acre hardwood-conifer swamp is littered with downed trees and large branches. The amount of CWD is estimated to average well over 10 logs/branches per acre (3 points).

Example 2: A 5-acre floodplain forest Wetland is intensely managed by park staff. Every spring, laborers remove all the CWD from the forest floor. The park is very easy to walk through, but provides little habitat value at the ground level. Only a few very scattered downed large trees were observed, averaging less than 1 per acre (0 points).

3. **Large Standing Trees, Living or Dead -** Large trees (≥12 inches DBH), with their protective canopies, trunk crags, loose bark, and hollow areas, can provide shelter for invertebrates, tree frogs, small mammals, and birds. These areas provide roosting areas for raptors and other large birds, and provide nesting areas for a variety of wildlife (Goodburn and Lorimer 1998).

Todd Losee

Figure 38. Large standing trees in a floodplain of the Grand River, Ingham County, Michigan.

Submetric 6e(3): Large Standing Trees, Living or Dead (≥12 inches DBH), Scoring Options

Points	Habitat Coverage	Criteria
0	Virtually Absent	<1 per acre
1	Sparse	1 to 5 per acre
2	Moderate	6 to 10 per acre
3	Dense	>10 per acre

Scoring: Estimate the total coverage and select only one option. Maximum 3 points.

Example 1: Only 2 acres of a 20-acre Wetland is forested. It is estimated that there are approximately 60 large trees (≥12 inches DBH) within the 2-acre woodlot. Averaged over the 20-acre Wetland, there are approximately 3 trees per acre (1 point).

Example 2: A southern hardwood swamp comprises the majority of a 50-acre Wetland. At any point within the swamp, at least several large trees (≥12 inches DBH) are within view, relatively close to the Evaluator. However, large trees clearly do not dominate the canopy, and small trees are quite abundant. Because large trees are common but clearly do not dominate the canopy, it is estimated that the density is approximately 6 to 10 large trees per acre (2 points).

4. **Amphibian Breeding/Nursery Habitat -** Permanent and temporary areas of standing water serve to provide habitat for frogs and salamanders. Temporary pools, also known as vernal or ephemeral pools, serve as high-quality amphibian habitat, since they do not contain predatory fish and, therefore, they provide the best breeding habitat for a variety of amphibian species (Zedler 2003). Permanent areas of standing water along the edges of ponds, lakes, and some streams also serve as amphibian habitat. For this component of the submetric, the entire area of a fishless temporary pool should be counted as amphibian breeding and nursery habitat, while for permanent waterbodies that contain fish, only the edge areas should be counted as Amphibian Breeding/Nursery Habitat. Temporary pools must provide standing water of sufficient duration and depth to support frog and/or salamander reproduction.

DNRE Staff

Figure 39. Vernal pools provide amphibian breeding and nursery habitat. Washtenaw County, Michigan.

Submetric 6e(4): Amphibian Breeding/Nursery Habitat, Scoring Options

Points	Habitat Coverage	Criteria
0	Virtually Absent	<5% of the Wetland
1	Sparse	5% to 10% of the Wetland
2	Moderate	11% to 50% of the Wetland
3	Dense	>50% of the Wetland

Scoring: Estimate the total coverage and select only one option. Maximum 3 points.

Example 1: The Wetland is a 20-acre complex of inundated shrub swamp and vernal pools. It is estimated that 15 acres (75 percent) of the Wetland is open water during the Spring. Predatory fish are not normally present within this type of habitat, so successful reproduction of at least several amphibian species is likely (3 points).

Example 2: The Wetland is an inundated shrub swamp fringing an old river oxbow pool. The swamp and pool appear to be cut-off from the river, which is well over 100 feet away. Close inspection reveals that the pool is at least several feet deep in some areas and likely receives surface water (and predatory fish) from the large river during spring flooding via the old channel. Therefore, it is likely not ideal amphibian breeding/nursery habitat (0 points).

Example for Scoring Entire Habitat Features Submetric: The Wetland is an inundated shrub swamp that intergrades into a hardwood-conifer swamp. A few sedge tussocks, several nursery logs, and tree mounds/depressions cover approximately 20 percent of the Wetland (2 points assigned for Hummocks/Tussocks/Tree Mounds). Large braches (CWD) are strewn densely throughout the Wetland (3 points assigned for CWD). The forested component, which dominates much of the Wetland, is comprised mostly of trees over 12 inches DBH (3 points assigned for Large Standing Trees, Living or Dead). However, no evidence can be found that temporary pools exist within the Wetland (0 pts assigned for Amphibian Breeding/Nursery Habitat). The submetric total is 2+3+3+0 = 8 points.

Metric 7: Scenic, Recreational, and Cultural Value

Wetlands provide valuable open space for visual and recreational enjoyment and also provide educational and research opportunities. Bird watching, hiking, wildflower viewing, along with introspection, quiet reflection, and the opportunity to explore Michigan's natural communities are just a few of the benefits provided by wetlands. Some wetlands also serve as important cultural resources. Section 324.30311(e) of Part 303 recognizes that scenic, recreational, and cultural value can potentially be provided by wetlands in Michigan.

Submetric 7: Scoring Options

Points	Metric Criteria
1	Scenic: The public can view the Wetland from a public road or public land OR the Wetland has significant scenic value.
1	Recreational: The general public has access to the Wetland or the Wetland is assumed to be used for recreational activities.
1	Cultural/Historical: The Wetland, or any part of the Wetland, has been recognized as having important cultural or historic value.

Scoring: Select all that apply. Maximum 3 points.

7a. Scenic: The public can view the Wetland from a public road or public land OR the Wetland has significant scenic value (assign 1 point).

Any Wetland viewable from a public road or public lands (e.g., a local or state park, forest lands, etc.) or any Wetland with significant scenic value should receive 1 point for this metric. Significant scenic value includes, but is not limited to, wetlands on or adjacent to a designated Wild and Scenic River, wetlands that are part of a state or federal park or wilderness areas or other wetlands that have significant scenic appeal (e.g., scenic wetlands along a river used for canoeing, kayaking or fishing).

Todd Losee

Figure 40. A scenic wetland in Luce County, Michigan.

7b. Recreational: The general public has access to the Wetland or the Wetland is assumed to be used for recreational activities (assign 1 point).

Assign 1 point if the Wetland is accessible by the public (parkland, state forest, wilderness area, etc.) or if any recreational activities are assumed to occur within or immediately adjacent to the Wetland. For this submetric, recreational activities include hunting, fishing, hiking, wildflower viewing, bird watching, etc. It is assumed that the majority of wetlands will be awarded this point, since most wetlands offer recreational opportunities. Examples of wetlands that would not receive this point include wetlands located on fenced lands, such as industrial lands, airports, and potentially some highways where recreational access is not possible. Also, some wetlands may be so small or difficult to access that they provide very little to no recreational opportunity.

7c. Cultural/Historical: The Wetland, or any part of the Wetland, has been recognized as having important cultural or historic value (assign 1 point). If any part of the Wetland has been recognized by the State Historic Preservation Office as having important cultural or historic value, assign 1 point.

Chapter VII: Problem Situations and the MiRAM Summary

Problem Situations

The Evaluator should be aware that the time of year in which a MiRAM evaluation is performed may affect the evaluation of a Wetland. The most reliable scores are obtained during the growing season, which is typically May through October, depending on geographic location of the Wetland (see Approximate MiRAM Season Chart in Chapter 2). If the MiRAM evaluation is conducted outside of the growing season, add 10 points to the total score. Below, are examples of non-optimal evaluation situations. Areas of uncertainty due to any non-optimal evaluation situation should always be noted thoroughly. A re-evaluation or a follow-up evaluation may be required by the DNRE.

- Drought or late summer dry-downs may obscure a Wetland's normal hydrologic processes. A MiRAM evaluation may be performed during these periods. However, more time than usual may be required to thoroughly analyze archival aerial photographs and search for secondary indicators of hydrology. For more information on indicators of hydrology, consult the *Corps Manual*. A follow-up evaluation may be required when conditions return to normal.
- Deep-flooding events may cover much of a Wetland, obscuring its characteristics. However, unlike deep snow cover, deep flooding may actually affect only a small portion of a Wetland. If this is the case, proceed with the evaluation. When conditions return to normal, a follow-up evaluation is recommended. If flood waters affect the majority of the Wetland, the Evaluator should wait until flood waters recede to conduct a complete evaluation.
- The MiRAM was not developed to be used in times of snow cover. Snow cover may significantly inhibit the Evaluator's ability to conduct the MiRAM evaluation. Any evaluation conducted during winter snow conditions should not be considered accurate.

Interpreting the Narrative Rating Answers

The Narrative Rating is designed to incorporate elements of Part 303, including the legislative findings provided in Section 30302 and the permit application review criteria of Section 30311. If any of the Narrative Rating questions are answered affirmatively, the Wetland has ***high functional value*** and completion of the Quantitative Rating is not necessary. If none of the Narrative Rating questions are answered affirmatively, then the Evaluator is required to complete the Quantitative Rating section of the MiRAM. Failure to properly consider all Narrative Rating questions may result in an incorrect evaluation. Affirmative results for the Narrative Rating take precedence over the results of the Quantitative Rating.

Interpreting the Quantitative Rating Score

The Quantitative Rating's numeric score should not be considered an inherent and absolute evaluation of a Wetland's quality. Rather, the numeric score must be considered in light of other available information about the nature of the Wetland. The Quantitative Rating score allows the Evaluator to compare the functional value of a Wetland to other wetlands in Michigan.

Because of its post-glacial topography, long and ecologically diverse Great Lakes shoreline, and large latitudinal extremes, Michigan has an extremely diverse array of wetland types (Albert 1995, Kost et al. 2007). Therefore, the Evaluator should always be aware of the possibility that over-scoring or under-scoring of Wetlands may occur, especially when a Wetland does not fit into the assumptions that the MiRAM utilizes. In this regard, the Evaluator should always keep in mind that nature does not read the *User's Manual*. Given that the MiRAM is primarily a tool for evaluating a Wetland's condition, function, and value, users should be especially cautious in applying the results of the MiRAM in any other context, such as evaluation of preservation value, suitability of the Wetland as habitat for a specific species or evaluation of stormwater management potential. In some cases, additional assessment techniques, such as indices of biological integrity or floristic quality assessments will need to be used to properly identify the functional value of the Wetland.

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